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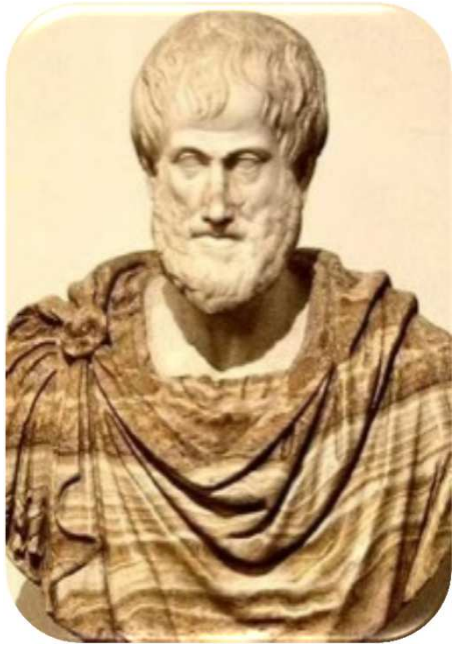
«Libro Verde»
Repertorio Efficacia
Melaleuca Alternifolia (TTO)

Melaleuca alternifolia – Indice del Repertorio

- Conformità del «chemotipo»
- Profilo delle proprietà
- Geografia R&D
- Efficacia «Peer Reviewed»
- Target attività R&D
- Meccanismi d'azione Identificati
- Generalità e proprietà
- Attività virucida
- Attività biocida
- Attività fungicida
- Attività antiparassitaria



«La natura non fa nulla di inutile»

Aristotele
383 – 322 AC
Mente filosofica innovativa.
Maestro dei Sapienti.
Scienziato greco.

Melaleuca alternifolia – Conformità del «chemotipo»

ISO International Organization for Standardization

edqm European Directorate for the Quality of Medicines & HealthCare

CAS # 68647-73-4
EINECS # 285-377-1

British Pharmacopoeia

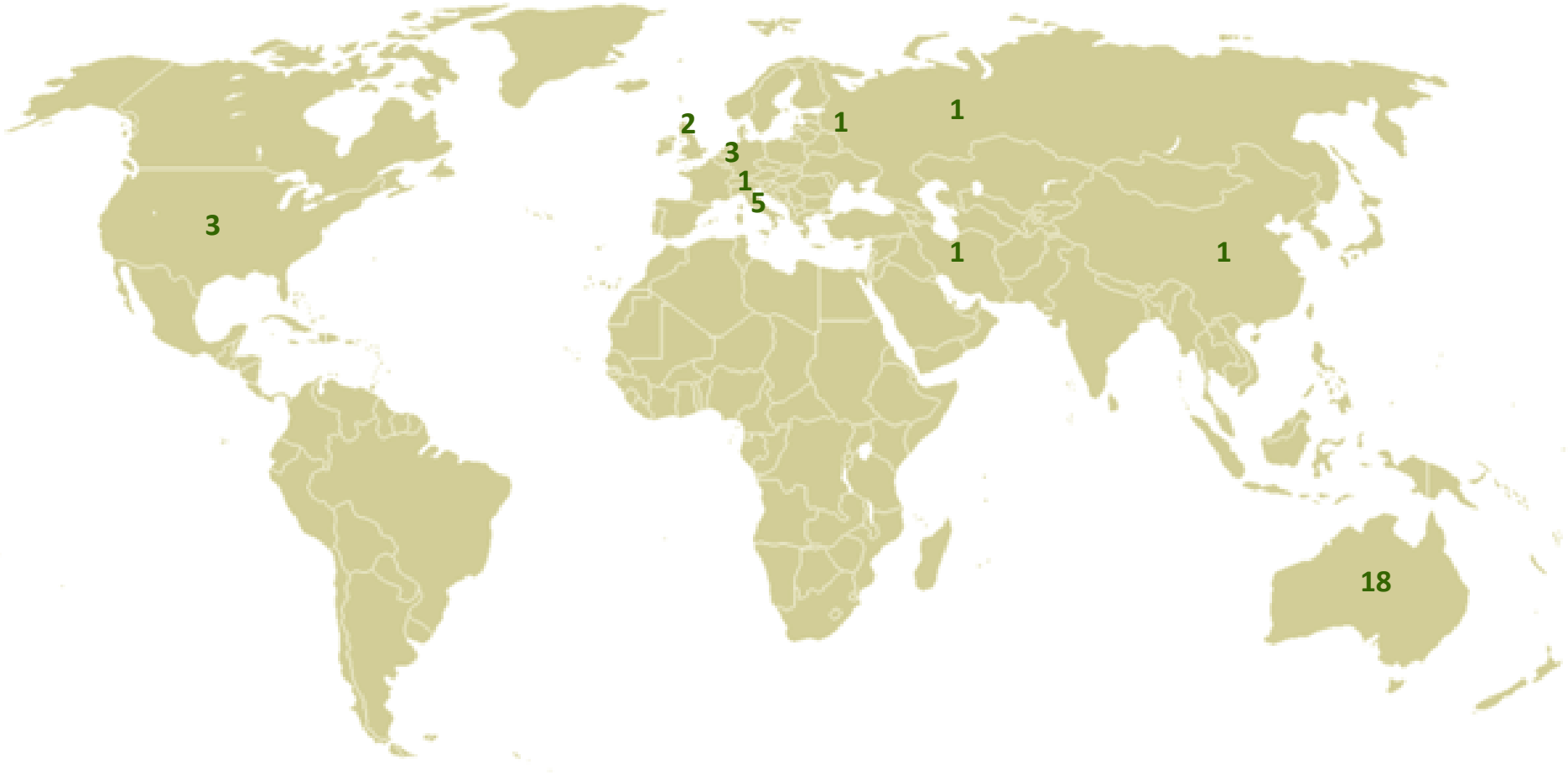
Constituent	Minimum (%)	Maximum (%)
Terpinolene	1.5	5
1,8-Cineole (eucalyptol)	Trace	15
α-Terpinene	5	13
γ-Terpinene	10	28
p-Cymene	0.5	8
Terpinen-4-ol	30	48
α-Terpineol	1.5	8
Limonene	0.5	1.5
Sabinene	Trace	3.5
Aromadendrene	Trace	3
δ-Cadinene	Trace	3

Constituent	Minimum (%)	Maximum (%)
Globulol	Trace	1
Viridiflorol	Trace	1
α-Pinene	1	6
Ledene (syn. viridiflorene)	Trace	3

Melaleuca alternifolia – Profilo delle proprietà intrinseche

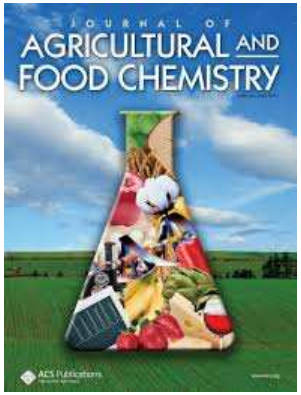
- Proprietà antibatteriche e immunostimulanti «intrinseche»
- Attività anti-flogistica, lenitiva, analgesica e vulneraria
- Azione bioattivatrice a effetto plastificante
- Protezione «dermoattiva» ad attività residuale

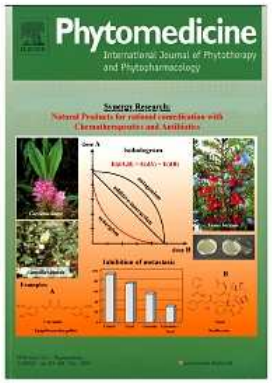
Melaleuca alternifolia – «geografia» attività R&D

