



Pharmacognostic and Pharmacological Properties of *Eriodictyon crassifolium* Benth: A Review

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ABSTRACT

Yerba Santa (*Eriodictyon crassifolium*) is a shrub which have large and woolly leaves. It has an attractive cluster of flowers. Native Americans use leaves of this plant to make tea or syrups. It is found in Southern California up to 4000 feet. It is also known as Felt leaved yerba santa which is a dicot angiosperm belonging to the family Boraginaceae. It is used to treat cold, cough and fever. Several species of *Eriodictyon* showed anti-inflammatory and neuroprotective activities. The presence of flavanones sterubin, homoeriodictyol and eriodictyol measured by mass spectrometry method. It is also used in the treatment of Alzheimer's disease. It has shown its potential for antioxidant and anticancer benefits. The Kawaiisu tribe used tea of yerba santa to treat gonorrhoea. The tribe community known as 'chumash' used its leaves for the purpose of treating diseases like asthma, pneumonia. The whole plant is used in the medicinal purpose including leaves, flowers and stems. Chief chemical constituent is flavanones. Other than flavanones, it also contains flavonoids, tannins and volatile oils.

Keywords: *Eriodictyon crassifolium*, California, Boraginaceae, anti-inflammatory, neuroprotective, sterubin, eriodictyol, Alzheimer's disease.

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INTRODUCTION

Yerba Santa (*Eriodictyon crassifolium*) is a shrub used by Native Americans. It is easily found in California, Northern New Mexico. It is found in hot, dry summers and mild winters climatic condition. Few species can be seen Midwest United States and some are in the North eastern region of United States. "Yerba Santa" means "holy herb" derived from Spanish¹. Yerba Santa is endemic in California. It is found in various types of habitat like chaparral, inland hills and mountains and also in coast ranges and transverse range². It can be grown in river bottoms and also on dry slopes³. The elevations go up to 2500m (8000 ft.) but commonly seen below 1800m (6000 ft.)⁴. Lower elevated plants are 2m tall and also thickly vegetated. Luiseno people used this plant as medicinal purposes. Chumash used Yerba Santa for the cure of lung disease. The roots were used to relief the pain⁵. Leaves are used to stop the bleeding and chewing helps to keep the mouth fresh and moist. This plant has many flavonoids but eriodictyol among them shows anti-inflammatory, anti-bacterial as well as expectorant properties. It is also used as bathing sore parts and also in cough syrups⁶. The flavanone sterubin obtained from *E. crassifolium* is used as

a neuroprotective and anti-inflammatory component. Eriodictyol and homoeriodictyol also reported in *E. crassifolium*. Yerba Santa is also used for masking of drugs during manufacturing process. It is used as a flavoring agent in foods and beverages. The other names used for Yerba Santa are: Bears weed, Consumptives weed, *Eriodictyon*, *Eriodictyon californicum*, Gum Bush, Gum Plant, Herbe des Montagnes, Holy weed, Tarweed, *Wigandia californicum*, Mountain Balm. Yerba Santa chemical constituents that are responsible for loosening of mucus in the chest and also enhances urination. It is avoided during pregnancy. The plant dies in 20-30 years. It is a haploid (n). The species *Eriodictyon* is listed in recent literature in Namaceae⁷.

Synonyms: 1. *Eriodictyon tomentosum*. Brand.

2. *Eriodictyon crassifolium* Benth. Var. *denudatum* Abrams.

3. *Eriodictyon crassifolium* var. *niveum* Brand

4. *Eriodictyon crassifolium* subsp. *Benthamianum*

Common Names: Thick leaf yerba, Bicolored yerba santa

Taxonomical Classification

Kingdom : Plantae
Subkingdom : Tracheobionta
Superdivision : Spermatophyta
Division : Magnoliophyta
Class : Magnoliopsida
Order : Boraginales
Family : Hydrophyllaceae



Genus : Eriodictyon
Species : *Eriodictyon crassifolium*

Species of Yerba Santa:

