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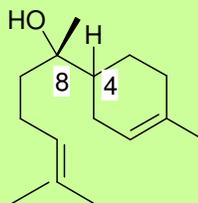
Cropwatch's Candeia [*Eremanthus erythropappus* (DC) MacLeish syn. *Vanillosmopsis erythropappus*]

Bibliography.

v1.02 Feb. 2009.

[To be continuously expanded].

Cropwatch comments: The candeia tree/plant (*Eremanthus erythropappus* (DC) MacLeish syn. *Vanillosmopsis erythropappus*) grows in S.E. & Midwest Brazil. But the main concern has centered around candeia trees in the Atlantic Brazilian rainforest, mainly south of Minas Geras State, which have been over-exploited for many years as a source of (-)-alpha-bisabolol, primarily by the German pharmaceutical industry (Lopes *et al.* 1991). Levels of irresponsible extraction became so high that the highland rainforest itself was threatened, but new conservation initiatives for candeia forest, partly involving **Symrise**, a long-time user of alpha-bisabolol, have been announced amid a flurry of trumpets (Prance 2008) - but see Abreu (2008) for a slightly less-hyped overview.



(-)-alpha-bisabolol [4S,8S]

Previously Lauterbach *et al.* (1992) of **BASF**, Germany, were granted a US patent for the purification of alpha-bisabolol from candeia extract using a reduced pressure distillation process and lower distillation column outlet. (-) Alpha-bisabolol (also found in chamomile oil) possesses a sweet and faintly floral odour and exhibits anti-inflammatory, wound-healing, anti-bacterial and deodorizing properties. MacLeish (1987) discusses the revision of the *Eremanthus* noting that taxonomic distinctions between *Eremanthus* & *Vanillosmopsis* are largely artificial. Therefore the candeia plant can have several botanical namings.

Contents:

Candeia – Ecology & Conservation

Candeia extracts & alpha-Bisabolol – Chemistry

Candeia – Beneficial Properties Related Species of Interest

Candeia – Ecology & Conservation.

Cropwatch comments: In reality, the candeia plant is a poor source of (-)-alpha-bisabolol, and it has not been cost-effective to extract the ingredient until the plant is 12-15 years old, although plant-breeding efforts are being made to reduce this figure as low as 7 years. Although Symrise (amongst others) is a producer of synthetic alpha-bisabolol, the product contains other isomers. .

Abreu C.A. (11.11.2008) "Educating for reforestation." Sao Paulo: Brazil-Arab News Agency. **Cropwatch comments** Abreu (2008) reports that farmers from 6 cities in the state of Minas Gerais are helping with the reforestation of degraded areas and the preservation of important spp. such as *Eremanthus erythropappas*. The project includes the partnership of German & Brazilian governments, the Federal University of Lavras & others. Mônica Lopes Bueno, director of Amanhãgua Civil Society for Public Interest (Oscip), also a partnership member, reports that 200 farmers are growing candeia, compared with 80 last year. 30 family-based nurseries are also up and running, producing Ccandeia saplings, which are sold after 5 months, supplementing incomes. The article also comments on the potential for replacement of chamomile oil in cosmetics with Candeia oil, which the Brazilian company **Natura** is researching.

Carle R., Fleischhauer I, Beyer J, Reinhard E.(1990) "Studies on the origin of (-)-alpha-bisabolol and chamazulene in chamomile preparations; Part I. Investigations by Isotope Ratio Mass Spectrometry (IRMS)." *Planta Med.* **56**(5), 456-460. **Abstract.** IRMS was used to determine the delta (13)C-and deltaD-values of dried plant material and essential oil fractions of CHAMOMILLA RECUTITA and VANILLOSMOPSIS ERYTHROPAPPA and of isolated components thereof. Both plants turned out to follow the same C (3) photosynthetic pathway. The carbon isotope ratios (delta (13)C-values) of chamomile-derived bisabolol ranged from -32 per thousand to -30 per thousand; the corresponding deltaD-values varied between -240 per thousand and -205 per thousand. VANILLOSMOPSIS bisabolol differed significantly, with delta (13)C-values of approximately -27 per thousand, and a deltaD-value of about -175 per thousand. In addition, chamazulene of chamomiie was characterized by a delta (13)C-value of -31 per thousand, whereas in chamazulene from ACHILLEA MILLEFOLIUM lower carbon discrimination was found (delta (13)C = -30 per thousand). The delta (13)C-values allowed us to detect adulterations of chamomiie preparations. The isolation of bisabolol, a main ingredient of these preparations, and subsequent IRMS analysis is much more tedious than GC/IRMS, which makes it possible to determine the carbon isotope ratio of bisabolol without prior isolation. Only one commercial chamomile preparation was completely free of non-chamomile admixtures. Our investigations clearly demonstrate that admixtures of natural compounds can be detected in

chamomile oil and chamomile preparations even if there is no difference in the photosynthetic mechanism of the corresponding plants.