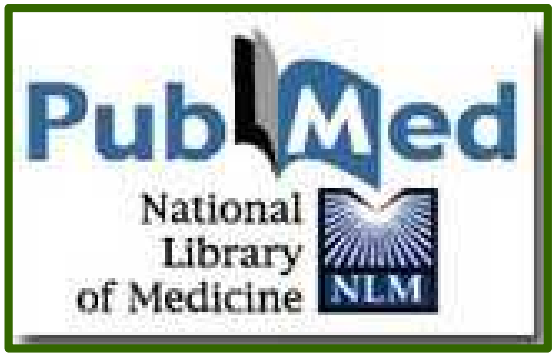


Numero riferimenti bibliografici selezionati per Paese

Melaleuca alternifolia – 307 recensioni PubMed 01/2014





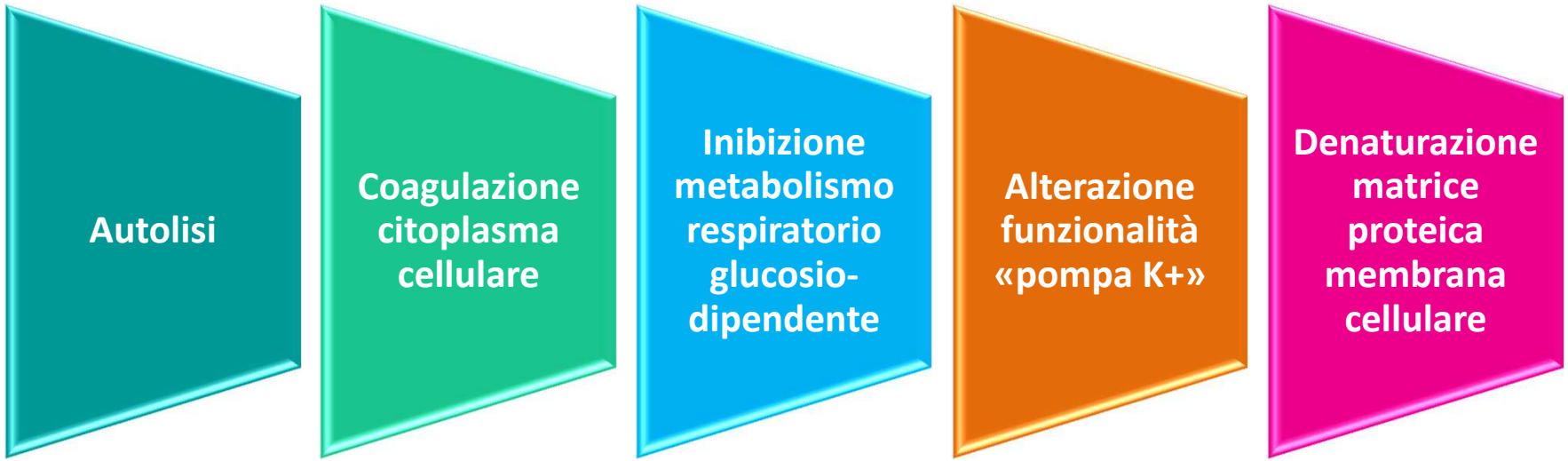


Melaleuca alternifolia – Target attività R&D 1998/2013

ANNI	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
R&D																
ANTIBIOTICORESISTENZA																
AZIONE LIFTING BIOFILM																
MIC50/MIF50																
VALIDAZIONE BIOCIDA																
ATTIVITA' ANTISETTICA																
ATTIVITA' ANTIPARASSITARIA																
ATTIVITA' ANTIMICOTICA																
AZIONE ANTIVIRALE																
ATTIVITA' IMMUNOMODULANTE																
SVILUPPO GALENICO																
MECCANISMI AZIONE																
APPLICAZIONI VETERINARIE																

Melaleuca alternifolia – Meccanismi d'azione identificati

Dimostrato spettro d'azione biocida, virucida, fungicida, anti-protozoario, ectoparassitario



Staphylococcus aureus MRSA, Staphlyococcus epidermidis, E. coli, Pseudomonas aeruginosa, Aspergilllus niger, Trichophyton mentagrophytes, Leishmania spp.

Melaleuca alternifolia – Generalità e e proprietà

Melaleuca alternifolia – «Rischio Zero» resistenza crociata

Aprile 2013

Int J Antimicrob Agents. 2013 Apr;41(4):343-51. doi: 10.1016/j.ijantimicag.2012.12.011. Epub 2013 Mar 6.

Effect of habituation to tea tree (Melaleuca alternifolia) oil on the subsequent susceptibility of Staphylococcus spp. to antimicrobials, triclosan, tea tree oil, terpinen-4-ol and carvacrol.

Thomsen NA, Hammer KA, Riley TV, Van Belkum A, Carson CF.

PathWest Laboratory Medicine WA, Nedlands, WA 6009, Australia.

Abstract

The aim of this study was to seek additional data on the antimicrobial susceptibility of Staphylococcus spp. after habituation to low levels of the topical antimicrobial agent tea tree (Melaleuca alternifolia) oil. Meticillin-susceptible Staphylococcus aureus (MSSA), meticillin-resistant S. aureus (MRSA) and coagulase-negative staphylococci (CoNS) were habituated to 0.075% tea tree oil for 3 days. Subsequently, the susceptibility of five isolates each of MSSA, MRSA and CoNS to fusidic acid, mupirocin, chloramphenicol, linezolid and vancomycin was determined by Etest, and susceptibility to tea tree oil, terpinen-4-ol, carvacrol and triclosan was determined by agar dilution. Following habituation to 0.075% tea tree oil, antimicrobial MICs differed between control and habituated isolates on 33 occasions (out of a possible 150), with MICs being higher in habituated isolates on 22 occasions. Using clinical breakpoint criteria, one MSSA isolate changed susceptibility category from vancomycin-susceptible (MIC=2μg/mL) to intermediate susceptibility (MIC=3μg/mL) after habituation in one of two replicates. For the non-antibiotic antimicrobial agents, MICs of habituated and control isolates differed on 12 occasions (out of a possible 120); 10 occasions in MRSA and 2 occasions in MSSA. MICs were higher for habituated isolates on five occasions. However, all the differences were one serial dilution only and were not regarded as significant. Habituation to sublethal concentrations of tea tree oil led to minor changes in MICs of antimicrobial agents, only one of which may have been clinically relevant. There is no evidence to suggest that tea tree oil induces resistance to antimicrobial agents.

Parole Chiave

Staphylococcus aureus MRSA. Vancomicina. Triclosan. Resistenza crociata.

Melaleuca alternifolia – Analisi bioinformatica

Marzo 2013

Phytother Res. 2013 Mar;27(3):390-6. doi: 10.1002/ptr.4738. Epub 2012 May 23.

Tea Tree Oil-Induced Transcriptional Alterations in Staphylococcus aureus.

Cuaron JA, Dulal S, Song Y, Singh AK, Montelongo CE, Yu W, Nagarajan V, Jayaswal RK, Wilkinson BJ, Gustafson JE.
Microbiology Group, Department of Biology, New Mexico State University, Las Cruces, NM, 88003, USA.

Abstract

Tea tree oil (TTO) is a steam distillate of Melaleuca alternifolia that demonstrates broad-spectrum antibacterial activity. This study was designed to document how TTO challenge influences the Staphylococcus aureus transcriptome. Overall, bioinformatic analyses (S. aureus microarray meta-database) revealed that both ethanol and TTO induce related transcriptional alterations. TTO challenge led to the down-regulation of genes involved with energy-intensive transcription and translation, and altered the regulation of genes involved with heat shock (e.g. clpC, clpL, ctsR, dnaK, groES, groEL, grpE and hrcA) and cell wall metabolism (e.g. cwrA, isaA, sle1, vraSR and vraX). Inactivation of the heat shock gene dnaK or vraSR which encodes a two-component regulatory system that responds to peptidoglycan biosynthesis inhibition led to an increase in TTO susceptibility which demonstrates a protective role for these genes in the S. aureus TTO response. A gene (mmpL) encoding a putative resistance, nodulation and cell division efflux pump was also highly induced by TTO. The principal antimicrobial TTO terpene, terpinen-4-ol, altered ten genes in a transcriptional direction analogous to TTO. Collectively, this study provides additional insight into the response of a bacterial pathogen to the antimicrobial terpene mixture TTO.

Parole Chiave

Staphylococcus aureus. Bioinformatica. Pompa efflusso. Terpinen-4-olo. Alterazione genetica.

Melaleuca alternifolia – Prospettive uso topico (1)

Settembre 2012

Int J Dermatol. 2012 Sep 24. doi: 10.1111/j.1365-4632.2012.05654.x. [Epub ahead of print]

A review of applications of tea tree oil in dermatology.

Pazyar N, Yaghoobi R, Bagherani N, Kazerouni A.

Department of Dermatology, Jundishapur University of Medical Sciences, Ahvaz, Iran.

Abstract

Tea tree oil (TTO) is an essential oil, steam-distilled from the Australian native plant, Melaleuca alternifolia. It has a minimum content of terpinen-4-ol and a maximum content of 1, 8-cineole. Terpinen-4-ol is a major TTO component which exhibits strong antimicrobial and anti-inflammatory properties. Tea tree oil exerts antioxidant activity and has been reported to have broad-spectrum antimicrobial activity against bacterial, viral, fungal, and protozoal infections affecting skin and mucosa. Several studies have suggested the uses of TTO for the treatment of acne vulgaris, seborrheic dermatitis, and chronic gingivitis. It also accelerates the wound healing process and exhibits anti-skin cancer activity. This review opens up new horizons for dermatologists in the use of this herbal agent.

Parole Chiave

Cicatrizzazione. Attività antimicrobica, anti-infiammatoria, antiossidante. Uso topico.

Melaleuca alternifolia – Attività formulato commerciale

Settembre 2011

J Altern Complement Med. 2011 Sep;17(9):835-41. doi: 10.1089/acm.2010.0508. Epub 2011 Aug 19.

Survey of the antimicrobial activity of commercially available Australian tea tree (Melaleuca alternifolia) essential oil products in vitro.

Thomsen PS, Jensen TM, Hammer KA, Carson CF, Mølgaard P, Riley TV.

School of Pharmacy, Murdoch University, Murdoch, Western Australia. p.thomsen@murdoch.edu.au

Abstract

OBJECTIVES: The aim of this study was to investigate the antimicrobial activity of a range of commercially available tea tree oil (TTO) products and to evaluate whether formulation plays a significant part in their antiseptic activity.

METHODS: The antimicrobial activity of the purchased products and control TTO solutions was assessed against Escherichia coli, Staphylococcus aureus, Salmonella typhimurium, Pseudomonas aeruginosa, and Candida albicans using well diffusion, broth microdilution, and broth macrodilution assays.

RESULTS: Zone sizes obtained by the agar well diffusion assay ranged from 0 to 49.8 mm, with the more viscous and lipophilic products producing the smallest zones. Micro- and macrodilution methods showed that eight products had minimum inhibitory concentrations that were lower than the nonformulated TTO control. The remaining three products showed activity equivalent to the TTO control.

CONCLUSIONS: In general, the commercially available antiseptic TTO products showed antimicrobial activity that was equivalent to, or greater than the nonformulated TTO control. This suggests that the TTO within these products has retained its antimicrobial activity. Furthermore, the enhanced activity of the products may be attributed to other antimicrobial excipients within the products such as preservatives, or to synergistic antimicrobial interactions between the TTO and other product excipients. The observation that the commercially available antiseptic TTO products tested in this study retained adequate antimicrobial activity emphasizes the importance of considering how product bases and excipients may interact with the active compound during formulation to ensure efficacy of the final product. Finally, the current data suggest that these TTO products may also be active in vivo. However, this can only be determined through further studies and in clinical trials.