- E. altissimum** : Indian Knob mountainbalm
- E. angustifolium** : Narrow – leaved yerba santa
- E. californicum** : California yerba santa
- E. capitatum** : Lompoc yerba santa
- E. lobbii** : Dwarf yerba santa
- E. parryi** : Poodle-dog bush
- E. tomentosum** : Woolly yerba santa
- E. traskiae** : Pacific yerba santa
- E. trichocalyx** : Hairy yerba santa

Morphological characteristics

Yerba Santa is a perennial, hairy, wooly shrub (fig. 1). Stems appear woody and branching. It is 4-6 feet in height. Leaves are lance shaped and are 12-15 cm⁸. The flowers are bell shaped creamy and purple (fig. 2). It is tomentose and having rhizome shrub. It is 1-2 m tall and have large, thick alternate leaves. Cymes are branched and give hairy and funnel shaped lavender flowers. The morphological characteristics of trichomes and density on the adaxial part of leaf differentiates between the two current accepted varieties. *Eriodictyon crassifolium* consists of dense and villous hairs on both sides of leaf surfaces (fig 3). The leaf surfaces of both sides do not have sticky glands. The leaves come out during cool rainy season. Plants becomes densely leafy, darker green in color and sticky in the growth phase. Flowers are bisexual in nature and symmetrical. The partitioning of calyx takes place into five segments. The shape of corolla is bell-shaped. Stamens of different lengths are also present. The shape of anthers is globular, which have purple and white pollen. Flowering takes place from mid to late spring and fruits become mature in the mid –summer⁹. In the hot dry weather plants become grey and leaves falls¹⁰. Flowers are the attraction site for animals like hummingbird, bees, moths, bee flies, butterflies¹¹. The flowers are pollinated by bees in the genera like *Bombus*, *Nomadopsis*, *Chelostoma* in the genus *Eriodictyon*¹². The shape of seeds is elliptic and transversely ridged. It is 0.8-1.2 mm long. Seeds are dispersed by gravity¹³. Seeds comes out from erect capsules when pollinated by animals¹⁴. Capsules are 2m above the ground held on branches. Light and heat plays an important role in germination of *Eriodictyon crassifolium*. It was found that when seeds of *E. crassifolium* kept in light, 33% of untreated seeds germinated while only 2% in dark¹⁵. A heat shock at 90 degree Celsius for 5 min, stimulate germination¹⁶. Maturity of seeds takes place in the early summer. The splitting of dry capsules (in July and august) shows the maturity phase of seeds. Seeds are stored under cool and dry conditions. This condition with controlled temperature and moderate humidity enhances

the shelf life of germinated seeds. Propagation of plants can be carried out through seeds or rhizomes cut section. The seeds are buried outside for one year and then it is brings to exposure of smoke¹⁷. The pleasant scent of *E. crassifolium* makes more attractive¹⁸.