Carle R. (1996) "Kamillenol - Gewinnung and Qualitätsbeurteilung." *Dtsch. Apoth. Ztg.*, **136**, 2165-2176 (1996).

Freitas V.L., Lemos-Filho J.P. & Lovato M.B.. (2008) "Contrasting genetic diversity and differentiation of populations of two successional stages in a neotropical pioneer tree (*Eremanthus erythropappus*, Asteraceae)." *Genet Mol Res.* **7**(2),388-98, [Abstract](#). *Eremanthus erythropappus*, commonly known as "candeia", is an abundant pioneer tree species, forming dense populations known as "candeial", but it is also found in forests at middle stages of succession. Trees from forests are bigger and occur in lower density than in the "candeial". The objectives of the present study were to investigate if the decrease in population density during successional process is accompanied by 1) changes in within-population genetic diversity, and 2) differentiation of populations. Eight populations, four of early successional stage ("candeial") and four of middle successional stages (forest), were analyzed with RAPD markers. The genetic diversity found was high compared to other tree species analyzed with RAPD markers. AMOVA revealed that most of the genetic variations of *E. erythropappus* were found within populations (85.7%), suggesting that this species is predominantly outcrossing. The relatively low differentiation among the populations can be attributed to small distances among the populations analyzed (0.2 to 10.8 km). No indication that populations from middle successional habitats show lower genetic variation than populations from early successional stages was found. The percentage of polymorphic fragments (82.8 and 84.8%) and the Shannon indexes (0.442 and 0.455) were similar in "candeial" and forest, respectively. These results suggest that if an increase in selection intensity occurred during succession, it did not result in a decrease in genetic diversity or that the selection effect was balanced by other factors, such as gene flow. Higher significant differentiation among *E. erythropappus* populations from "candeial" in relation to that among populations from forest was also not detected.

MacLeish N.F.F. (1987) "Revision of *Eremanthus* (Compositae: Vernoniaeae)" *Annals of the Missouri Botanical Garden*, **74**(2), 265-290.

Pérez J.F.M, Scolforo J.R.S., de Oliveira A.D., de Mello J.M., Borges L.F.R. , Camolesi J.F. (2004) "Management system for native Candeia forest (*Eremanthus erythropappus* (DC) MacLeish) - the option for selective citting *Cerne*, **10** (2),257-273.

Prance L. (2007) "Symrise ups efforts to save alpha-bisabolo (sic) production." - see <http://www.cosmeticsdesign-europe.com/news/nq.asp?n=77098&m=2CDE607&c=mbslkouyzvdsosv>

Scolforo J. R. S., Oliveira, A. D. de, Mello, J. M. de, Pérez, J. F. M., Camolesi, J. F., Borges, L. F. R. (2004) "Management system for native candeia forest (*Eremanthus erythropappus* (DC) MacLeish) - the option for selective cutting."

Cerne 10(2), 257-273. **Abstract:** This research defines a sustained yield management system for native candeia forest (*Eremanthus erythropappus*), considering oil production, volume growth rate and balanced forest concept. Data were collected in a sample of 18 plots, 606.65 m² each and from a scaling of 63 trees scattered in diametric classes ranging from 5 for 35 cm, in a native candeia forest located in Aiuruoca county, Minas Gerais, Brazil. The suggested management plan was based on the association of information of diameter growth, recovered from stem analysis, of horizontal and vertical structure studies, of oil production of several diameter classes and of balanced forest concept. It is concluded that candeia is the most important tree species in the native forest studied and its exploitation is economically feasible; the optimal diameter class both for oil extraction and for fencepost is 5-10 cm, the minimum diameter for oil extraction and for fencepost production is, respectively, 5 and 7 cm; besides, the trees of higher dimension occupies large areas damaging the development of small trees that have higher potential and are in higher number; the best management plan for producing oil and fencepost was the one that presented De Lioucourt coefficient 2.2 times the original value that indicated the removal of 60% of the basal area and maximum diameter of 30 cm; if the chief purpose is only oil production the removal reached 13.394 m³/ha or 25.625 mst/ha, if both stem and branches >3 cm of diameter are used. The commercialization of this wood volume produces a gross income/ha of R\$1921.88 for the farmer. If the management aims at obtaining fencepost with diameter equal or greater than 7 cm, gross income will reach R\$1590.38 The oil extraction of branches smaller than 3 cm not used for fencepost may add R\$953.64 to the revenue with the commercialization for oil producing. The commercial exploitation of candeia can only be done when the predominance of this tree species is higher than 70% of the vegetation.