Parole Chiave

Salmonella typhimurium. Staphylococcus aureus. Pesudomonas aeruginosa. Escherichia coli. Candida albicans.

Melaleuca alternifolia – Prospettive uso topico (2)

Agosto 2011

Int Wound J. 2011 Aug;8(4):375-84. doi: 10.1111/j.1742-481X.2011.00801.x. Epub 2011 May 12.

Uncontrolled, open-label, pilot study of tea tree (Melaleuca alternifolia) oil solution in the decolonisation of methicillin-resistant Staphylococcus aureus positive wounds and its influence on wound healing.

Edmondson M, Newall N, Carville K, Smith J, Riley TV, Carson CF.

Silver Chain Nursing Association, Osborne Park, WA, Australia.

Abstract

Many complementary and alternative products are used to treat wounds. The essential oil of Melaleuca alternifolia, tea tree oil, has proven antimicrobial and anti-inflammatory properties, may be useful in methicillin-resistant Staphylococcus aureus (MRSA) decolonisation regimens and is reputed to have 'wound-healing' properties, but more data are required to support these indications. The primary aim of this uncontrolled case series was to assess whether a tea tree oil solution used in a wound cleansing procedure could decolonise MRSA from acute and chronic wounds of mixed aetiology. The secondary aim was to determine if the tea tree oil solution influenced wound healing outcomes. Nineteen participants with wounds suspected of being colonised with MRSA were enrolled in a pilot study. Seven were subsequently shown not to have MRSA and were withdrawn from the study. As many as 11 of the remaining 12 participants were treated with a water-miscible tea tree oil (3·3%) solution applied as part of the wound cleansing regimen at each dressing change. Dressing changes were three times per week or daily as deemed necessary by the study nurse following assessment. One participant withdrew from the study before treatment. No participants were MRSA negative after treatment. After treatment had been implemented, 8 of the 11 treated wounds had begun to heal and reduced in size as measured by computer planimetry. Although this formulation and mode of delivery did not achieve the primary aim of the study, tea tree oil did not appear to inhibit healing and the majority of wounds reduced in size after treatment.

Parole Chiave

Staphylococcus aureus MRSA. Cicatrizzazione. Attività antimicrobica e anti-infiammatoria.

Melaleuca alternifolia – Disinfezione aria

Giugno 2011

Ann Agric Environ Med. 2011 Jun;18(1):139-44.

Antimicrobial activity of two essential oils.

Mickienė R, Bakutis B, Baliukonienė V.

Department of Food Safety and Animal Hygiene, Veterinary Academy of Lithuanian University of Health Science, Kaunas, Lithuania. mickiene@lva.lt

Abstract

The aim of the study was to evaluate the antimicrobial activity of essential oils in vitro for possible application to reduce the content of microorganisms in the air of animal houses. The essential oils of Cymbopogon citrarus L. and Malaleuca alternifolia L. were screened against bacteria Staphylococcus aureus, Enterococcus faecium, Pseudomonas aeruginosa, Escherichia coli, Proteus mirabilis and yeast Candida albicans. The minimal inhibitory concentration of the active essential oils was tested using broth dilution assay. The essential oils concentrations ranged from 0.1-50.0%. The combined effects of essential oils were tested for Malaleuca alternifolia L. and Cymbopogon citrarus L. concentrations ranged from 0.005-50.0%. The oils showed a wide spectrum of antibacterial activity. Concentrations of 0.1-0.5% of Cymbopogon citrarus L. and Malaleuca alternifolia L. reduced total microorganisms count of Proteus mirabilis and Candida albicans. High antibacterial activity was also revealed for Cymbopogon citrarus L. with bactericidal concentrations of 0.8% for Escherichia coli, 5.0% for Enterococcus faecium, 5.0% for Pseudomonas aeruginosa and 8.0% for Staphylococcus aureus. Bactericidal concentrations of Malaleuca alternifolia L. were 5.0% for Pseudomonas aeruginosa and Enterococcus faecium, and 8.0% for Staphylococcus aureus. The essential oils of Cymbopogon citrarus and Malaleuca alternifolia may be a promising alternative of air disinfection in animal houses.

Parole Chiave

Zootecnia. Aria. Disinfezione. Escherichia coli. Pseudomonas aeruginosa. Staphylococcus aureus.

Melaleuca alternifolia – Inibizione virus influenzale H1N1

Gennaio 2011

Antiviral Res. 2011 Jan;89(1):83-8. doi: 10.1016/j.antiviral.2010.11.010. Epub 2010 Nov 21.

Activity of Melaleuca alternifolia (tea tree) oil on Influenza virus A/PR/8: study on the mechanism of action.

Garozzo A, Timpanaro R, Stivala A, Bisignano G, Castro A.

Department of Microbiological and Gynaecological Sciences, University of Catania, Via Androne 81, 95124 Catania, Italy. agar@unict.it

Abstract

Our previous study demonstrated that Melaleuca alternifolia (tea tree) oil (TTO) had an interesting antiviral activity against Influenza A in MDCK cells. In fact, when we tested TTO and some of its components, we found that TTO had an inhibitory effect on influenza virus replication at doses below the cytotoxic dose; terpinen-4-ol, terpinolene, and alfa-terpineol were the main active components. The aim of this study was to investigate the mechanism of action of TTO and its active components against Influenza A/PR/8 virus subtype H1N1 in MDCK cells. None of the test compounds showed virucidal activity nor any protective action for the MDCK cells. Thus, the effect of TTO and its active components on different steps of the replicative cycle of influenza virus was studied by adding the test compounds at various times after infection. These experiments revealed that viral replication was significantly inhibited if TTO was added within 2h of infection, indicating an interference with an early step of the viral replicative cycle of influenza virus. The influence of the compound on the virus adsorption step, studied by the infective center assay, indicated that TTO did not interfere with cellular attachment of the virus. TTO did not inhibit influenza virus neuraminidase activity, as shown by the experiment measuring the amount of 4-methylumbelliferone, cleaved by the influenza virus neuraminidase from the fluorogenic substrate 2'-O-(4-methylumbelliferyl)-N-acetylneuraminic acid. The effect of TTO on acidification of cellular lysosomes was studied by vital staining with acridine orange using bafilomycin A1 as positive control. The treatment of cells with 0.01% (v/v) of TTO at 37°C for 4h before staining inhibited the acridine orange accumulation in acid cytoplasmic vesicles, indicating that TTO could inhibit viral uncoating by an interference with acidification of intralysosomal compartment.

Parole Chiave

Virus influenzale H1/N1. Terpinen 4-olo. Inibizione meccanismi replicazione.

Melaleuca alternifolia – Efficacia in presenza di biofilm

Gennaio 2011

Pol J Microbiol. 2011;60(1):35-41.

Antibiofilm activity of selected plant essential oils and their major components.

Budzyńska A, Wieckowska-Szakiel M, Sadowska B, Kalemba D, Rózalska B.

Institute of Microbiology, Biotechnology and Immunology, University of L6di, Poland.

Abstract

The aim of the study was to examine the antibiofilm activity of selected essential oils (EO): Lavandula angustifblia (LEO), Melaleuca alternifolia (TTO), Melissa officinalis (MEO) and some of their major constituents: linalool, linalyl acetate, alpha-terpineol, terpinen-4-ol. Biofilms were formed by Staphylococcus aureus ATCC 29213 and Escherichia coli NCTC 8196 on the surface of medical biomaterials (urinary catheter, infusion tube and surgical mesh). TTC reduction assay was used for the evaluation of mature biofilm eradication from these surfaces. Moreover, time-dependent eradication ofbiofilms preformed in polystyrene 96-well culture microplates was examined and expressed as minimal biofilm eradication concentration (evaluated by MTT reduction assay). TTO, alpha-terpineol and terpinen-4-ol as well as MEO, showed stronger anti-biofilm activity than LEO and linalool or linalyl acetate. Among the biomaterials tested, surgical mesh was the surface most prone to persistent colonization since biofilms formed on it, both by S. aureus and E. coli, were difficult to destroy. The killing rate studies of S. aureus biofilm treated with TTO, LEO, MEO and some of their constituents revealed that partial (50%) destruction of 24-h-old biofilms (MBEC50) was achieved by the concentration 4-8 x MIC after 1 h, whereas 2-4 x MIC was enough to obtain 90% reduction in biomass metabolic activity (MBEC90) after just 4 h of treatment. A similar dose-dependent effect was observed for E. coli biofilm which, however, was more susceptible to the action of phytochemicals than the biofilms of S. aureus. It is noteworthy that an evident decrease in biofilm cells metabolic activity does not always lead to their total destruction and eradication.

Parole Chiave

Biofilm. Staphylococcus aureus. Escherichia coli. MBEC50. MBEC90.

