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THE FIRST TRULY INDEPENDENT WATCHDOG FOR THOSE WORKING WITH NATURAL AROMATIC MATERIALS

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Ravensara/Ravintsara Bibliography v1.01.

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[To be continually updated].

Contents: **Botany of *Ravensara* genus**.
***Ravensara anisata* Danguy et Choux (syn. *R. aromatica* Sonnerat?)**
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C*innamomum camphora* (: ravintsara).

N.B. Articles may be duplicated under more than one heading.

Cropwatch comments: Confusion regarding the exact botanical origins of ravensara & ravintsara oils are reviewed in a companion document *Ravensara-Ravintsara Confusion*, in *The Cropwatch Files*.

Botany of *Ravensara* Genus.

Kostermans A. J. G. H. (1950) "Famille 81. Lauraceae" In: Humbert H. (ed.) *Flore de Madagascar et des Comores*. Firmin-Didot, Paris. pp 1-90.

Kostermans A. J. G. H. (1958). "Le genre *Ravensara* Sonn. (Lauracées) à Madagascar." *Bulletin du Jardin botanique de l'État*, Bruxelles **28**, 173-191.

Rohwer J.G. (1993) "Lauraceae" In: Kubitzki K., Rohwer J. G. & Bittrich V. (eds). *The Families and Genera of Vascular Plants II*. Springer Verlag, Berlin pp 366-391.

Sonnerat P. (1782) "Voyage aux Indes orientales et à la Chine, fait depuis 1774 jusqu'à 1781." *Chez l'auteur*, Paris, 615 p.

Van der Werff H. (2008) "A new species and new combinations in *Cryptocarya* from Madagascar." *Adansonia* 3,30(1),41-46. Abstract. A new species, *Cryptocarya glabriflora*, is described and illustrated. It differs from other Malagasy species of Cryptocarya in being entirely glabrous, in its coriaceous, obovate or obovate-elliptic leaves with a rounded apex and in its inflorescences being 3.5 to 9 cm long. Eight species of *Ravensara*, now considered a synonym of *Cryptocarya*, are transferred to *Cryptocarya*. New names are proposed for six of

these eight species. ***Cropwatch comments***. Van Der Werff presents a useful overview of the *Ravensara* genus in the introduction to this publication.

Van der Werff H. (1993) “Proposal to conserve 281 *Cryptocarya* against *Ravensara* (Lauraceae).” *Taxon* **41**,129-130.

Ravensara anisata Danguy et Choux.

Andrianaivoravelonaa J.O., Terreaux C., Sahpaz S., Rasolondramanitra J. & Hostettmann K. (1999) "A phenolic glycoside and N-(p-coumaroyl)-tryptamine from *Ravensara anisata*." *Phytochemistry* **52**(3), 1145-1148. Abstract. A new phenolic glycoside, 1-(α-L-rhamnosyl(1-6)-β-D-glucopyranosyloxy)-3,4,5-trimethoxybenzene, together with the alkaloid N-(p-coumaroyl)-tryptamine and four known flavonoids were isolated from the methanolic bark extract of *Ravensara anisata* Danguy (Lauraceae). Their structures have been established by NMR spectroscopy, and chemical methods.

Andrianaivoravelona J.O., Sahpaz S., Terreaux C., Hostettmann K., Stoeckli-Evans H. & Rasolondramanitra J. (1999) "Two 6-substituted 5,6-dihydro-α-pyrones from *Ravensara anisata*." *Phytochemistry* **52**(2) 265-269. Abstract. The leaves and bark dichloromethane extracts of *Ravensara anisata* showed antifungal activity against the yeast *Candida albicans* and the phytopathogenic fungus *Cladosporium cucumerinum* in bioautographic TLC assays. Activity-guided fractionation afforded two new α-pyrones: 6R*-(4R*-acetoxy-2S*-hydroxy-8-phenyloctyl)-5,6-dihydro-2-H-pyran-2-one and 6R*-(2S*-acetoxy-4R*-hydroxy-8-phenyloctyl)-5,6-dihydro-2-H-pyran-2-one. Their structures have been established by NMR spectroscopy, chemical methods and X-ray crystallographic analysis. The antifungal activity against *C. albicans* and *C. cucumerinum* was determined for both compounds.