Scolforo J. R. S., Oliveira A. D. de, Mello J. M. de, Acerbi Jr. F. W., Pérez J. F. M., Camolesi J. F. & Borges L. F. R. (2004) "Volume estimation, dry weight, oil content and quantity of fenceposts of candeia (*Eremanthus erythropappus* (DC) MacLeish)." *Cerne*, 10 (1) 87-102. **Abstract:** This study was conducted to estimate the volume, dry weight, oil content and fence post quantity per diameter class of candeia (*Eremanthus erythropappus*), and to define its stack factor, with and without diameter class control. Equations used for estimating these parameters were provided. Data were obtained from a forest inventory conducted in a native candeia forest located in Aiuruoca county, Minas Gerais, Brazil. Huber formula was used for tree volume calculation while solvent and vapour hauling methods were employed for oil extraction. Traditional double entry models were used to estimate volume, dry weight, oil content and fencepost number. Oil weight in a 1 m³ of wood of small dimension (trees between 5 and 10 cm) is approximately 6 kilos, while the oil content of the largest trees (between 40 and 45 cm) is approximately 11 kilos. The same tendency was observed for the wood volume without bark, and in the volume of piled up wood, although in the latter the magnitude of quantities was different. The oil content in the stem and branches (up to 3 cm diameter with bark) of candeia varies from 1.02 to 1.37%, in plants with diameter between 5 and 10 cm and between 40 and 45 cm,

respectively. In the branches with less than 3 cm with bark, oil content varies from 0.33 to 0.65% in plants with diameter between 5 and 10 cm and between 40 and 45 cm, respectively. In the leaves, oil content varies from 0.28 to 0.77%, for plants with diameter between 5 to 10 cm and between 40 to 45 cm, respectively. The average stack factor is 1.9087 and decreases as diameter classes increase. The best model for estimating oil content, dry weight, fence post quantity and volume is the logarithmic form of Schumacher-Hall model.

da Silva M.A, de Mello J.M.. Scolforo J.R.S. ; Czanck Jr L.. Andrade I.S. & de Oliveira A.D. (2008) "Analysis of the spatial distribution of Candeia." *Cerne* **14**(4),311-316, [Abstract](#). Candeia (*Eremanthus erythropapus*) is a woody species that produces wood for various uses and with high economic value. This fact has caused an uncontrolled exploitation of the species. One way to reduce the exploitation impact of candeia tree is to elaborate a sustainable management plan. Spatial evaluation is important to analyze the ecological behavior of the species. The results may help the comprehension of the spatial dependency and the pattern of distribution. The objective of this study was to analyze the horizontal spatial structure of *Eremanthus erythropapus* (candeia) under a tree-seed system, in trials installed in August 2003 in the district of Aiuruoca, in the State of Minas Gerais. The spatial analysis of the regeneration and the seed-trees were performed by Ripley sK, using their geographic coordinates. The results indicated that the regeneration presented an aggregated distribution pattern, confirming the capacity of candeia to form mosaics in the vegetation, originating candeia predominant forests. The adult plants presented an aggregated pattern moving into a random pattern. There was no dependency relationship between adult plants and regeneration.

Candeia Extracts & alpha-Bisabolol – Chemistry.

Bhatia S.P., McGinty D., Letizia C.S. & Api A.M.. (2008) "Fragrance material review on alpha-bisabolol." *Food Chem Toxicol.* **46** Suppl 11, S72-6.