Melaleuca alternifolia – Attività anti-infiammatoria

Ottobre 2006

Mechanisms Involved in the Anti-Inflammatory Action of Inhaled Tea Tree Oil in Mice

MATEUSZ GOLAB[1] AND KRYSTYNA SKWARLO-SONTA

Department of Animal Physiology, Faculty of Biology, Warsaw University, Miecznikowa 1, 02–096 Warsaw, Poland

Tea tree oil (TTO) is well known as an antimicrobial and immunomodulatory agent. In the present study we confirmed the anti-inflammatory properties of TTO and investigated the involvement of the hypothalamic-pituitary-adrenal (HPA) axis in the immunomodulatory action of TTO administered by inhalation. Sexually mature, 6–8-week-old, $C_{57}Bl_{10}$ × CBA/H (F_1) male mice were used. One group of animals was injected intraperitoneally (ip) with Zymosan to elicit peritoneal inflammation and was then submitted to four sessions of TTO inhalation (15 mins each). Some of the mice were simultaneously injected ip with Antalarmin, a CRH-1 receptor antagonist, to block HPA axis functions. Twenty-four hours after the injections the mice were killed by CO_2 asphyxia, and peritoneal leukocytes (PTLs) were isolated and counted. Levels of reactive oxygen species (ROS) and cyclooxygenase (COX) activity in PTLs were assessed by fluorimetric and colorimetric assays, respectively. The results obtained show that sessions of TTO inhalation exert a strong anti-inflammatory influence on the immune system stimulated by Zymosan injection, while having no influence on PTL number, ROS level, and COX activity in mice without inflammation. The HPA axis was shown to mediate the anti-inflammatory effect of TTO; Antalarmin abolished the influence of inhaled TTO on PTL number and their ROS production in mice with experimental peritonitis, but it had no effect on these parameters in mice without inflammation. Exp Biol Med 232:420–426, 2007

Key words: tea tree oil; inflammation; HPA; COX; immunomodulation

nifolia). This oil contains over a hundred different compounds, mainly monoterpenes and their derivatives. Well known for its antimicrobial properties, TTO is able to kill a wide range of bacteria, fungi, and viruses as a result of the action of terpinen-4-ol, γ-terpinen, and 1,8-cineole, the main active components of this oil (1–3).

Immunomodulatory effects of TTO have also been demonstrated. The main components of TTO exhibit anti-inflammatory activity *in vitro*, suppressing the production of proinflammatory cytokines by lipopolysaccharide (LPS)-activated human monocytes (4). The water-soluble fraction of this oil suppressed LPS-stimulated superoxide production by human monocytes, but not by neutrophils (5). An anti-inflammatory effect of TTO has also been observed in *in vivo* studies. In mice, topically applied TTO reduced the edema associated with contact hypersensitivity to a chemical hapten (6) and with intradermal injection of histamine (7), indicating that TTO has an inhibitory effect on proinflammatory cytokine production by lymphocytes. The anti-inflammatory effect of topically applied TTO in reducing the nickel-induced hypersensitivity reaction has also been shown in humans (8). On the other hand, data indicating an immuno-stimulatory effect of TTO are also

Parole Chiave

TTO. Attività anti-infiammatoria. Immunostimolazione. Meccanismo d'azione per via inalatoria.

Melaleuca alternifolia – Sviluppo formulazione galenica

Marzo 2005

Pharmazie. 2005 Mar;60(3):208-11.

Formulation and evaluation of an effective pH balanced topical antimicrobial product containing tea tree oil.

Biju SS, Ahuja A, Khar RK, Chaudhry R.

Author information

Abstract

The effect of pH on the antimicrobial activity of Melaleuca alternifolia essential oil formulations was studied. Microemulsions, liposomal dispersions, multiple emulsions and a colloidal bed of sterile clay were formulated using 5% w/w of tea tree oil. A number of formulations were prepared at various pH values (5.0, 5.5, 6.0, 6.5, and 7.0). Thermal stability studies showed that the formulations were stable for more than eight months. Agar dilution tests showed MICs of 1.0% v/v S. aureus and S. epidermidis. In the broth dilution test, MBC of the oil for P. acnes was 0.5% v/v. MIC and MBC values were comparable to those of non-formulated tea tree oil, indicating that tea tree oil retained its activity in the above-mentioned formulations. The microbiological evaluation showed that the formulations containing 5% w/w tea tree oil had a maximum effect at pH 5.5.

PMID: 15801675 [PubMed - indexed for MEDLINE]

Parole Chiave

Microemulsioni. pH. Staphylococcus aureus. Staphylococcus epidermidis.

Melaleuca alternifolia – Attività antiossidante

Maggio 2004

J Agric Food Chem. 2004 May 19;52(10):2849-54.

Evaluation of antioxidant activity of Australian tea tree (Melaleuca alternifolia) oil and its components.

Kim HJ, Chen F, Wu C, Wang X, Chung HY, Jin Z.

Department of Food Science, Clemson University, Clemson, South Carolina 29634, USA.

Abstract

Antioxidant activity of Australian tea tree (Melaleuca alternifolia) oil (TTO) was determined using two different assays. In the 2,2-diphenyl-1-picrylhydrazyl assay, 10 microL/mL crude TTO in methanol had approximately 80% free radical scavenging activity, and in the hexanal/hexanoic acid assay, 200 microL/mL crude TTO exhibited 60% inhibitory activity against the oxidation of hexanal to hexanoic acid over 30 days. These results were equivalent to the antioxidant activities of 30 mM butylated hydroxytoluene in both tests at the same experimental conditions. This indicated that the TTO could be a good alternative antioxidant. Inherent antioxidants, i.e., alpha-terpinene, alpha-terpinolene, and gamma-terpinene, in the crude TTO were separated and identified chromatographically using silica gel open chromatography, C(18)-high-pressure liquid chromatography, and gas chromatography-mass spectrometry. Their antioxidant activities decreased in the following order in both assays: alpha-terpinene > alpha-terpinolene > gamma-terpinene.

Parole Chiave

Antiossidante. BHT. Azione scavenger. Radicali liberi.

Melaleuca alternifolia – Meccanismi d'azione

Giugno 2002

Antimicrobial Agents and Chemotherapy
AAC Article | Journal Info. | Authors | Reviewers | Permissions | Journals.ASM.org

Antimicrob Agents Chemother. 2002 June; 46(6): 1914–1920. PMCID: PMC127210
doi: 10.1128/AAC.46.6.1914-1920.2002

Mechanism of Action of *Melaleuca alternifolia* (Tea Tree) Oil on *Staphylococcus aureus* Determined by Time-Kill, Lysis, Leakage, and Salt Tolerance Assays and Electron Microscopy

Christine F. Carson,[1,*] Brian J. Mee,[1] and Thomas V. Riley[1,2]

Author information ▶ Article notes ▶ Copyright and License information ▶

ABSTRACT

Go to:

The essential oil of *Melaleuca alternifolia* (tea tree) has broad-spectrum antimicrobial activity. The mechanisms of action of tea tree oil and three of its components, 1,8-cineole, terpinen-4-ol, and α-terpineol, against *Staphylococcus aureus* ATCC 9144 were investigated. Treatment with these agents at their MICs and two times their MICs, particularly treatment with terpinen-4-ol and α-terpineol, reduced the viability of *S. aureus*. None of the agents caused lysis, as determined by measurement of the optical density at 620 nm, although cells became disproportionately sensitive to subsequent autolysis. Loss of 260-nm-absorbing material occurred after treatment with concentrations equivalent to the MIC, particularly after treatment with 1,8-cineole and α-terpineol. *S. aureus* organisms treated with tea tree oil or its components at the MIC or two times the MIC showed a significant loss of tolerance to NaCl. When the agents were tested at one-half the MIC, only 1,8-cineole significantly reduced the tolerance of *S. aureus* to NaCl. Electron microscopy of terpinen-4-ol-treated cells showed the formation of mesosomes and the loss of cytoplasmic contents. The predisposition to lysis, the loss of 260-nm-absorbing material, the loss of tolerance to NaCl, and the altered morphology seen by electron microscopy all suggest that tea tree oil and its components compromise the cytoplasmic membrane.

Parole Chiave

Membran citoplasmatica. Autolisi.

Melaleuca alternifolia – Permeabilità membrana

Gennaio 2000

J Appl Microbiol. 2000 Jan;88(1):170-5.

The mode of antimicrobial action of the essential oil of Melaleuca alternifolia (tea tree oil).

Cox SD, Mann CM, Markham JL, Bell HC, Gustafson JE, Warmington JR, Wyllie SG.

Centre for Biostructural and Biomolecular Research, University of Western Sydney, Hawkesbury, New South Wales, Western Australia. s.cox@uws.edu.au

Abstract

The essential oil of Melaleuca alternifolia (tea tree) exhibits broad-spectrum antimicrobial activity. Its mode of action against the Gram-negative bacterium Escherichia coli AG100, the Gram-positive bacterium Staphylococcus aureus NCTC 8325, and the yeast Candida albicans has been investigated using a range of methods. We report that exposing these organisms to minimum inhibitory and minimum bactericidal/fungicidal concentrations of tea tree oil inhibited respiration and increased the permeability of bacterial cytoplasmic and yeast plasma membranes as indicated by uptake of propidium iodide. In the case of E. coli and Staph. aureus, tea tree oil also caused potassium ion leakage. Differences in the susceptibility of the test organisms to tea tree oil were also observed and these are interpreted in terms of variations in the rate of monoterpene penetration through cell wall and cell membrane structures. The ability of tea tree oil to disrupt the permeability barrier of cell membrane structures and the accompanying loss of chemiosmotic control is the most likely source of its lethal action at minimum inhibitory levels.

Parole Chiave

Chemiosmosi. Ione potassio. Membrana cellulare.

Melaleuca alternifolia – Attività virucida

Melaleuca alternifolia – Prevenzione virus influenzale

Agosto 2013

Molecules. 2013 Aug 9;18(8):9550-66. doi: 10.3390/molecules18089550.

Melaleuca alternifolia concentrate inhibits in vitro entry of influenza virus into host cells.

Li X, Duan S, Chu C, Xu J, Zeng G, Lam AK, Zhou J, Yin Y, Fang D, Reynolds MJ, Gu H, Jiang L.