De Medici D., Pieretti S., Salvatore G., Nicoletti M. & Rasoanaivo P. (1992) “Chemical analysis of essential oil of Malagasy medicinal plants by gas chromatography & NMR spectrometry.” *Flav. & Frag. J* **7**, 275-281. Abstract. In Collaboration with the Institut Malgache de Recherches Appliquées, Antananarivo, the composition of the essential oils of medicinal plants indigenous to or cultivated in Madagascar was determined. The aim of the study was the evaluation of these plants for their possible safe use in many products of wide consumption such as foodstuffs, pharmaceuticals or cosmetics. Analyses were performed coupling the data obtained by capillary gas chromatography and 1H- and 13C-NMR techniques. The 13C-NMR spectroscopy proved to be an important tool, which can be very useful in the identification of main constituents, whereas only partial indications can be obtained for minor components. The results of the analyses of the essential oils of commercial plants (*Cinnamomum camphora* Nees and Eberm., *Cinnamomum zeylanicum* Breyn., *Eucalyptus citriodora* Hook, *Eucalyptus globulus* Labill., *Eucalyptus* spp., *Melaleuca viridiflora* Soland. ex Gaertn., *Ocimum gratissmium* L.) and endemic species (i.e., *Helichrysum gymnocephalum* Humbert, *Priadia goyavia* Berger, *Ravensara anisata* Danguy and Choux) are reported. Some antibacterial activities against *Escherichia coli* of the essential oils are also reported.

Raharivelomanana P.J., Terrom G.P., Bianchini J.P. & Coulanges P. (1989) [Study of the antimicrobial action of various essential oils extracted from Malagasy plants. II: Lauraceae] *Arch Inst Pasteur Madagascar*. **56**(1), 261-71. Abstract. The microbial growth inhibitory properties of some Lauraceae essential oils, *Laurus nobilis*, *Cinnamomum zeylanicum* (cinnamon) and *Ravensara anisata* were studied by the determination of their respective M.I.C. (Minimal Inhibitory Concentration). Five bacterial strains, one fungi and two yeasts were used to evaluate the essential oils inhibitory capacities. These vegetable extracts, with decrease activity, were range also: *C. zeylanicum*--bark greater than *R. anisata*--bark greater than *C. zeylanicum*--leaves greater than *L. nobilis* greater than *R. anisata*--leaves. The essential oils extracted from cinnamon and *R. anisata*--bark were very interesting by their antifungic activities.

Theron E., Holeman M., Potin Gautier M., Pinel R. (1994) "Authentication of *Ravensara aromatica* and *Ravensara anisata*." *Planta Med*. **60** (5), 489-491.

Tucker A.O. (1995) "Two commercial oils of Ravensara from Madagascar: *R. anisata* Danguy and *R. aromatica* Sonn. (Lauraceae)." *JOER* **7**(3), 327-329. Abstract. Commercial essential oil of *Ravensara anisata*, examined by GC/MS, is dominated by methyl chavicol (61.62%) and (E)-anethole (20.09%), while a commercial oil of *R. aromatica* is dominated by 1,8-cineole (30.97%), sabinene (17.23%) and alpha-terpineol (10.34%). ***Cropwatch comments***: It should be borne in mind that the botanical origins of these essential oils were not expertly established.

***Ravensara aromatica* Sonnerat.**

Andrianoelisoa H.S., Menut C., de Chatelperron P.C., Saracco J., Ramanoelina P. & Danthu P. (2008) "Intraspecific chemical variability and highlighting of chemotypes of leaf essential oils from *Ravensara aromatica* Sonnerat, a tree endemic to Madagascar." *Flav. & Frag. J.* **21**(5), 833-838. Abstract. *Ravensara aromatica* Sonnerat is a tree endemic to Madagascar. The essential oil extracted from the leaves is used in aromatherapy. Previous chemical studies have generated some confusion with regard to the chemical composition of this essential oil. In order to eliminate this uncertainty, we undertook a systematic evaluation of the chemical composition of essential oils from leaves of this species. The study focused on 28 individual samples formally identified as *R. aromatica*. The essential oils were obtained by hydrodistillation and analysed by GC and GC-MS. It was possible to distinguish four groups of trees through principal components analysis and agglomerative hierarchical clustering analysis of the seven chief molecules identified in their essential oils. Two groups were characterized by a prevalence of compounds with an aromatic structure: methyl chavicol (representing more than 90% of the essential oil) in the first group and methyl eugenol (74-82%) in the second group. The predominant compounds of the other two groups proved to be of the monoterpenic type: α-terpinene (25-28%) and limonene (15-22%) in the third group, while sabinene (25-34%), linalool (7-21%) and terpinen-4-ol (6-12%) were the primary constituents of the

essential oils in the fourth group. The importance of these results for the commercial production of the essential oils from this species is discussed.