Braun N. A., Meier M., Kohlenberg B. & Hammerschmidt F. J. (2003) "Two new bisabolene diols from the stem wood essential oil of *Vanillosmopsis erythropappa* Schultz-Bip. (Asteraceae)." *Journal of Essential Oil Research* [Abstract](#). The stem wood oil of *V. erythropappa*, collected from Minas Gerais, Brazil, was analysed using GC/MS. Forty-three constituents were identified: 31 sesquiterpenoids, one phenylpropane and 11 others. 2-Bisabolene-7,11-diol and 10-bisabolene-3,7-diol were recorded for the first time in nature and were characterized using ¹H-, ¹³C-NMR, GC/FTIR and GC/MS analyses.

Brunke E.J. & Koester F.H. "Process for the purification of alpha-bisabolol." European Patent EP0253922 (A1) [Abstract](#). alpha -Bisabolol has distinct odour-fixing properties, which makes it very difficult to separate off attendant mixtures of unpleasant odour from a crude product (which may be of natural or synthetic origin). The conventional purification operations such as distillation, adsorption on activated carbon, or the like, fail, so that in the past relatively complicated chemical treatments were required. The purification process now proposed

consists in filtering a solution of crude alpha -bisabolol in an inert solvent having a boiling point of between 40 and 200 DEG C, preferably 60 - 150 DEG C, through an exchanger resin, then removing the solvent and, if desired, subjecting it to further purification operations.; The solvent is advantageously an aliphatic alcohol having up to 6 carbon atoms, preferably isopropanol, which is used in an amount of 10 to 1000 % by weight, preferably 50 - 200 % by weight, relative to the crude alpha -bisabolol. The preferred exchanger resin is a highly polymeric crosslinked polycondensation or polymerisation resin whose active groups are either acidic groups, preferably sulphonic acid, carboxylate or phenol groups or basic groups, preferably mono- or polyalkylated amino groups, it being sufficient to use an amount of 5 - 100 % by weight, preferably 10 - 50 % by weight of resin, reactive to the crude alpha -bisabolol. This purification process has surprisingly good effectiveness and is distinguished, compared with chemical treatments, by extreme simplicity, low expenditure on equipment, work and auxiliaries and very low environmental pollution.

Corbrella A., Gariboldi P. & Jomimi G. (1974). "Structure and absolute stereochemistry of vanillosmin, a guaianolide from *Vanillosmopsis erythropappa*". *Phytochemistry* **13**, 459-465.

Gottlieb. O.R & Magalhaes M.T. (1958), Essential oil of the wood of *Vanillosmopsis erythropappa*. *Perf. Essent. Oil. Record*, **49**: 711-714.

Lima P. D. D. B.; Garcia, M. & Rabi. J. A., (1985) "Selective extraction of α -methylene- γ -lactones. Re-investigation of *Vanillosmopsis erythropappa*." *J.Nat. Prod.*, **48**: 986-988.

Lopes J. N. C., Lopes, J. L. C. Vichnewski W., Rodrigues D. C., Gottlieb O. R. (1991) "Chemical variability of *Vanillosmopsis erythropappa*". *Anais da Academia Brasileira de Ciências* **63**, 21-22. [Abstract](#). The existence of *Vanillosmopsis erythropappa* (Asteraceae) with an aberrant, bisabolol-poor, chemical composition is reported and interpreted as a case of micromolecular diversity of sympatric species.

Silverio M.S. *et al* (2008). "Propriedades farmacológicas do extrato etanólico de *Eremanthus erythropappus* (DC.) McLeisch (Asteraceae)." *Rev. bras. farmacogn.* [online]. 2008, **18**(3),. 430-435.

de Souza A.T., Benazzi T.L., Grings M.B., Cabral V., da Silva E.A. Lúcio Cardozo-Filho L. & Antunes O.A.C. (2008) "Supercritical extraction process and phase equilibrium of Candeia (*Eremanthus erythropappus*) oil using supercritical carbon dioxide." *J. Supercritical Fluids* **47**(2),182-187 [Abstract](#). In this work a kinetic experimental study of supercritical oil extraction of Candeia (*Eremanthus erythropappus*) oil was carried out. In addition, the phase equilibrium study of the essential oil in CO₂ was measured and modeled. The extraction was performed at temperatures of 308, 313 and 333 K, from 100 to 200 bar, while the phase equilibrium experiments were obtained in the CO₂ overall composition range of 10–90 wt.%, from 313 to 333 K and pressures up to 250 bar. The experimental

data of the phase equilibrium for the Candeia Oil + CO₂ system were described satisfactorily by the Peng–Robinson equation of state with VdW2 mixing rule. To represent the kinetics of oil extraction in a fixed bed column, it was employed a 2nd order kinetic model. It was showed, based on the comparison between experimental and theoretical results, that the model satisfactorily describes the extraction kinetics in all the studied cases using just one parameter. The chemical characterization of the extracts (CO₂ and hydrodistillation) was done using gas chromatography coupled to mass spectrometry.