Author information

Abstract

Influenza virus causes high morbidity among the infected population annually and occasionally the spread of pandemics. Melaleuca alternifolia Concentrate (MAC) is an essential oil derived from a native Australian tea tree. Our aim was to investigate whether MAC has any in vitro inhibitory effect on influenza virus infection and what mechanism does the MAC use to fight the virus infection. In this study, the antiviral activity of MAC was examined by its inhibition of cytopathic effects. In silico prediction was performed to evaluate the interaction between MAC and the viral haemagglutinin. We found that when the influenza virus was incubated with 0.010% MAC for one hour, no cytopathic effect on MDCK cells was found after the virus infection and no immunofluorescence signal was detected in the host cells. Electron microscopy showed that the virus treated with MAC retained its structural integrity. By computational simulations, we found that terpinen-4-ol, which is the major bioactive component of MAC, could combine with the membrane fusion site of haemagglutinin. Thus, we proved that MAC could prevent influenza virus from entering the host cells by disturbing the normal viral membrane fusion procedure.

Parole Chiave

Concentrato Melaleuca alternifolia. Immunofluoroscenza. Virus influenzale. Emoagglutinine. Terpinen-4-olo.

Melaleuca alternifolia – Attività antivirale aerosol TTO

Gennaio 2013

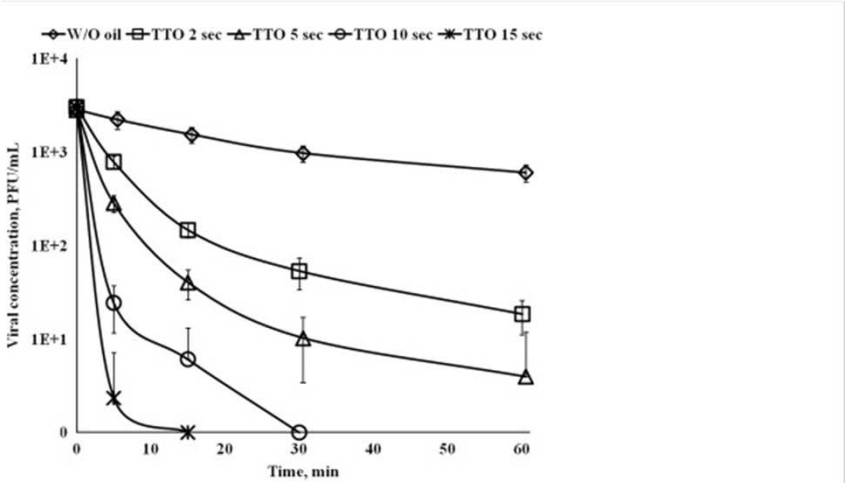


Fig. 2. Inactivation of airborne Influenza A virus by aerosolised TTO. Error bars represent standard deviation of at least three experimental runs. Test oil concentration supplied into the chamber is presented as viral suspension nebulization time.

Antiviral activity of tea tree and eucalyptus oil aerosol and vapour

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http://dx.doi.org/10.1016/j.jaerosci.2013.01.004, How to Cite or Link Using DOI

Permissions & Reprints

Abstract

Our previous studies demonstrated high antiviral efficiency of natural disinfectants, i.e. tea tree oil (TTO) and eucalyptus oil (EUO) on the filter surface. The TTO aerosol challenge as disinfectant showed its high antiviral potential. The main aim of this study was to investigate the antiviral activity of TTO and EUO aerosols in range of concentrations against Influenza A virus and *E. coli* phage M13. It was found that both tested oils aerosols possess strong antiviral action and capable of inactivating model viruses with efficiency of more than 95% within 5–15 min of exposure. Additionally, the TTO and EUO vapors were also challenged for their antiviral activity. The use of natural disinfectants like TTO and EUO in aerosol form as well as in vapour phase looks very promising for further development of virus inactivating procedures and technologies for air quality applications.

Parole Chiave

Aerosol. Qualità aria. Virus influenzale. Attività virucida.

Melaleuca alternifolia – Attività antivirale specifica H1N1

Dicembre 2009

Lett Appl Microbiol. 2009 Dec;49(6):806-8. doi: 10.1111/j.1472-765X.2009.02740.x. Epub 2009 Sep 18.

In vitro antiviral activity of Melaleuca alternifolia essential oil.

Garozzo A, Timpanaro R, Bisignano B, Furneri PM, Bisignano G, Castro A.

Department of Microbiological and Gynaecological Sciences, University of Catania, Italy. agar@unict.it

Abstract

AIMS: To investigate the in vitro antiviral activity of Melaleuca alternifolia essential oil (TTO) and its main components, terpinen-4-ol, alpha-terpinene, gamma-terpinene, p-cymene, terpinolene and alpha-terpineol.

METHODS AND RESULTS: The antiviral activity of tested compounds was evaluated against polio type 1, ECHO 9, Coxsackie B1, adeno type 2, herpes simplex (HSV) type 1 and 2 viruses by 50% plaque reduction assay. The anti-influenza virus assay was based on the inhibition of the virus-induced cytopathogenicity. Results obtained from our screening demonstrated that the TTO and some of its components (the terpinen-4-ol, the terpinolene, the alpha-terpineol) have an inhibitory effect on influenza A/PR/8 virus subtype H1N1 replication at doses below the cytotoxic dose. The ID (50) value of the TTO was found to be 0.0006% (v/v) and was much lower than its CD(50) (0.025% v/v). All the compounds were ineffective against polio 1, adeno 2, ECHO 9, Coxsackie B1, HSV-1 and HSV-2. None of the tested compounds showed virucidal activity. Only a slight virucidal effect was observed for TTO (0.125% v/v) against HSV-1 and HSV-2.

CONCLUSIONS: These data show that TTO has an antiviral activity against influenza A/PR/8 virus subtype H1N1 and that antiviral activity has been principally attributed to terpinen-4-ol, the main active component.

SIGNIFICANCE AND IMPACT OF THE STUDY: TTO should be a promising drug in the treatment of influenza virus infection.

Parole Chiave

In vitro. Terpinen-4-olo. Virus influenzale sottotipo H1N1.

Melaleuca alternifolia – Attività antivirale specifica HSV

Aprile 2001

Pharmazie. 2001 Apr;56(4):343-7.

Antiviral activity of Australian tea tree oil and eucalyptus oil against herpes simplex virus in cell culture.

Schnitzler P, Schön K, Reichling J.

Department of Virology, Hygiene Institute, University of Heidelberg, Germany.

Abstract

The antiviral effect of Australian tea tree oil (TTO) and eucalyptus oil (EUO) against herpes simplex virus was examined. Cytotoxicity of TTO and EUO was evaluated in a standard neutral red dye uptake assay. Toxicity of TTO and EUO was moderate for RC-37 cells and approached 50% (TC50) at concentrations of 0.006% and 0.03%, respectively. Antiviral activity of TTO and EUO against herpes simplex virus type 1 (HSV-1) and herpes simplex virus type 2 (HSV-2) was tested in vitro on RC-37 cells using a plaque reduction assay. The 50% inhibitory concentration (IC50) of TTO for herpes simplex virus plaque formation was 0.0009% and 0.0008% and the IC50 of EUO was determined at 0.009% and 0.008% for HSV-1 and HSV-2, respectively. Australian tea tree oil exhibited high levels of virucidal activity against HSV-1 and HSV-2 in viral suspension tests. At noncytotoxic concentrations of TTO plaque formation was reduced by 98.2% and 93.0% for HSV-1 and HSV-2, respectively. Noncytotoxic concentrations of EUO reduced virus titers by 57.9% for HSV-1 and 75.4% for HSV-2. Virus titers were reduced significantly with TTO, whereas EUO exhibited distinct but less antiviral activity. In order to determine the mode of antiviral action of both essential oils, either cells were pretreated before viral infection or viruses were incubated with TTO or EUO before infection, during adsorption or after penetration into the host cells. Plaque formation was clearly reduced, when herpes simplex virus was pretreated with the essential oils prior to adsorption. These results indicate that TTO and EUO affect the virus before or during adsorption, but not after penetration into the host cell. Thus TTO and EUO are capable to exert a direct antiviral effect on HSV. Although the active antiherpes components of Australian tea tree and eucalyptus oil are not yet known, their possible application as antiviral agents in recurrent herpes infection is promising.

Parole Chiave

Herpesvirus HSV1. Herpesvirus HSV2. Azione antivirale diretta.

Melaleuca alternifolia – Attività biocida

Melaleuca alternifolia – Attività antimicrobica specifica

Settembre 2011

J Altern Complement Med. 2011 Sep;17(9):835-41. doi: 10.1089/acm.2010.0508. Epub 2011 Aug 19.

Survey of the antimicrobial activity of commercially available Australian tea tree (Melaleuca alternifolia) essential oil products in vitro.

Thomsen PS, Jensen TM, Hammer KA, Carson CF, Mølgaard P, Riley TV.

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Abstract

OBJECTIVES: The aim of this study was to investigate the antimicrobial activity of a range of commercially available tea tree oil (TTO) products and to evaluate whether formulation plays a significant part in their antiseptic activity.

METHODS: The antimicrobial activity of the purchased products and control TTO solutions was assessed against Escherichia coli, Staphylococcus aureus, Salmonella typhimurium, Pseudomonas aeruginosa, and Candida albicans using well diffusion, broth microdilution, and broth macrodilution assays.

RESULTS: Zone sizes obtained by the agar well diffusion assay ranged from 0 to 49.8 mm, with the more viscous and lipophilic products producing the smallest zones. Micro- and macrodilution methods showed that eight products had minimum inhibitory concentrations that were lower than the nonformulated TTO control. The remaining three products showed activity equivalent to the TTO control.