Bakkali F., Averbeck S. & Idaomar M. (2007) “Biological effects of essential oils – A review.” *Food & Chemical Toxicology* **46**(2), 446-475. Abstract. Since the middle ages, essential oils have been widely used for bactericidal, virucidal, fungicidal, antiparasitical, insecticidal, medicinal and cosmetic applications, especially nowadays in pharmaceutical, sanitary, cosmetic, agricultural and food industries. Because of the mode of extraction, mostly by distillation from aromatic plants, they contain a variety of volatile molecules such as terpenes and terpenoids, phenol-derived aromatic components and aliphatic components. In vitro physicochemical assays characterise most of them as antioxidants. However, recent work shows that in eukaryotic cells, essential oils can act as prooxidants affecting inner cell membranes and organelles such as mitochondria. Depending on type and concentration, they exhibit cytotoxic effects on living cells but are usually non-genotoxic. In some cases, changes in intracellular redox potential and mitochondrial dysfunction induced by essential oils can be associated with their capacity to exert antigenotoxic effects. These findings suggest that, at least in part, the encountered beneficial effects of essential oils are due to prooxidant effects on the cellular level.

Bakkalia F., Averbeck S., Averbeck D., Zhiri A. & Idaomar M. (2005) "Cytotoxicity and gene induction by some essential oils in the yeast *Saccharomyces cerevisiae*." *Mutation Research/Genetic Toxicology and Environmental Mutagenesis* **585**(1-2), 1-13. Abstract. In order to get an insight into the possible genotoxicity of essential oils (EOs) used in traditional pharmacological applications we tested five different oils extracted from the medicinal plants *Origanum compactum*, *Coriandrum sativum*, *Artemisia herba alba*, *Cinnamomum camphora* (*Ravintsara aromatica*) and *Helichrysum italicum* (*Calendula officinalis*) for genotoxic effects using the yeast *Saccharomyces cerevisiae*. Clear cytotoxic effects were observed in the diploid yeast strain D7, with the cells being more sensitive to EOs in exponential than in stationary growth phase. The cytotoxicity decreased in the following order: *Origanum compactum* > *Coriandrum sativum* > *Artemisia herba alba* > *Cinnamomum camphora* > *Helichrysum italicum*. In the same order, all EOs, except that derived from *Helichrysum italicum*, clearly induced cytoplasmic petite mutations indicating damage to mitochondrial DNA. However, no nuclear genetic events such as point mutations or mitotic intragenic or intergenic recombination were induced. The capacity of EOs to induce nuclear DNA damage-responsive genes was tested using suitable Lac-Z fusion strains for RNR3 and RAD51, which are genes involved in DNA metabolism and DNA repair, respectively. At equitoxic doses, all EOs demonstrated significant gene induction, approximately the same as that caused by hydrogen peroxide, but much lower than that caused by methyl methanesulfonate (MMS). EOs affect mitochondrial structure and function and can stimulate the transcriptional expression of DNA damage-responsive genes. The induction of mitochondrial damage by EOs appears to be closely linked to overall cellular cytotoxicity and appears to mask the occurrence of nuclear

genetic events. EO-induced cytotoxicity involves oxidative stress, as is evident from the protection observed in the presence of ROS inhibitors such as glutathione, catalase or the iron-chelating agent deferoxamine.

Behra O., Rakotoarison C. & Harris R. (2001). "Ravintsara vs ravensara, a taxonomic clarification." *Int J. Aromatherapy* **15**, 4–7. Abstract. 'This article is presented by Olivier Behra, a recognized innovative conservation leader. Here he tries to unravel some of the confusion surrounding the origins and identities of ravintsara and ravensara. Madagascar has been found to be one of the three biodiversity hotspots of the world and is the most in need of attention. Future articles by the same author will help us focus on the ethical production of essential oils from this part of the world'. ***Cropwatch comments:*** The authors present results showing the variation in composition of *Ravensara aromatica* leaf oil against length of steam distillation time (3, 4 & 5 hours) where the concentrations of higher molecular weight materials such as germacrene D & β-caryophyllene increase with distillation time at the expense of lower molecular weight materials such as limonene & sabinene. The authors also present chemical analyses for ravintsara leaf oil, *Ravensara* aromatica leaf oil & *Ravensara aromatica* bark oil ("Havoso" bark oil) where 2.4-11.9% & 90-95% of methyl chavicol were determined in *Ravensara aromatica* leaf oil & *Ravensara aromatica* bark oil respectively. Methyl eugenol was not reported in any of the analyses presented. Also of interest is the statement that high 1,8-cineole containing oils labelled as *Ravensara aromatica* from Madagascar actually derive from ravinsara (from *Cinammomum camphora*). Of note: Behra *et al*. suggest that Rosoanaivo & De la Gorce (1998) described ravintasara oil incorrectly as *Ravensara aromatica* oil.

Cavalli J.F. (2002) "Caractérisation par CPG/IK, CPG/SM et RMN du carbone-13 d'huiles essentielles de Madagascar. *Thèse de Doctorat Chimie Organique et Analytique, Université de Corse, 2002*, p38-44.