United States Patent 3932533 "Process for the recovery of pure alpha-bisabolol." [Abstract](#). α - Bisabolol of plant origin is purified by being treated with alkali hydroxide, alkali alcoholate, alkali carbonate, alkali bicarbonate, alkaline earth hydroxide, alkaline earth oxide or aluminium hydroxide. Preferably activated carbon is also used in the purification. Preferably the α -bisabolol is treated with pure nitrogen gas before the alkali treatment.

Vichnewski W., Lopes J. N. C.; Santos-filho D. Dos & Herz W. (1976) "15-Deoxygoyazenzolide, a new heliangolide from *Vanillosmopsis erythropappas*. *Phytochemistry*, **15**: 1775-1776.

Vichnewski W., Takahashi A.M., Nasi A.M.T., Gonçalves D.C.R.G., Dias D.A., Lopes J.N.C., Goedken V.L., Gutierrez A.B., Herz W. (1989). "Sesquiterpene lactones and other constituents from *Eremanthus seidelii*, *E. goyazensis* and *Vanillosmopsis erythropappa*." *Phytochemistry* **28**, 1441-1451.

Candeia Extracts – Beneficial Properties

Jellinek J.S. (1984) "Alpha-bisabolol un agent anti-inflammatoire pour produits cosmétique." *Parfums Cosmet. Aromes* **57**, 55-57.

Lopes J. N. C.; Cruz F. S.; Lopes J. L. C. & Goncalves D. C. R. G. (1987) "Inhibitory activity of a sesquiterpene lactone from *Vanillosmopsis erythropappa* against *Trypanosoma cruzi*. In: *47th International Congress of Pharmaceutical Sciences of F.I.P., Abstracts*, p. 39, Amsterdam.

Nascimento A.M., Brandão M.G., Oliveira G.B., Fortes I.C. & Chartone-Souza E. (2007) "Synergistic bactericidal activity of *Eremanthus erythropappus* oil or beta-bisabolene with ampicillin against *Staphylococcus aureus*." *Antonie van Leeuwenhoek* **92**(1), 95-100. [Abstract](#). The activity of *Eremanthus erythropappus* oil (EO) and some of its compounds and their potential synergistic interaction with ampicillin against different strains of *Staphylococcus aureus* were investigated. Determination of chemical composition of EO by gas chromatography-mass spectrometry (GC/MS) and bioguided chemical fractionation led to the identification of beta-bisabolene as the main active compound. A synergistic bactericidal activity of EO or beta-bisabolene with ampicillin against *Staphylococcus aureus* was observed in a time-kill assay. EO and beta-bisabolene have the potential to restore the effectiveness of ampicillin against resistant *S. aureus*.

Pedralli G., Teixeira M.C.B. & Nunes Y.R. (1997). "Estudos sinecológicos sobre a candeia (*Vanillosmopsis erythropappa* Schult. Bip) na estação ecológica de Tripui, Ouro Preto," *MG. Rev Árvore* **21**, 301-306.

Scultz H. (2003) "Utilisation of plant genetic resources for valuable raw materials in foods, cosmetics, and pharmaceutical products." *Schriften zu Genetischen Ressourcen, 2003 - genres.de*

Silvério M.S. (2004). "Estudo químico e farmacológico de *Vanillosmopsis erythropappa* Schultz Bip. (Asteraceae). Rio de Janeiro, 94 p. *Dissertação de Mestrado - Programa de Pós-Graduação em Farmacologia e Terapêutica Experimental, Universidade Federal do Rio de Janeiro.*

Sousa O.V., Oliveira M.S., Rabello S.V., Cunha R.O., Costa B.L.S. & Leite M.N. (2003). "Estudo farmacognóstico de galhos de *Vanillosmopsis erythropappa* Schult. Bip. – Asteraceae." *Rev Bras Farmacogn* **13**, 50-53.