(a) Whole plant

(b) Leaf

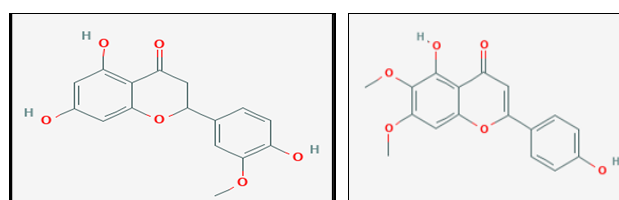


(c) Flowers

(d) wood

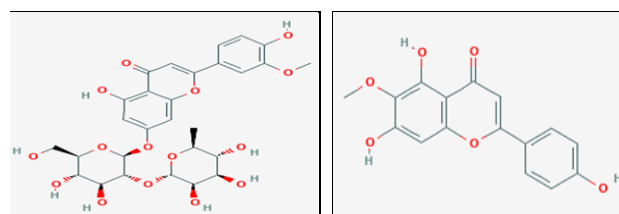
Chemical constituents

Yerba Santa consists of flavonoids which is 80% of mass, flavanones, flavones, tannins and small fraction of volatile oils¹⁹. The following flavanones are listed: Homoeriodictyol, Cirsimaritin, Chrysoeriol, Hispidulin, Eriodictyol (5%), 5,7,4-trihydroxy-6,3-dimethoxy flavanone, 5,4dihydroxy-6,7-dimethoxyflavanone, Naringenin 4'methyl ether, Sakuranetin, Pinocembrin, 3'-methyl-4'isobutyryleriodictyol, Chrysin, Methyl flavanones, Sterubin, Eriodictyonine (6%). Other compounds are found in smaller quantities like Luteolin, Nepetin, Apigenin, Jaceosidin, Kaempferol 3-O-glucosides, Quercetin 3-O-glucoside. Eriodictyol gives antibacterial, anti-inflammatory as well as expectorant activities²⁰.



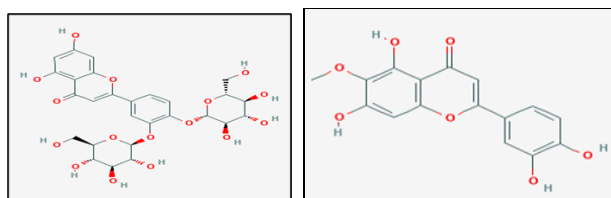
Homoeriodictyol

Cirsimaritin



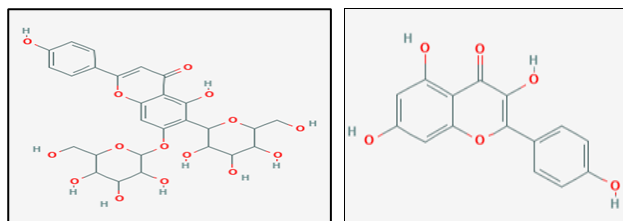
Chrysoeriol

Hispidulin



Luteolin

Nepetin



Apigenin

Kaempferol

Medicinal uses

Respiratory congestion

Yerba Santa is useful in cold, cough treatment. It is used as an expectorant. It is also helpful in loosening phlegm and in the treatment of asthma.

Anti-oxidant activity

The flavanones eriodictyol present acts as a powerful free radical scavenger which is more potent than vitamin E.

Anti-parasitic activity

During pre-clinical studies, the eriodictyol (Flavanones) found to be effective in the treatment against trypanosomes and malaria²¹.

Anticancer activity

Flavonoids including apigenin, eriodictyol, luteolin, rutin, quercetin, 3-hydroxyflavone shown cytotoxicity towards human normal cells including human lung embryonic fibroblasts (TIG-1) and human umbilical vein endothelial (HUVE) cells. Incubation of human normal cells with each flavonoids in culture medium for 24 hours resulted cytotoxicity of some flavonoids in higher concentrations. 3-hydroxyflavone, apigenin and luteolin founded more toxic for TIG-1 cells and quercetin, 3-hydroxyflavone as well as luteolin shown cytotoxicity for cells HUVE. HUVE cells when compared to TIG-1 found more vulnerable towards flavonoids cytotoxicity. The level of ROS increased apparently towards the flavones, apigenin, luteolin, quercetin, kaempferol and 3-hydroxyflavone. This proved that flavones and flavonols have cytotoxicity when levels of ROS increased intracellularly²². These studies shown that various flavonoids have ability to fight against cancer cells without causing any damage to the healthy human cells.

Alzheimer's disease

Alzheimer's disease is a neurodegenerative dementia commonly found in old-age people. The potent extract of *E. californicum* flavanone sterubin acts as neuroprotective and anti-inflammatory compound. The extracts of

dichloromethane prepared from leaves of 14 *Eriodictyon* taxa showed neuroprotection activity in the nerves cell for oxytosis and ferroptosis. Among eriodictyol, homoeriodictyol and sterubin; sterubin acts as major active compound²³.

