Journal de Mycologie Médicale (2012) 22, 308—315

Available online at
SciVerse ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

ORIGINAL ARTICLE / ARTICLE ORIGINAL

Chemical composition and antifungal activity of *Matricaria recutita* flower essential oil against medically important dermatophytes and soil-borne pathogens

Composition chimique et activité antifongique de l'huile essentielle de fleurs de Matricaria recutita *contre des dermatophytes médicalement importants et pathogènes du sol*

A. Jamalian [a,b], M. Shams-Ghahfarokhi [c], K. Jaimand [d], N. Pashootan [a], A. Amani [e], M. Razzaghi-Abyaneh [a,*]

[a] *Department of Mycology, Pasteur Institute of Iran, 13164 Tehran, Iran*
[b] *Department of Biology, Islamic Azad University, Science and Research Branch, Tehran, Iran*
[c] *Department of Mycology, Faculty of Medical Sciences, Tarbiat Modares University, 14115-331 Tehran, Iran*
[d] *Department of Medicinal Plants and By-Products, Research Institute of Forest and Rangelands, 13185 Tehran, Iran*
[e] *Medicinal Chemistry Laboratory, Pasteur Institute of Iran, 13164 Tehran, Iran*

Received 13 July 2012; received in revised form 5 September 2012; accepted 12 September 2012
Available online 23 October 2012

KEYWORDS
Matricaria recutita;
Hypericum sp.;
Foeniculum vulgare;
Essential oil;
Antifungal activity;
Dermatophytes;
Aspergillus;
Trichoderma;
Fusarium

Summary
Objective. — Fungal infections are potential public health threats all over the world. In the present study, effect of *Matricaria recutita* flower essential oil (EO) was evaluated against medically important dermatophytes and opportunistic saprophytes using microbioassay technique.
Materials and methods. — Flower essential oil (EO) of *M. recutita* prepared by hydrodistillation was analyzed by gas chromatography/mass spectrometry (GC/MS). The effect of plant EO on the growth of pathogenic dermatophytes and opportunistic saprophytes was assessed using microbioassay technique. In the bioassay, fungi were cultured in 6-well flat-bottom microplates in presence of various concentrations of plant EO (2.5—1000 μg/mL) for 4—10 days at 28 °C.
Results. — A total of 14 compounds were identified in the plant oil by GC/MS accounting for 97.5% of the oil composition. The main compound identified was chamazulene (61.3%) followed

* Corresponding author.
E-mail addresses: mrab442@yahoo.com, mrab442@pasteur.ac.ir (M. Razzaghi-Abyaneh).

1156-5233/$ — see front matter
http://dx.doi.org/10.1016/j.mycmed.2012.09.003

by isopropyl hexadecanoate (12.7%), *trans-trans*-farnesol (6.9%) and E-β-farnesol (5.2%). Growth inhibition for the dermatophytes exposed to serial two-fold concentrations of plant EO (2.5 to 80 μg/mL) was reported in the range of 3.24 to 68.15% for *Microsporum gypseum*, 24.48 to 100% for *M. canis*, 11.40 to 96.65% for *Trichophyton mentagrophytes*, 27.79 to 100% for *T. rubrum* and 45.73 to 100% for *T. tonsurans*. *M. recutita* EO inhibited the growth of opportunistic saprophytes by 3.98 to 64.29% for *Aspergillus flavus*, 6.38 to 93.62% for *A. fumigatus*, 3.52 to 89.45% for *A. niger*, 6.38 to 77.66% for *Trichoderma harzianum* and 17.41 to 89.41% for *Fusarium oxysporum* in serial two-fold concentrations of 15.62 to 1000 μg/mL.
Conclusion. — Results of the present study indicate that *M. recutita* could be considered as a potential candidate for designing effective antifungal formulations suitable for treatment of dermatophytosis and other fungal infections.