CONCLUSIONS: In general, the commercially available antiseptic TTO products showed antimicrobial activity that was equivalent to, or greater than the nonformulated TTO control. This suggests that the TTO within these products has retained its antimicrobial activity. Furthermore, the enhanced activity of the products may be attributed to other antimicrobial excipients within the products such as preservatives, or to synergistic antimicrobial interactions between the TTO and other product excipients. The observation that the commercially available antiseptic TTO products tested in this study retained adequate antimicrobial activity emphasizes the importance of considering how product bases and excipients may interact with the active compound during formulation to ensure efficacy of the final product. Finally, the current data suggest that these TTO products may also be active in vivo. However, this can only be determined through further studies and in clinical trials.

Parole Chiave

Minimum inhibitory concentration (MIC). Escherichia coli. Staphylococcus aureus. Salmonella typhimurium.

Melaleuca alternifolia – Attività antimicrobica in biofilm

Aprile 2009

Int J Antimicrob Agents. 2009 Apr;33(4):343-7. doi: 10.1016/j.ijantimicag.2008.08.028. Epub 2008 Dec 17.

Effects of tea tree (Melaleuca alternifolia) oil on Staphylococcus aureus in biofilms and stationary growth phase.

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Abstract

Tea tree oil (TTO) is known for its antimicrobial activity. In this study, we determined whether TTO is effective against Staphylococcus aureus in biofilms and how TTO activity is affected by the S. aureus growth phase. All clinical strains tested were killed by TTO both as planktonic cells and as biofilms. The minimum biofilm eradication concentration was usually two times higher than the minimum bactericidal concentration, yet it was never higher than 1% v/v. The fastest killing of biofilm occurred during the first 15min of contact with TTO and was not influenced by increasing TTO concentration above 1% v/v. Planktonic stationary phase cells exhibited decreased susceptibility to TTO compared with exponential phase cells. The killing rate for stationary phase cells was also less affected by increasing TTO concentration than that for exponential phase cells. These data show that TTO efficiently kills S. aureus in the stationary growth phase and within biofilms and is therefore a promising tool for S. aureus eradication.

Parole Chiave

Biofilm. Minimum inhibitory concentration (MIC). Staphylococcus aureus. Tempo contatto.

Melaleuca alternifolia – TTO e resistenza batterica

Agosto 2008

Int J Antimicrob Agents. 2008 Aug;32(2):170-3. doi: 10.1016/j.ijantimicag.2008.03.013. Epub 2008 Jun 20.

Frequencies of resistance to Melaleuca alternifolia (tea tree) oil and rifampicin in Staphylococcus aureus, Staphylococcus epidermidis and Enterococcus faecalis.

Hammer KA, Carson CF, Riley TV.

Discipline of Microbiology and Immunology, School of Biomedical, Biomolecular and Chemical Sciences, The University of Western Australia, 35 Stirling Highway, Crawley, WA, Australia. khammer@cyllene.uwa.edu.au

Abstract

This study was conducted to determine the frequencies at which single-step mutants resistant to tea tree oil and rifampicin occurred amongst the Gram -positive organisms Staphylococcus aureus, Staphylococcus epidermidis and Enterococcus faecalis. For tea tree oil, resistance frequencies were very low at <10(-9). Single-step mutants resistant to tea tree oil were undetectable at two times the minimum inhibitory concentration (MIC) for S. aureus RN4220 and derivative mutator strains or at 3 x MIC for the remaining S. aureus strains, including a clinical meticillin-resistant S. aureus isolate. Similarly, no mutants were recovered at 2x MIC for S. epidermidis or at 1x MIC for E. faecalis. Resistance frequencies determined in vitro for rifampicin (8 x MIC) ranged from 10(-7) to 10(-8) for all isolates, with the exception of the S. aureus mutator strains, which had slightly higher frequencies. These data suggest that Gram-positive organisms such as Staphylococcus and Enterococcus spp. have very low frequencies of resistance to tea tree oil.

Parole Chiave

Staphylococcus aureus. Staphyloccus epidermidis. Enterococcus faecalis. Resistenza batterica.

Melaleuca alternifolia – TTO e Staphylococcus MRSA

Settembre 2006

Int J Immunopathol Pharmacol. 2006 Jul-Sep;19(3):539-44.

Melaleuca alternifolia essential oil possesses potent anti-staphylococcal activity extended to strains resistant to antibiotics.

Ferrini AM, Mannoni V, Aureli P, Salvatore G, Piccirilli E, Ceddia T, Pontieri E, Sessa R, Oliva B.
Istituto Superiore di Sanita, National Centre for Food Quality, Rome, Italy.

Abstract

Melaleuca alternifolia Cheel essential oil (TTO) and its major component terpinen-4-ol were examined against a large number of clinical isolates of Staphylococcus aureus to establish their anti-staphylococcal activities. Classic and established procedures were used to study M.I.C., time-kill curves, synergism and mutational frequency. The anti-staphylococcal activity of terpinen-4-ol and TTO were superior to those of antibiotics belonging to the major families (all the tested drugs are for topical use or included in ointments, eye drops or used during surgery); terpinen 4-ol and TTO were active against strains resistant to mupirocin, fusidic acid, vancomycin, methicillin and linezolid. TTO and terpinen-4-ol were bactericidal as revealed by time-kill curves; the frequency of mutational frequency to TTO was < 2.9 x 10 9. The study demonstrates good anti-staphylococcal activity of TTO and terpinen-4-ol against a large number of S.aureus isolates and suggests the possible application of these agents for topical treatment of staphylococcal infections. This is the first extensive study on the anti-staphylococcal activity of TTO. The results suggest that this compound may have application as a topical agent for the control of superficial staphylococcal infections, including activity against organisms resistant to antibiotics which can be used, or are specific, for topical use.

Parole Chiave

Staphylococcus aureus. Antibioticoresistenza. Meticillina. Applicazione topica.

Melaleuca alternifolia – TTO e Pseudomonas spp.

Agosto 2006

J Antimicrob Chemother. 2006 Aug;58(2):449-51. Epub 2006 May 30.

Susceptibility of pseudomonads to Melaleuca alternifolia (tea tree) oil and components.

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Abstract

OBJECTIVES: Thirty isolates of Pseudomonas aeruginosa, 15 isolates of Pseudomonas putida and 11 isolates of Pseudomonas fluorescens were tested for susceptibility to tea tree oil (TTO), the essential oil of Melaleuca alternifolia, and the components terpinen-4-ol, alpha-terpineol, cineole, gamma-terpinene and rho-cymene.

METHODS: MICs were determined by broth microdilution in Mueller-Hinton medium supplemented with 0.002% (v/v) Tween 80.

RESULTS: The MIC90 of TTO for all isolates tested was 4% (v/v) or less. Susceptibility to components tested varied between species.

CONCLUSIONS: Pseudomonas spp. are susceptible to TTO and some of its components although they are less susceptible than many other bacteria tested previously.

Parole Chiave

Pseudomonas aeruginosa. Pseudomonas putida. Pseudomonas fluorescens. Terpinen-4-olo.

Melaleuca alternifolia – TTO, biofilm, antibioticoresistenza

Giugno 2006

Parole Chiave

Staphylococcus aureus MRSA.
Antibioticoresistenza.
Biofilm.

Journal of Medical Microbiology (2006), 55, 1375–1380 DOI 10.1099/jmm.0.46558-0

In vitro activity of tea-tree oil against clinical skin isolates of meticillin-resistant and -sensitive *Staphylococcus aureus* and coagulase-negative staphylococci growing planktonically and as biofilms

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The susceptibility of *Staphylococcus aureus* [meticillin-resistant (MRSA) and meticillin-sensitive (MSSA)] and coagulase-negative staphylococci (CoNS), which respectively form part of the transient and commensal skin flora, to tea-tree oil (TTO) was compared using broth microdilution and quantitative *in vitro* time–kill test methods. MRSA and MSSA isolates were significantly less susceptible than CoNS isolates, as measured by both MIC and minimum bactericidal concentration. A significant decrease in the mean viable count of all isolates in comparison with the control was seen at each time interval in time–kill assays. However, the only significant difference in the overall mean $\log_{10}$ reduction in viable count between the groups of isolates was between CoNS and MSSA at 3 h, with CoNS isolates demonstrating a significantly lower mean reduction. To provide a better simulation of *in vivo* conditions on the skin, where bacteria are reported to grow as microcolonies encased in glycocalyx, the bactericidal activity of TTO against isolates grown as biofilms was also compared. Biofilms formed by MSSA and MRSA isolates were completely eradicated following exposure to 5% TTO for 1 h. In contrast, of the biofilms formed by the nine CoNS isolates tested, only five were completely killed, although a reduction in viable count was apparent for the other four isolates. These results suggest that TTO exerts a greater bactericidal activity against biofilm-grown MRSA and MSSA isolates than against some biofilm-grown CoNS isolates.

Received 8 February 2006
Accepted 19 June 2006

Melaleuca alternifolia – Validazione attività biocida

Febbraio 2005

J Hosp Infect. 2005 Feb;59(2):113-25.

Assessment of the antibacterial activity of tea tree oil using the European EN 1276 and EN 12054 standard suspension tests.

Messager S, Hammer KA, Carson CF, Riley TV.

Discipline of Microbiology, School of Biomedical and Chemical Sciences, The University of Western Australia, 35 Stirling Highway, Crawley WA 6009, Australia.