Choi W-S, Park B-S, Lee Y-H, Jang D.Y., Yoon H.Y. & Sung-Eun Lee (2006) "Fumigant toxicities of essential oils and monoterpenes against *Lycoriella mali* adults." *Crop Protection* **25**(4),398-401. Abstract. Toxicity of various essential oils and their volatile components against the mushroom sciarid, *Lycoriella mali* was determined. The most potent fumigant toxicity was found in essential oil from thyme followed by the oils of sage, eucalyptus, and clove bud. α-Pinene was the most toxic fumigant compound found in thyme essential oil (air) followed by β-pinene (air) and linalool (air). The mixture of α- and β-pinene exhibited stronger fumigant toxicity than α- or β-pinene itself against the mushroom fly adults. Therefore, thyme essential oil, α- and β-pinene could be potent fumigants to control mushroom flies during mushroom cultivation.

Danthu P., Ramaroson N. & Rambeloarisoa G. (2008) "Seasonal dependence of rooting success in cuttings from natural forest trees in Madagascar." *Agroforestry Systems* **73**(1), 47-53. Abstract. Four ligneous species from the tropical forest in the east of Madagascar, with a proven or potentially high economic value, were subject to 'low-tech' vegetative propagation tests from stem cuttings. The species

concerned were *Aphloia theiformis*, *Ilex mitis*, *Prunus africana* and *Ravensara aromatica*. The cuttings were three-node segments of stems on which one leaf was retained. All the species proved amenable to rooting. The maximum percentage of rooting ranged from 33% for P. africana to 60% for *I. mitis*. Rooting success was dependant on the season of cutting (high in the hot season, from October to May, and null in cold season). This study is the first successful attempt at propagating cuttings from Malagasy forest species. This result is of particular importance to *P. africana*, threatened by destructive exploitation in Madagascar. It goes a step further in the domestication of this species by demonstrating the ability of cutting from 10 year old ortets collected in natural forest to root as it offers the possibility of a reliable and effective method of reintroduction for the species in over-exploited zones.

Franchomme P. & Penoel D. (eds). (1990) *l'aromatherapie exactement,* pub. R. Jollois, Limoges, France.

Friedman M., Henika P.R. & Mandrell R.E. (2002) “Bactericidal activities of plant essential oils and some of their isolated constituents against *Campylobacter jejuni*, *Escherichia coli*, *Listeria monocytogenes*, and *Salmonella enterica*." *Journal of Food Protection* **65**(10), 1545–1560. Abstract. An improved method of sample preparation was used in a microplate assay to evaluate the bactericidal activity levels of 96 essential oils and 23 oil compounds against *Campylobacter jejuni*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, and *Salmonella enterica* obtained from food and clinical sources. Bactericidal activity (BA50) was deemed as the percentage of the sample in the assay mixture that resulted in a 50% decrease in CFU relative to a buffer control. Twenty-seven oils and 12 compounds were active against all four species of bacteria. The oils that were most active against *C. jejuni* (with BA50 values ranging from 0.003 to 0.009) were marigold, ginger root, jasmine, patchouli, gardenia, cedarwood, carrot seed, celery seed, mugwort, spikenard, and orange bitter oils; those that were most active against E. coli (with BA50 values ranging from 0.046 to 0.14) were oregano, thyme, cinnamon, palmarosa, bay leaf, clove bud, lemon grass, and allspice oils; those that were most active against *L. monocytogenes* (with BA50 values ranging from 0.057 to 0.092) were gardenia, cedarwood, bay leaf, clove bud, oregano, cinnamon, allspice, thyme, and patchouli oils; and those that were most active against *S. enterica* (with BA50 values ranging from 0.045 to 0.14) were thyme, oregano, cinnamon, clove bud, allspice, bay leaf, palmarosa, and marjoram oils. The oil compounds that were most active against *C. jejuni* (with BA50 values ranging from 0.003 to 0.034) were cinnamaldehyde, estragole, carvacrol, benzaldehyde, citral, thymol, eugenol, perillaldehyde, carvone R, and geranyl acetate; those that were most active against *E. coli* (with BA50 values ranging from 0.057 to 0.28) were carvacrol, cinnamaldehyde, thymol, eugenol, salicylaldehyde, geraniol, isoeugenol, citral, perillaldehyde, and estragole; those that were most active against *L. monocytogenes* (with BA50 values ranging from 0.019 to 0.43) were cinnamaldehyde, eugenol, thymol, carvacrol, citral, geraniol, perillaldehyde, carvone S, estragole, and salicylaldehyde; and those that were most active against *S. enterica* (with BA50 values ranging from 0.034 to 0.21)

were thymol, cinnamaldehyde, carvacrol, eugenol, salicylaldehyde, geraniol, isoeugenol, terpineol, perillaldehyde, and estragole. The possible significance of these results with regard to food microbiology is discussed. ***Cropwatch comments***: essential oils tested included *Ravensara aromatica*.