Sousa O.V., Silvério M.S., Del-Vechio-Vieira G., Matheus F.C., Yamamoto C.H. & Alves MS. (2008) "Antinociceptive and anti-inflammatory effects of the essential oil from *Eremanthus erythropappus* leaves." *J Pharm Pharmacol.* **60**(6), 771-7. [Abstract](#). The chemical composition of the essential oil from air-dried leaves of *Eremanthus erythropappus* was studied. The main compounds were beta-pinene (23.24%), beta-caryophyllene (22.92%), beta-myrcene (10.03%) and germacrene D (9.40%). The essential oil had an LD50 of 2.90 g kg(-1) in mice. Doses of 200 and 400 mg kg(-1) inhibited 10.69% and 27.06% of acetic-acid-induced writhing in mice, respectively. In the formalin-induced nociception test in mice, the essential oil inhibited the first phase of paw licking by 29.13% (400 mg kg(-1)) and the second phase by 32.74% (200 mg kg(-1)) and 37.55% (400 mg kg(-1)). In the hot-plate test in mice, doses of 200 mg kg(-1) and 400 mg kg(-1) significantly increased the reaction time after 30, 60 and 90 min of treatment. Doses of 200 and 400 mg kg(-1) inhibited carrageenan-induced paw oedema in rats by 15.18% and 36.61%, respectively. Doses of 200 and 400 mg kg(-1) administered 4 h before intrapleural injection of carrageenan significantly reduced exudate volume (by 20.20% and 48.70%, respectively) and leucocyte mobilization (by 5.88% and 17.29%, respectively). These results demonstrate that *E. erythropappus* has analgesic and anti-inflammatory properties, supporting the use of this plant in folk medicine.

Related Species.

de Andrade I.L., Bezerra J.N., Lima M.A., de Faria R.A., Lima M.A., Andrade-Neto M., Cavalcanti F.S. & Mesquita A.L. (2004) "Chemical composition and insecticidal activity of essential oils from *Vanillosmopsis pohlii* baker against *Bemisia argentifolii*." *J Agric Food Chem.* **52**(19), 5879-81. [Abstract](#). Essential oils from the heartwood and leaves of specimens of *Vanillosmopsis pohlii* collected in two different localities were analyzed by GC-MS. The major constituent of both heartwood essential oils was the sesquiterpene alpha-bisabolol. Essential oil composition from leaves was quite different for two specimens and showed beta-pinene and E-caryophyllene as principal

constituents. The essential oil of heartwood and the pure sesquiterpene alpha-bisabolol were tested against *Bemisia argentifolii*, the white fly fruit plague, and pronounced insecticidal effects were observed.

Barth L.R., Fernandes A.P., Ribeiro-Paes J.T. & Rodrigues V. (1997) "Effects of goyazensolide during in vitro cultivation of *Schistosoma mansoni*." *Mem Inst Oswaldo Cruz.* **92**(3), 427-9. [Abstract](#). Goyazensolide, a component extracted of *Eremanthus goyazensis* showed a significant inhibitory effect on egg-laying of *Schistosoma mansoni* during in vitro cultivation of this parasite. Motility of the worms was also reduced under treatment with goyazensolide and 90% of mortality was reached with concentrations up to 4 micrograms/ml. It has found that separated worms were more susceptible than worms pairing during drug exposition and female alone was significantly more susceptible than male worm in the same conditions of in vitro cultivation. Natural products isolated from plants represent potential sources for the identification of structures useful for the design of alternative molecules to be used as new drug substances against several infectious diseases. **Cropwatch comments:** goyazensolide also occurs in extracts of *E. erythropappus*.

Canalle R., Burim R.V., Callegari Lopes J.L. & Takahashi CS. (2001) "Assessment of the cytotoxic and clastogenic activities of the sesquiterpene lactone lynchnopholide in mammalian cells in vitro and in vivo." *Cancer Detect Prev.* **25**(1), 93-101. [Abstract](#). Lynchnopholide (LNP), a sesquiterpene lactone with antitumor, trypanocidal, and antimicrobial activities, was isolated from *Vanillosmopsis erythropappa*. The present study was carried out to assess the cytotoxic and clastogenic potential of this new agent in human cultured lymphocytes and Swiss bone marrow cells before the agent was used in medicine. The mitotic index, chromosomal aberrations (CAs), sister chromatid exchanges (SCEs), and proliferation index were investigated. There was no alteration in the number of CAs and SCEs in the continuous in vitro treatment. However, the highest concentration (0.2 microg/ml) of LNP was cytotoxic. LNP (0.1, 0.2, and 0.4 microg/ml) induced a significant increase in CA frequency at the G2 phase in all treated cultures. Only the highest concentration (26.67 mg/kg) caused a significant increase in the total number of CAs in the in vivo investigation. On the basis of these results, LNP had a clastogenic effect on both test systems and a cytotoxic effect in vitro.