Abstract

The activity of tea tree oil (TTO) and TTO-containing products was investigated according to the EN 1276 and EN 12054 European suspension methods. The activity of different concentrations of TTO, a hygienic skin wash (HSW), an alcoholic hygienic skin wash (AHSW) and an alcoholic hand rub (AHR) was investigated. These formulations were assessed in perfect conditions with the EN 12054 test, and in perfect conditions as well as in the presence of interfering substances with the EN 1276 test, against Staphylococcus aureus, Acinetobacter baumannii, Escherichia coli and Pseudomonas aeruginosa. With the latter test, the activity of the same formulations without TTO was also assessed as a control. With the EN 1276 test, the AHR achieved a >10(5)-fold reduction against all four test organisms within a 1-min contact time. The AHSW achieved a >or=10(5)-fold reduction against A. baumannii after a 1-min contact time and against S. aureus, E. coli and P. aeruginosa after a 5-min contact time. The efficacy of TTO appeared to be dependent on the formulation and the concentration tested, the concentration of interfering substances and, lastly, the organism tested. Nevertheless, 5% TTO achieved a >10(4)-fold reduction in P. aeruginosa cell numbers after a 5-min contact time in perfect conditions. TTO (5%) in 0.001% Tween 80 was significantly more active against E. coli and P. aeruginosa than against S. aureus and A. baumannii. With the EN 12054 test, after a 1-min contact time, 5% TTO in 0.001% Tween 80 and the AHSW achieved a >10(4)-fold reduction in E. coli and A. baumannii cell numbers, respectively, and the AHR achieved a >4 log10 reduction against all organisms tested. The formulations used in this study are now being tested using a novel ex vivo method as well as the in vivo European standard handwashing method EN 1499.

Parole Chiave

Staphylococcus aureus. Escherichia coli. Actinobacter baumannii. Pseudomonas aeruginosa. EN 1276. EN 12054.

Melaleuca alternifolia – Attività biocida vs Mycoplasma

Febbraio 2000

Pharmazie. 2000 May;55(5):380-4.

Effect of Australian tea tree oil on the viability of the wall-less bacterium Mycoplasma pneumoniae.

Harkenthal M, Layh-Schmitt G, Reichling J.

Institut für Pharmazeutische Biologie, Universität Heidelberg, Germany.

Abstract

In vitro assays using a variety of essential oils revealed a particularly high antibacterial effect of Australian tea tree oil (TTO) on a great number of gram -negative and gram-positive bacteria of unrelated phylogenetic origin. In the present study, the susceptibility of cell wall-less bacteria such as the human pathogenic bacterium Mycoplasma pneumoniae to Australian tea tree oil was examined. The minimum inhibitory concentration (MIC) was determined to be 0.006% (v/v) TTO for the wild type and to 0.003% (v/v) TTO for mutants of M. pneumoniae which lost the ability to adhere to host cells (cytadherence-negative). The MIC and the MBC (minimum bactericidal concentration) for M. pneumoniae are 100 times lower than those for all other eubacteria tested. Electron microscopy with negatively stained cells as well as with ultrathin sections revealed a tendency to ovoid or round cells after oil treatment whereas the untreated cells of the wild type exhibit a flask-shaped morphology with a tip-like structure at one pole of the cell. The integrity of the mycoplasmal membrane seems not to be affected by TTO since no leakage of the Mycoplasma cell was observed after oil treatment. In the HET-CAM test TTO did not show any visible signs of irritation in concentrations less than 25%. Although the active component in TTO that has anti -mycoplasmal activity is not known, it seems very promising to use TTO tentatively for mouth washing and inhalation in case of Mycoplasma-pneumoniae-infection.

Parole Chiave

Mycoplasma hyopneumoniae. Minimum inhibitory concentration. Citoaderenza. Sindromi respiratorie.

Melaleuca alternifolia – Attività antimicotica

Melaleuca alternifolia – Attività immunomodulante

Giugno 2012

Parole Chiave

Proprietà immunostimolanti.
Attività antifungina.
Biofilm.
Candida spp.

frontiers in MICROBIOLOGY

ORIGINAL RESEARCH ARTICLE
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Antifungal, cytotoxic, and immunomodulatory properties of tea tree oil and its derivative components: potential role in management of oral candidosis in cancer patients

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Candida albicans forms oral biofilms that cause disease and are difficult to treat with conventional antifungal agents. Tea tree oil (TTO) is a natural compound with reported antimicrobial and immunomodulatory activities. The aims of the study were to evaluate the antifungal efficacy of TTO and key derivatives against *C. albicans* biofilms, to assess the toxicological effects of TTO on a clinically relevant oral cell line, and to investigate its impact on inflammation. TTO and its derivatives were examined against 100 clinical strains of *C. albicans*. Planktonic minimum inhibitory concentrations (MICs) were determined using the CLSI M-27A broth microdilution method. Sessile MICs were determined using an XTT reduction assay. Inhibition, time-kill, and mode of action studies were performed. OKF6-TERT2 epithelial cells were used for cytotoxicity and cytokine expression assays. Planktonic *C. albicans* isolates were susceptible to TTO, terpinen-4-ol (T-4-ol), and α-terpineol, with an MIC_{50} of 0.5, 0.25, and 0.25%, respectively. These three compounds also displayed potent activity against the 69 biofilm-forming strains, of which T-4-ol and α-terpineol displayed rapid kill kinetics. For all three compounds, 1 × MIC_{50} effectively inhibited biofilm growth when *C. albicans* were treated at 0, 1, and 2 h post adhesion. By scanning electron microscopy analysis and PI uptake, TTO and derivative components were shown to be cell membrane active. TTO and T-4-ol were cytotoxic at 1 × MIC_{50}, whereas at 0.5 × MIC_{50} T-4-ol displayed no significant toxicity. Transcript and protein analysis showed a reduction of IL-8 when treated with TTO and T-4-ol. These data provide further *in vitro* evidence that TTO and its derivative components, specifically T-4-ol, exhibit strong antimicrobial properties against fungal biofilms. T-4-ol has safety advantages over the complete essential oil and may be suitable for prophylaxis and treatment of established oropharyngeal candidosis. A clinical trial of T-4-ol is worthy of consideration.

Melaleuca alternifolia – Attività antifungina specifica

Novembre 2009

Phytomedicine. 2009 Nov;16(11):1056-8. doi: 10.1016/j.phymed.2009.03.013. Epub 2009 Apr 28.

Antifungal activity of tea tree oil from Melaleuca alternifolia against Trichophyton equinum: an in vivo assay.

Pisseri F, Bertoli A, Nardoni S, Pinto L, Pistelli L, Guidi G, Mancianti F.

Author information

Abstract

Dermatophytes are a group of keratinophilic and keratinolytic molds, some of which are responsible for ringworm. Among them Trichophyton equinum, which mostly infects equids, can cause extensive outbreaks in stud farms. The conventional treatment of equine trichophytosis is topic, based upon medicated shampoos to reduce the spread of infection among the animals. Nevertheless the popularity of phytotherapy is at an all-time peak, and the interest for natural alternatives or complements to conventional drug therapy is challenging both in human and veterinary field. Among herbal remedia Tea Tree Oil (TTO) shows a wide range of antimicrobial activities. A randomized open clinical trial was carried out on 60 thoroughbred breeding horses affected by equine ringworm. The animals were randomly divided into 2 groups of 30 subjects. Diagnostic criteria were the presence of clinical signs and positive T. equinum culture. Specificity control using TTO mixture in 5 not dermatophyte affected animals was achieved also. The antimycotic activity against T. equinum of a mixture containing 25% TTO in sweet almond oil, was evaluated in vivo treating 30 subjects, the others were administered enilconazole 2% solution. The animals of both groups were topically treated twice a day for 15 days with a 25% mixture of TTO diluted in sweet almond oil and every 3 days, four times with enilconazole rinses, respectively. The clinical and mycological outcome were evaluated at day 30 from the start of the treatments. Data analysis was performed by chi square test. All the treated animals showed complete clinical and aetiological healing. Part of control subjects also, showed an improvement and none of them exacerbate the lesions. This therapeutic protocol appears to be effective and versatile, being applicable immediately after physical examination, prior to have the laboratory response. It could be an alternative for practitioners interested in herbal medicines, contributing to fulfill the gap existing between in vitro and clinical studies.

Parole Chiave

Trichophyton equinum. Dermatofitosi. Equini.

Melaleuca alternifolia – Attività fungicida ampio spettro

Aprile 2003

J Appl Microbiol. 2003;95(4):853-60.

Antifungal activity of the components of Melaleuca alternifolia (tea tree) oil.

Hammer KA, Carson CF, Riley TV.

Discipline of Microbiology, School of Biomedical and Chemical Sciences, The University of Western Australia, Crawley, WA, Australia. khammer@cyllene.uwa.edu.au

Abstract

AIMS: To investigate the in vitro antifungal activity of the components of Melaleuca alternifolia (tea tree) oil.

METHODS AND RESULTS: Activity was investigated by broth microdilution and macrodilution, and time kill methods. Components showing the most activity, with minimum inhibitory concentrations and minimum fungicidal concentrations of < or =0.25%, were terpinen-4-ol, alpha-terpineol, linalool, alpha-pinene and beta-pinene, followed by 1,8-cineole. The remaining components showed slightly less activity and had values ranging from 0.5 to 2%, with the exception of beta-myrcene which showed no detectable activity. Susceptibility data generated for several of the least water-soluble components were two or more dilutions lower by macrodilution, compared with microdilution.

CONCLUSIONS: All tea tree oil components, except beta-myrcene, had antifungal activity. The lack of activity reported for some components by microdilution may be due to these components becoming absorbed into the polystyrene of the microtitre tray. This indicates that plastics are unsuitable as assay vessels for tests with these or similar components.

SIGNIFICANCE AND IMPACT OF THE STUDY: This study has identified that most components of tea tree oil have activity against a range of fungi. However, the measurement of antifungal activity may be significantly influenced by the test method.

Parole Chiave

Terpinen-4-olo. 1,8 cineolo. Attività antimicotica.