Traditional uses

Chumash used leaves of *E. crassifolium* to treat asthma, tuberculosis, bacterial pneumonia. To relieve from pain they also used roots which were chewed or directly put on skin. Leaves were also used to stop bleeding and chewed to keep the mouth moist. The presence of Eriodictyol provide it antibacterial, anti-inflammatory and expectorant activities²⁴. Chumash also used this plant for the cough syrups purpose and as a bathing sore parts²⁵. *E. angustifolium* acts as anti-infective agents²⁶. The leaves of *E. crassifolium* also used to make tea but its odor consider unpleasant²⁷. The Salinan tribe used its leaves for making salve for the eyes. Yerba Santa also used in treatment of rheumatism using its leaves and branches. Leaves were also used for making skirts and aprons. The Spanish missionaries used the leaves for the treatment of coughs, cold, stomach-aches, joint pain and also to purify blood. Liniment also used topically to reduce fever²⁸. The extract of *Eriodictyon* also used in cosmetics. The Spanish used Yerba santa for tea and whiskey²⁹.

Other uses:

a) Prevention of erosion and re-vegetation: Yerba Santa planted in riverside for the prevention of erosion. The seeds of *E. californica* are helpful in prevention of erosion and re-vegetation³⁰.

b) Restoration of habitat: The plants which are grown from seeds helpful in restoration of alluvial vegetation. Chaparral vegetation also helpful in restoration of vegetation in Angeles National Forest. The plants in alluvial habitat during early winter have been fully grown with the highest rate of survival in one year. It has weekly irrigation in winter and spring at drought condition³¹.

c) Horticulture/agriculture: The seeds are buried outside for one year and then exposed to smoke for increasing germination at highest. If the seeds are not buried it will take 2.5 months to emerge as seedlings³².

Contraindications of Yerba santa

Yerba Santa when used as expectorant, it can over dry the nasal as well as lung passages. Its uses are also avoided in case of pregnancy and lactation period. Yerba Santa and Lithium drug interaction also found. The flavonoids such as homoeriodictyol and eriodictyol present in yerba santa may get interacted with some drugs using the liver's enzyme system "cytochrome P450" which results in the increase of level of these drugs and cause serious adverse reactions. This herb is not taken by the person suffering from chronic gastrointestinal disorders. When it is used as stimulant, cause sleep disorder³³.



CONCLUSION

Eriodictyon species have flavones which have free radical scavenging properties. Due to this property, it has been used in number of health problems. *Eriodictyon crassifolium* was used in the treatment of pulmonary diseases (influenza, asthma, bronchitis, tuberculosis) saliva production and also in stopping bleeding during cuts. More study is required for making a firm recommendation. The intensive study of *Eriodictyon crassifolium* prove its biological importance due to having several pharmacological uses. It is being used since long as herbal medicine by the native people of California. The phyto constituents are used in the treatment of various disease like Alzheimer and neuroprotective. *Eriodictyon crassifolium* still requires a thorough study to reveal its toxicity, contraindications as well as adverse effect in detail.