Craveiro A.A., Alencar J.W., Matos F.J.A., Sousa M.P. & Machado M.I.L. (1989) "Volatile constituents of leaves, bark and wood from *Vanillosmopsis arborea* Baker." *J. Essent. Oil Res.* **1**, 293-294.

Dias Barros D.A., Callegari Lopes J.L., Vichnewski W., Callegari Lopes J.N., Kulanthaivel P. & Herz W. (1985) "Sesquiterpene lactones in the molluscidal extract of *Eremanthus glomerulatus*." *Planta Med.* (1), 38-9

Dias Fda L, Takahashi CS, Sakamoto-Hojo E, Vichnewski W, Sarti SJ. (1995) "Genotoxicity of the natural cercaricides "sucupira" oil and eremanthine in mammalian cells in vitro and in vivo." *Environ Mol Mutagen.* **26**(4), 338-44.

Abstract. "Sucupira" oil and the lactone eremanthine, extracted from *Pterodon pubescens* and *Eremanthus elaeagnus*, respectively, are known for their cercaricidal action in experimental animals. Because of their biological effect, they have the potential to be used for the prophylaxis of schistosomiasis caused by *Schistosoma mansoni*. To test the clastogenicity of these agents, "sucupira" oil, either pure or diluted in corn oil, was tested in vivo on Wistar rat bone marrow cells following dermal application. Metaphase analysis showed that the compound did not induce a significant increase in the frequencies of chromosomal aberrations. When eremanthine was tested on BALB/c mice following gavage at doses of 100, 200, and 300 mg/kg bw, it did not induce structural or numerical chromosomal aberrations. In the in vitro treatment of human lymphocyte cultures, eremanthine also did not cause any increase in chromosomal aberrations or sister chromatid exchanges at the following concentrations in culture medium: 1.25, 2.50, and 5.00 micrograms/ml. From these results, under our experimental conditions, neither "sucupira" oil nor eremanthine showed clastogenic effects on mammalian cells *in vivo* or *in vitro*.

Leite G de O., da Penha A.R., Fernandes C.N., Souza H.H.F., da Costa J.G.M. & Campos A.R. (2009) "Gastroprotective mechanism of *Vanillosmopsis arborea* bark essential oil." *Fitoterapia* **80**(1),77-80. **Abstract.** This study was aimed to clarify the mechanism of gastroprotection by *Vanillosmopsis arborea* Baker essential oil (EOVA) using ethanol-induced gastric mucosal damage in mice. Gastric lesions were significantly reduced by EOVA (200 and 400 mg/kg). Chemical analysis showed that the major compound of EOVA was α -bisabolol. Pretreatment of mice with yohimbine, the α 2-antagonist, greatly suppressed the gastroprotective effect of OEVA. Furthermore, OEVA gastroprotection was not attenuated in mice pretreated with indomethacin, L-NAME or glibenclamide, the respective inhibitors of cyclooxygenase, nitric oxide synthase and K⁺ATP channel activation. These data suggest that OEVA affords gastroprotection most possibly by α 2-receptor activation.

Matos M.E.O., Matos F.J.A. & Aragao Craveiro A. (1988) "Sesquiterpenes from *Vanillosmopsis arborea*." *Journal of Natural Products* **51**(4), 780-782.

Menezes A.M.S., Almeida F.R.C., Rao V.S.N. & Matos M.E.O. (1990). "Anti-inflammatory activity of the essential oil of *Vanillosmopsis arborea*." *Fitoterapia* **61**. 252-254.

Raffauf R.F., Huang P.C., Le Quesne P.W., Lavery S.B. & Brennan T.F.. (1975) Letter: "Eremantholide a, a novel tumor-inhibiting compound from *Eremanthus elaeagnus* Schultz-Bip. (Compositae)." *J Am Chem Soc.* **97**(23), 6884-6.

Schumacher H. (1982) "Rediscovery of *Vanillosmopsis arborea* Baker (Compositae)". *Taxon*, 1982.