Groebel A., Lenoir D. & Pernet R. (1970) [Contents of *Ravensara aromatica* a Lauracea growing in Madagascar] *Planta Med*.**18**(1), 66-72.

Groebel A. (1966) US Patent 3,478,147. "Pharmacologically active substance and method of preparing it from *Ravensara aromatica*." Abstract. A pharmacologically active substance isolated from the bark of *Ravensara aromatica* by steam distillation of the bark and solvent extraction of the distillate, or by solvent extraction of the bark, followed by isolation of the active substance from the extract by distillation or chromatography.

Hoechst AG (1969-04-23) "Compounds from *Ravensara aromatica* and process for preparing it." Patent Publicn No GB1149369. Abstract of GB 1149369 (A). 1,149,369. Extract of bark of *Ravensara aromatica*. FARBWERKE HOECHST A.G. 22 Sept., 1966 [22 Sept., 1965], No. 42344/66. Heading C2C. A novel compound which is an extract of the bark of *Ravensara aromatica* and has the following characteristics: composition C: 61À6%, H: 10À6%, 0: 27À1%; b.p. 67 C/l mm. Hg; U.V. maxima at 225, 278 and 284 mÁ; 2,4- dinitrophenylhydrazide m.p. 159 C.; $NaHSO_3$ adduct has m.p. 194 C. (decomposition), is is obtained either by steam distillation of the crushed bark or by extraction of the bark with an organic solvent e.g. ether after optionally previously extracting it with petroleum ether and in both cases further purifying the extract or steam distillate by distillation or chromatography.; Pharmaceutical compositions for oral or intraarterial administration and having spasmolytic and coronaro-dilatatory activity comprise the above novel extract and a suitable pharmaceutical carrier therefore.

Holm Y & Hiltunen R. (1999) "Chemical composition of a commercial oil of *R. aromatica* Sonn. used in Aromatherapy." *J. Essent. Oil Res*. **11**, 677-678.

Idaomar M., El-Hamss R., Bakkali F., Mezzoug N., Zhiri A., Baudoux D., Muñoz-Serrano A., Liemans V. & Alonso-Moraga A. (2002) "Genotoxicity and antigenotoxicity of some essential oils evaluated by wing spot test of *Drosophila melanogaster*." *Mutat Res.* **513**(1-2), 61-8. Abstract. Essential oils extracted from the three medicinal plants; *Helichrysum italicum*, *Ledum groenlandicum* and *Ravensara aromatica*, together with their mixture were tested for their genotoxic and antigenotoxic activities against urethane, a well-known promutagen. We have adopted the somatic mutations and recombination test (SMART) in the wings of *Drosophila melanogaster*. Three days old larvae, trans-heterozygous for two genetic markers mwh and flr, were treated by essential oil and/or urethane. A negative control corresponding to solvent was also used. Our results do not show any significant effect of the oils tested but they reduce the mutation ratio resulting from urethane. The mixture of the three oils at equal volume seems to be the most effective. The antimutagenic effect of these oils could be explained by the

interaction of their constituents with cytochrome P-450 activation system leading to a reduction of the formation of the active metabolite. The effect could also be attributed to certain molecules that are involved in these oils.

Inouye S., Uchida K., Maruyama N., Yamaguchi H. & Abe S. (2006) "A novel method to estimate the contribution of the vapor activity of essential oils in agar diffusion assay ." *Nippon Ishinkin Gakkai Zasshi* **47**, 91-98. ***Cropwatch comments***. Battery of essential oil vapours tested against *Trichophyton mentagrophytes* and *Aspergillus fumigatus* included *Ravensara aromatica*.

Juliani H.R., Kapteyn J., Jones D., Koroch A.R., Wang M., Carles D & Simon J.E. (2006) "Application of near-infrared spectroscopy in quality control and determination of adulteration of African essential oils." *Phytochem. Anal*. **17**, 121–128 (2006). Abstract. An evaluation has been made of the potential of near-infrared (NIR) technologies in the assessment of essential oil components and in the identification of individual essential oils. The results showed that cross-validation models are able to predict accurately almost all of the components of essential oils. In different cinnamon (*Cinnamomum zeylanicum*) and clove (*Syzygium aromaticum*) essential oils, which showed a similar composition, 23 components (representing 97.8–99.9% of the oil) were accurately predicted, as well as 20 components (93.0–99.1%) in *Cinnamomum camphora* (ravintsara), 32 components (92.3–98.1%) in *Ravensara aromatica* (ravensara), and 26 components (96.6–98.4%) in *Lippia multiflora*. For almost all of the components, the modelled and reference values obtained by GC-FID were highly correlated ($r2 \geq 0.985$) and exhibited a low variance (less than 5%). The model was also able to discriminate between the ravintsara and ravensara essential oils. It was shown that two commercial oils labelled as *R. aromatica* were actually ravintsara (*C. camphora*), revealing the misidentification of these essential oils in the marketplace. The study demonstrates the application of NIR technology as a quality control tool for the rapid identification of individual essential oils, for product authentication, and for the detection of adulteration.