REFERENCES

- Montalvo AM, Riordan EC, & Beyers J. Plant profile for *Eriodictyon crassifolium*. *Native Plant Recommendations for Southern California Ecoregions*, 2017.
- Jepson WL & Hickman JC. *The Jepson manual: higher plants of California*. Univ of California Press, 1993.
- Hofmann M, Walden GK, Hilger HH, & Weigend M. Hydrophyllaceae. In *Flowering Plants. Eudicots*, Springer, 2016; 221–238.
- Smith JP. *California Floras: Literature on the Identification and Uses of California Vascular Plants*. Humboldt State University Herbarium, 2010.
- Skoczen S & Bussmann RW. ebDB-Filling the gap for an International Ethnobotany Database. *Lyonia*, 2006;11(2):71–81.
- Adams J D & Garcia C. The spiritual sense, prayer and traditional American Indian healing. *CELLMED*, 2012;2(1):18-25.
- Skidmore-Roth L. *Mosby's Handbook of Herbs & Natural Supplements-E-Book*. Elsevier Health Sciences, 2009.
- Hannan GL. Evaluation of relationships within *Eriodictyon* (Hydrophyllaceae) ,using trichome characteristics. *American Journal of Botany*, 1988; 75(4): 579–588.
- Parker VT & Vasey MC. Two New Subspecies of *Arctostaphylos* (Ericaceae) From California and Implications For Understanding Diversification In This Genus. *Madroño*, 2016;63(3):283–291.
- Ackerly D. Functional strategies of chaparral shrubs in relation to seasonal water deficit and disturbance. *Ecological Monographs*, 2004;74(1):25–44.
- Moldenke AR & Neff JL. *Studies on pollination ecology and species diversity of natural California plant communities*, AR Moldenke and JL Neff, 1974.
- Moldenke AR. *California pollination ecology and vegetation types*, 1976.
- Wall M & Macdonald J. *Processing seeds of California native plants for conservation, storage, and restoration*. Rancho Santa Ana Botanic Garden, 2009.
- Keeley JE. Role of fire in seed germination of woody taxa in California chaparral. *Ecology*, 1987;68(2):434–443.
- Went FW ,Juhren G & Juhren MC. Fire and biotic factors affecting germination. *Ecology*, 1952;33(3): 351–364.
- Keeley JE, McGinnis TW & Bollens KA. Seed germination of Sierra Nevada postfire chaparral species. *Madroño*, 2005;52(3):175–181.
- Keeley JE, McGinnis TW & Bollens KA. Seed germination of Sierra Nevada postfire chaparral species. *Madroño*. 2005;52(3):175–181.
- Wall M & Macdonald J. *Processing seeds of California native plants for conservation, storage, and restoration*, Rancho Santa Ana Botanic Garden, 2009.
- Johnson ND. Flavonoid aglycones from *Eriodictyon californicum* resin and their implications for herbivory and UV screening. *Biochemical Systematics and Ecology*, 1983;11(3): 211–215.
- Johnson ND. Flavonoid aglycones from *Eriodictyon californicum* resin and their implications for herbivory and UV screening. *Biochemical Systematics and Ecology*, 1983;11(3):211–215.
- Ahmed MS, Galal AM, Ross SA, Ferreira D, ElSohly MA, Ibrahim RS, Mossa JS & El-Feral FS. A weakly antimalarial biflavanone from *Rhus retinorrhoea*. *Phytochemistry*, 2001;58(4): 599–602.
- Matsuo M, Sasaki N, Saga K & Kaneko, T. Cytotoxicity of flavonoids toward cultured normal human cells, *Biological and Pharmaceutical Bulletin*, 2005; 28(2):253–259.
- Fischer W, Currais A, Liang Z, Pinto A & Maher P. Old age-associated phenotypic screening for Alzheimer's disease drug candidates identifies sterubin as a potent neuroprotective compound from Yerba santa. *Redox Biology*, 2019;21:101089.
- Adams JD & Garcia C. The spiritual sense, prayer and traditional American Indian healing. *CELLMED*, 2012;2(1):41-49.
- Dentali SJ & Hoffmann JJ. Potential antiinfective agents from *Eriodictyon angustifolium* and *Salvia apiana*. *International Journal of Pharmacognosy*, 1992;30(3): 223–231.
- Kirk DR. *Wild edible plants of western North America*, Naturegraph Publishers, 1975.



27. Service U. S. F. and W. ,Eriodictyon capitatum (Lompoc yerba santa)5-Year Review: Summary and Evaluation. *Eriodictyon Capitatum (Lompoc Yerba Santa). 5-Year Review: Summary and Evaluation*, 2011.
28. Smith JP.*California Floras: Literature on the Identification and Uses of California Vascular Plants*, Humboldt State University Herbarium, 2010.
29. Smith JP. *California Ethnobotany: A Bibliography*, 2015.
30. Newton GA & Claassen VP. *Rehabilitation of disturbed lands in California: A manual for decision-making* California Geological Survey, Resources Agency, Department of Conservation. 2003;123:82-87.
31. Keeley JE.Role of fire in seed germination of woody taxa in California chaparral. *Ecology*. 1987;68(2):434–443.
32. Fillius ML.*Native Plants: Torrey Pines State Reserve and Nearby San Diego County Locations*, Fillius Interests. 2007.
33. Allen RL & Roberts FM.*Wildflowers of Orange County and the Santa Ana Mountains*. Laguna Wilderness Press, 2013.

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