Melaleuca alternifolia – Attività fungicida e sporicida

Agosto 2002

J Antimicrob Chemother. 2002 Aug;50(2):195-9.

In vitro activity of Melaleuca alternifolia (tea tree) oil against dermatophytes and other filamentous fungi.

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Abstract

The in vitro activity of Melaleuca alternifolia (tea tree) oil against dermatophytes (n = 106) and filamentous fungi (n = 78) was determined. Tea tree oil MICs for all fungi ranged from 0.004% to 0.25% and minimum fungicidal concentrations (MFCs) ranged from <0.03% to 8.0%. Time-kill experiments with 1-4 x MFC demonstrated that three of the four test organisms were still detected after 8 h of treatment, but not after 24 h. Comparison of the susceptibility to tea tree oil of germinated and non-germinated Aspergillus niger conidia showed germinated conidia to be more susceptible than non-germinated conidia. These data demonstrate that tea tree oil has both inhibitory and fungicidal activity.

Parole Chiave

Melaleuca alternifolia. Attività fungicida. Attività sporicida. Minima concentrazione fungicida (MIF).

Melaleuca alternifolia – Premesse impiego veterinario

Maggio 2002

Schweiz Arch Tierheilkd. 2002 May;144(5):215-21.

Antifungal effect of Australian tea tree oil on Malassezia pachydermatis isolated from canines suffering from cutaneous skin disease.

Weseler A, Geiss HK, Saller R, Reichling J.

Institute of Pharmaceutical Biology, Ruprecht-Karls-University Heidelberg, Germany.

Abstract

The lipophilic yeast Malassezia pachydermatis is part of the normal skin flora of most warm-blooded organisms. In a number of surveys it could be demonstrated that this yeast species might be involved in different skin diseases like seborrhoeic dermatitis, especially in dogs and cats. In order to look for an alternative therapeutic agent to the commonly used antimycotic and antiseptic synthetic substances the in vitro activity of Australian tea tree oil, the essential oil of Melaleuca alternifolia, against several strains of Malassezia pachydermatis was examined. All tested strains showed remarkably high susceptibility to tea tree oil. With these results the excellent antibacterial activity of tea tree oil is extended to a new group of fungal pathogens colonizing mainly mammals' skin. During the last ten years there was an increasing popularity of tea tree oil containing human health care products. The presented data open up new horizons for this essential oil as a promising alternative agent for topical use in veterinary medicine as well.

Parole Chiave

Malassezia pachydermatis. Uso topico. Medicina veterinaria.

Melaleuca alternifolia – Uso topico vs. Candida spp

Maggio 1998

Journal of Antimicrobial Chemotherapy (1998) 42, 591–595

JAC

In-vitro activity of essential oils, in particular *Melaleuca alternifolia* (tea tree) oil and tea tree oil products, against *Candida* spp.

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The in-vitro activity of a range of essential oils, including tea tree oil, against the yeast candida was examined. Of the 24 essential oils tested by the agar dilution method against *Candida albicans* ATCC 10231, three did not inhibit *C. albicans* at the highest concentration tested, which was 2.0% (v/v) oil. Sandalwood oil had the lowest MIC, inhibiting *C. albicans* at 0.06%. *Melaleuca alternifolia* (tea tree) oil was investigated for activity against 81 *C. albicans* isolates and 33 non-*albicans Candida* isolates. By the broth microdilution method, the minimum concentration of oil inhibiting 90% of isolates for both *C. albicans* and non-*albicans Candida* species was 0.25% (v/v). The minimum concentration of oil killing 90% of isolates was 0.25% for *C. albicans* and 0.5% for non-*albicans Candida* species. Fifty-seven *Candida* isolates were tested for sensitivity to tea tree oil by the agar dilution method; the minimum concentration of oil inhibiting 90% of isolates was 0.5%. Tests on three intra-vaginal tea tree oil products showed these products to have MICs and minimum fungicidal concentrations comparable to those of non-formulated tea tree oil, indicating that the tea tree oil contained in these products has retained its anticandidal activity. These data indicate that some essential oils are active against *Candida* spp., suggesting that they may be useful in the topical treatment of superficial candida infections.

Parole Chiave

Candida spp. Melaleuca alternifolia. Infezioni cutanee. Uso topico.

Melaleuca alternifolia – Attività antiparassitaria

Melaleuca alternifolia – Attività acaricida specifica

Ottobre 2012

Vet Parasitol. 2012 Oct 26;189(2-4):338-43. doi: 10.1016/j.vetpar.2012.04.025. Epub 2012 Apr 23.

Dipping and jetting with tea tree (Melaleuca alternifolia) oil formulations control lice (Bovicola ovis) on sheep.

James PJ, Callander JT.

Author information

Abstract

The in vivo pediculicidal effectiveness of 1% and 2% formulations of tea tree (Melaleuca alternifolia) oil (TTO) against sheep chewing lice (Bovicola ovis) was tested in two pen studies. Immersion dipping of sheep shorn two weeks before treatment in both 1% and 2% formulations reduced lice to non detectable levels. No lice were found on any of the treated sheep despite careful inspection of at least 40 fleece partings per animal at 2, 6, 12 and 20 weeks after treatment. In the untreated sheep louse numbers increased from a mean (± SE) of 2.4 (± 0.7) per 10 cm fleece part at 2 weeks to 12.3 (± 4.2) per part at 20 weeks. Treatment of sheep with 6 months wool by jetting (high pressure spraying into the fleece) reduced louse numbers by 94% in comparison to controls at two weeks after treatment with both 1% and 2% TTO formulations. At 6 and 12 weeks after treatment reductions were 94% and 91% respectively with the 1% formulation and 78% and 84% respectively with the 2% formulation. TTO treatment also appeared to reduce wool damage in infested sheep. Laboratory studies indicated that tea tree oil 'stripped' from solution with a progressive reduction in concentration as well as volume as more wool was dipped, indicating that reinforcement of active ingredient would be required to maintain effectiveness when large numbers of sheep are treated. The results of these studies suggest significant potential for the development of ovine lousicides incorporating TTO.

Parole Chiave

Ectoparassiti. Bovicola ovis. Ovini. Pidocchio mallofago. Dipping. In vivo.

Melaleuca alternifolia – Attività ectoparassiticida

Aprile 2005

Vet Parasitol. 2005 Apr 20;129(1-2):173-6.

Acaricidal properties of the essential oil of Melaleuca alternifolia Cheel (tea tree oil) against nymphs of Ixodes ricinus.

Iori A, Grazioli D, Gentile E, Marano G, Salvatore G.

Author information

Abstract

The aim of the study was to examine the acaricidal effect of essential oil of Melaleuca alternifolia (tea tree oil, TTO) at different doses (4, 6, 8 and 10 microl) and for different exposure times (30, 60, 90 and 120 min) on nymphs of Ixodes ricinus. A dose of 8 microl TTO was lethal for more than 70% of ticks when inhaled and this effect was enhanced when the dose was increased to 10 microl (> 80%). The effect was correlated with the duration of exposure of ticks to TTO, with a significant effect being observed after 90 min exposure. The findings show that TTO has acaricidal properties and could be extremely useful in controlling ticks that are efficient vectors of pathogens.

PMID: 15817219 [PubMed - indexed for MEDLINE]

Parole Chiave

Ixodes ricinus. Zecca dei boschi. Aracnide. Ematofagia. Vettore.

Melaleuca alternifolia – Attività acaricida comparata

Maggio 2004

Arch Dermatol. 2004 May;140(5):563-6.

Acaricidal activity of Melaleuca alternifolia (tea tree) oil: in vitro sensitivity of sarcoptes scabiei var hominis to terpinen-4-ol.

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Abstract

OBJECTIVE: To compare the acaricidal activity of Melaleuca alternifolia (tea tree) oil (TTO) and some of its individual active components on the itch mite Sarcoptes scabiei var hominis.

DESIGN: In vitro acaricide sensitivity assessment.

SETTING: The Menzies School of Health Research laboratory, located near the Infectious Diseases Ward of the Royal Darwin Hospital, Australia, where patients are admitted and treated for crusted scabies.

PARTICIPANTS: Scabies mites (S scabiei var hominis) were collected from a 20-year-old Aboriginal woman admitted to the Royal Darwin Hospital with crusted scabies. Interventions Within 3 hours of collection, scabies mites were placed in continuous direct contact with the TTO products and control acaricides and were observed at regular intervals.

MAIN OUTCOME MEASURES: Percentage of mites dead at regular observation intervals between 5 minutes and 24 hours during continuous exposure to the TTO products and acaricides.

RESULTS: The 5% TTO and active component terpinen-4-ol were highly effective in reducing mite survival times. Statistically significant differences in mite survival curves were observed for 5% TTO, 2.1% terpinen-4-ol, 5% permethrin, and ivermectin (100 microg/g of Emulsifying Ointment British Pharmacopoeia 88). In vivo effectiveness was also observed.

CONCLUSIONS: Documentation of resistance against antiectoparasitic compounds is increasing. Reported S scabiei treatment failures with lindane, crotamiton, and benzyl benzoate, as well as likely emerging resistance to 5% permethrin and oral ivermectin, are of concern and advocate for the identification and development of novel acaricidal drugs. Tea tree oil is a membrane-active biocide extracted from the tree M alternifolia. It is a principal antimicrobial in a wide range of pharmaceuticals sold in Australia, with the main active component being oxygenated terpenoids. The results suggest that TTO has a potential role as a new topical acaricide and confirm terpinen-4-ol as the primary active component.

Parole Chiave

Sarcoptes spp. Ivermectina. Permetrina. Terpinen-4-olo.

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