Juliani H.R., Behra O., Moharram H., Ranarivelo L., Ralijerson B., Andriantsiferana M., Ranjatoson N., Rasoarahona J., Ramanoelina P., Wang M. & Simon J.E. (2005). "Searching for the real ravensara (*Ravensara aromatica* Sonn.) essential oil: a case study for 'Natiora' the Malagasy natural product label." *Perf Flavor* **30**, 60– 65. Abstract. The essential oil of ravintsara is obtained from the leaves of *Cinnamomum camphora*, introduced from Taiwan to Madagascar as an ornamental, but has often been misreported and traded as *Ravensara aromatica*. The true ravensara oil is extracted from the leaves of an endemic species, *R. aromatica* (also known as *R. anisata*). This study was conducted on commercial and research samples of ravensara and ravintsara as part of a programme to develop grades and standards for Natiora, a new natural plant products label of Madagascar. The physicochemical properties of each sample were compared, and the oils were analysed by GC-MS. Quality standards are presented for the 2 oils.

Juliani H.R., Simon J.E., Ramboatiana M.M.R., Behra O., Garvey A. & Raskin I. (2004). "Malagasy aromatic plants: essentials, antioxidant and antimicrobial activities." *Acta Hortic* **629**, 77– 81. Abstract.

Lardry J.-M. (2007) "Les autres indications des huiles essentielles." *Kinésithérapie, la Revue* **7**(61), 35-42.

Lawrence B.M. (2000) “Progress in Essential Oils: Ravensara” *Perf & Flav.* **25**(5), Sept/Oct 68-71.

Lis-Balchin M. (1999) "Possible health and safety problems in the use of novel plant essential oils and extracts in aromatherapy." *Journal of the Royal Society for the Promotion of Health*, **119**(4), 240-243. Abstract: Aromatherapy is a branch of complementary or alternative therapy which is increasing in popularity, yet has scant scientific credibility. Aromatherapy should be defined as treatment using odours and practised as such. However, essential oils are usually used in conjunction with massage and often combined with counselling of some kind. The use of most commonly-used essential oils in massage is seldom dangerous, as they have low systemic toxicity, especially when used at 2% dilution (provided they are not adulterated); however, their safety during pregnancy, childbirth and babies has not been clearly demonstrated. Sensitisation, however, is a growing concern. Some aromatherapists are now introducing novel plant essential oils, extracts and phytols into their massage routine, many of which have no odour and are potentially toxic. The possible dangers of these plant products are therefore discussed using specific examples. ***Cropwatch comments***: Burfield & Sorensen (1999) wrote a full-length critique of this article which the editor of the Journal of the Royal Society of Health refused to publish. This critique was eventually published elsewhere (see *Ravensara-Ravintsara Confusion* feature in *Cropwatch Files*.

Lis-Balchin M., Deans S.G. & Eaglesham E. (1998) "Relationship between bioactivity and chemical composition of commercial essential oils." *Flavour & Frag J* **13**(20), 98-104. Abstract. In order to establish the value of the use of biological activities as accessory criteria (in conjunction with gas chromatography, but in the absence of enantiomeric analysis) for establishing the authenticity of essential oils, the biological activities of 105 commercial essential oils were investigated against 25 species of bacteria, 20 strains of *Listeria* monocytogenes, and three filamentous fungi; their antioxidant action was also determined and all the results were related to the actual chemical composition of the oils as determined by gas chromatography. The results showed some relationship between the major components and some bioactivities. There was a negative correlation between 1,8-cineole content and antifungal activity. There was, however, great variability between the biological action of different samples of individual oils and groups of oils under the same general name, e.g. lavender, eucalyptus or chamomile, which was reflected in differences in chemical composition, The results suggest that, although the biological activities are not all related to the main components, any significant blending, rectification and adulteration of commercial oils can be monitored by their biological activities. The

use of essential oils named simply as chamomile or eucalyptus, or any commercial oil which has been adulterated, cannot be justifiably used in treating medical conditions unless it can be shown that the action is non-specific and independent of the chemical composition. ***Cropwatch comments:*** Battery of 105 esserntial oils tested included *Ravensara aromatica*.