MOTS CLÉS
Matricaria recutita ;
Hypericum sp. ;
Foeniculum vulgare ;
Huile essentielle ;
Activité antifongique ;
Dermatophytes ;
Aspergillus ;
Trichoderma ;
Fusarium

Résumé
Objectif. — Les infections fongiques sont des menaces potentielles pour la santé publique partout dans le monde. Dans la présente étude, l'effet de l'huile essentielle de fleurs de *Matricaria recutita* (EO) a été évalué contre des dermatophytes médicalement importants et saprophytes opportunistes en utilisant la technique microbioassay.
Matériel et méthodes. — L'huile essentielle de fleurs (EO) de *M. recutita* préparée par hydrodistillation a été analysée par chromatographie en phase gazeuse/spectrométrie de masse (GC/MS). L'effet de l'EO sur la croissance des dermatophytes pathogènes et saprophytes opportunistes a été évalué en utilisant la technique microbioassay. Dans l'essai biologique, les champignons ont été cultivés dans des microplaques à six puits à fond plat en présence de diverses concentrations d'EO (2,5 à 1000 μg/mL) pendant quatre à dix jours à 28 °C.
Résultats. — Un total de 14 composés a été identifié par GC/MS représentant 97,5 % de la composition de l'huile. Le principal composé identifié était le chamazulène (61,3 %) suivi par l'hexadécanoate isopropylique (12,7 %), le *trans-trans*-farnesol (6,9 %) et l'E-β-farnesol (5,2 %). L'inhibition de la croissance pour les dermatophytes exposés à une double série de concentrations d'EO (2,5 à 80 μg/mL) se situe dans la gamme de 3,24 à 68,15 % pour *Microsporum gypseum*, de 24,48 à 100 % pour *M. canis*, de 11,40 à 96,65 % pour *Trichophyton mentagrophytes*, de 27,79 à 100 % pour *T. rubrum* et de 45,73 à 100 % pour *T. tonsurans*. L'EO de *M. recutita* a inhibé la croissance de saprophytes opportunistes de 3,98 à 64,29 % pour *Aspergillus flavus*, de 6,38 à 93,62 % pour *A. fumigatus*, de 3,52 à 89,45 % pour *A. niger*, de 6,38 à 77,66 % pour *Trichoderma harzianum* et de 17,41 à 89,41 % pour *Fusarium oxysporum* en série double des concentrations de 15,62 à 1000 μg/mL.
Conclusion. — Les résultats de la présente étude actuelle indiquent que *M. recutita* pourrait être considéré comme un candidat potentiel pour la conception de formulations efficaces antifongiques appropriées pour le traitement dermatophytose et d'autres infections fongiques.

Introduction

Fungi are ubiquitous in the environment, and infection due to fungal pathogens has become more frequent [16,45,46]. Fungal diseases represent a critical problem to health and they are one of the main causes of morbidity and mortality worldwide [10]. Dermatophytoses, although very fastidious and difficult to manage, are less serious problems with respect to life-threatening invasive fungal infections [40]. A steady rise in the incidence of superficial and invasive fungal infections in past decades has been closely associated with particular infectious diseases such as AIDS, intensive chemotherapy and solid organ transplantation [9,12]. Recipients of organ transplants, leukemic patients and specific conditions such as prolonged neutropenia, corticosteroid therapy, diabetes and age are considered as the most important risk factors facilitate the onset of fungal infections [9,12,15,25,39]. Despite the improvement of diagnostic procedures, particularly non-cultural methods, the early diagnosis of invasive fungal infections remains difficult. The complexity and high cost of therapy and most of all the high case fatality rate of systemic fungal infections are reasons for the ongoing prophylactic approaches [9,25]. Non-absorbable polyenes for superficial mycoses and amphotericin B, echinocandins and newly developed azoles for invasive fungal infections have been successfully used in prevention and treatment programs; however the value of such antifungal prophylaxis in high-risk patients remains to be further studied.

In recent years, researchers have focused on finding novel antimicrobials from natural sources including higher plants, microorganisms, insects, nematodes and vertebrates. Plants are rich sources of beneficial secondary metabolites. Their essential oils (EOs) and extracts have a wide array of biological activities, especially antimicrobial effects on different groups of pathogenic organisms [1,2,42,44]. Plants with antimicrobial activity are also known to be numerous; yet prior to a decade ago, minimal research had been conducted in the area of antifungal medicinal plants [20,27,28,46]. Despite emphasis being put in research of synthetic drugs,