Lis-Balchin M. (1996) "Letter: Ravensara." *International Journal of Aromatherapy* 7(3), 43.

Minami M., Kita M., Nakaya T., Yamamoto T., Kuriyama H. & Imanishi J. (2003) "The inhibitory effect of essential oils on *Herpes Simplex* Type-1 Replication *in vitro*." *Microbiology & Immunology* **47**(9), 681-684. Abstract. The antiviral effect of 12 essential oils on *herpes simplex* virus type-1 (HSV-1) replication was examined in vitro. The replication ability of HSV-1 was suppressed by incubation of HSV-1 with 1% essential oils at 4 C for 24 hr. Especially, lemongrass completely inhibited the viral replication even at a concentration of 0.1%, and its antiviral activity was dependent on the concentrations of the essential oil. When Vero cells were treated with the essential oil before or after viral adsorption, no antiviral activity was found, which suggests that the antiviral activity of essential oils including lemongrass may be due to the direct interaction with virions. ***Cropwatch comments***: Essential oils tested included *Ravensara aromatica*.

Möllenbeck S., Köenig T., Schreier P., Schwab W. Rajaonarivony J., Ranarivelo L. (1997) "Chemical composition and analyses of enantiomers of essential oils from Madagascar." *Fl & Frag J*. **12**(2), 63-69. Abstract. The volatile constituents of twelve essential oils from Madagascar, namely those of *Cinnamomum camphora* (L.) Presl, *Cinnamomum zeylanicum* Blume (leaf oil), *Hedychium flavum* Roxb., *Helichrysum gymnocephalum* Humbert, *Helichrysum selaginifolium* L., *Lantana camara* L., *Pelargonium roseum* Willd., *Piper nigrum* L., *Ravensara aromatica* Havozo (bark oil and leaf oil), *Vetiveria zizanioides* (L.) Nash ex Small and *Zingiber officinale* Roscoe were identified and quantified by high resolution capillary gas chromatography coupled to mass spectrometry (HRGC-MS) and high resolution capillary gas chromatography (HRGC), respectively. In all the essential oils at least one of the five chiral monoterpenes citronellol, limonene, linalol, terpinen-4-ol and α-terpineol was detected. Analysis of the enantiomers using multidimensional capillary gas chromatography (MDGC) revealed specific enantiomeric excesses, except for linalol, which was found in racemic form in *P. roseum* essential oil.

Ohno T., Kita M., Yamaoka Y., Imamura S., Yamamoto T., Mitsufuji S., Kodama T. & Imanishi J. (2003) *Helicobacter* **8**(3), 207-215. Abstract. Background: *Helicobacter pylori* is an important pathogen responsible for gastroduodenal diseases in humans. Although the eradication of *H. pylori* using antibiotics often improves gastroduodenal diseases, resistance to the antibiotics is emerging. Materials and Methods: The antimicrobial effect of essential oils and the development of resistance to the essential oils were evaluated in vitro and in vivo. Results: Thirteen essential oils used in this study completely inhibited the growth of *H. pylori* in vitro at a concentration of 0.1% (v/v). *Cymbopogon citratus*

(lemongrass) and *Lippia citriodora* (lemon verbena) were bactericidal against H. pylori at 0.01% at pH 4.0 and 5.0. Resistance to lemongrass did not develop even after 10 sequential passages, whereas resistance to clarithromycin developed under the same conditions. In in vivo studies, the density of H. pylori in the stomach of mice treated with lemongrass was significantly reduced compared with untreated mice. Conclusions: These results demonstrate that the essential oils are bactericidal against *H. pylori* without the development of acquired resistance, suggesting that essential oils may have potential as new and safe agents for inclusion in anti-*H. pylori* regimens. ***Cropwatch comments***: Essential oils tested against *H. pylori* included *Ravensara aromatica*.

Ramanoelina P.A.R.,Rasoarahona J.R.E. & Gaydou E.M. (2006) "Chemical composition of *Ravensara aromatica* Sonn. leaf essential oils from Madagascar." *JEOR*. **18**(2), 215-217. Abstract. Five leaf essential oils of *Ravensara aromatica* Sonn. from Madagascar have been analyzed by GC and GC/MS. They were found to contain mainly methyl chavicol (79.7%), methyl eugenol (8.5%) and limonene (3.1%). The existence of methyl chavicol as a main component of the leaf oil is discussed.

Rasoanaivo P. (1997) "*Ravensara aromatica*: a threatened, aromatic species of Madagascar." *Med. Pl. Conserv*. **4**, 9 (1997)

Rasoanaivo P. & de la Gorce P. (1998). "Essential oils of economic value in Madagascar: present state of knowledge." *Herbalgram* **43**: 31– 59.

Sheppard-Hanger S. (1995) "The *Ravensara* dilemma or A comparison study of the taxonomy, chemical constituents, safety and an aromatherapy market survey of essential oils from the plants: *Ravensara aromatica*, *Cinnamomum camphora.*" *Thesis for An International Training Programme in Essential Oils: Advanced Studies*, Purdue Univ. West Lafayette, Indiana.

Halpern G.M. & Weverka P. (2003) *Healing Trail: Essential Oils of Madagascar - A Guide to the Health Benefits of the Eight Essential Oils of Madagascar*. Basic Health Publications Inc. 2003..

Ravintsara (C*innamomum camphora* (L.) Presl.**)**

Andriantiana J.L. (2003) "Plants at risk: Ravintsara," 1(5), December 2003, p. 16.

Behra O., Rakotoanison C. & Harris R. (2001). "Ravintsara vs ravensara, a taxonomic clarification." *Int J. Aromatherapy* **15**, 4–7. Abstract. This article is presented by Olivier Behra, a recognized innovative conservation leader. Here he tries to unravel some of the confusion surrounding the origins and identities of ravintsara and ravensara. Madagascar has been found to be one of the three biodiversity hotspots of the world and is the most in need of attention. Future articles by the same author will help us focus on the ethical production of essential oils from this part of the world.

Blanchard J.-M. (2007) "*Cinnamomum camphora* with cineol (ravintsara): a plant for the prevention of nosocomial infections." *Phytothérapie* **5**(1), 15-20. Abstract.

Nosocomial infections are an everyday concern in Western societies because they increase morbidity and have high social costs. The essential oil of *Cinnamomum camphora* with cineol (ravintsara) is empirically known for its antiviral and immunostimulatory properties. In a preliminary trial, the oil's antibiotic properties were studied to determine its effect on reducing nosocomial infections in a hospital setting. The results of the two-year trial are promising, but must be confirmed. Nosocomial infections is an every day major preoccupation in occidental societies, since it occurs enhancement of morbidity and social costs. *Cinnamomum camphora* cineole (ravintsara) essential oil is empirically known for its antiviral and immunostimulating properties. In a preliminary try, this effects associated to antibiotical control are checked in order to reduce the nosocomial infections in hospital service. In a two years essay promising results have been noticed but must be confirmed.

Jeannot V., Roger B., Chahboun J. & Baret P. (2007) "Ravintsara (*Cinnamomum camphora* (L.) Presl.) essential oil & hydrolat in therapeutics." *J. Essential* Oil *Therapeutics* 1,35-38. Abstract. The chemical composition of ravintsara (*Cinnamomum camphora* (L.) Presl.) essential oil and aromatic fraction of hydrolate were determined by gas chromatography. Six compounds are identified for the first time in this essential oil: linalool, *para*-menth-1-en-2-ol, δ-terpineol, borneol, *trans*-nerolidol and globulol. Thirteen compounds are identified in the aromatic fraction of ravintsara hydrolat, representing more than 90% of the product. 1,8-Cineole is the major component of both essential oil and hydrolat. The determination of the chemical composition of these products is the basis to discuss the use of these products in the field of therapeutics. ***Cropwatch comments***: Ten samples of (commercially produced) ravintsara oil were analysed by the authors from Malagasy production during 2005-6, along with 2 commercial samples of hydrolate from 2006 production. The precise botanical origins of the samples were therefore not established by an expert.

Juliani H.R., Behra O., Moharram H., Ranarivelo L., Ralijerson B., Andriantsiferana M., Ranjatoson N., Rasoarahona J., Ramanoelina P., Wang M. & Simon J.E. (2005). "Searching for the real ravensara (*Ravensara aromatica* Sonn.) essential oil: a case study for 'Natiora' the Malagasy natural product label." *Perf Flavor* **30**, 60– 65. Abstract. The essential oil of ravintsara is obtained from the leaves of *Cinnamomum camphora*, introduced from Taiwan to Madagascar as an ornamental, but has often been misreported and traded as *Ravensara aromatica*. The true ravensara oil is extracted from the leaves of an endemic species, *R. aromatica* (also known as *R. anisata*). This study was conducted on commercial and research samples of ravensara and ravintsara as part of a programme to develop grades and standards for Natiora, a new natural plant products label of Madagascar. The physicochemical properties of each sample were compared, and the oils were analysed by GC-MS. Quality standards are presented for the 2 oils.

Sheppard-Hanger S. (1995) "The Ravensara dilemma, or: A comparison study of the taxonomy, chemical constituents, safety and an aromatherapy market survey

of essential oils from the plants: *Ravensara aromatica*, *Cinnamomum camphora*." *Thesis for An International Training Programme in Essential Oils: advanced Studies, Purdue Univ. West Lafayette, Indiana.*