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Topic

Evaluation of the Antimicrobial Activity of *Tussilago farfara* L Extract.

Presented before the jury

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ABSTRACT

The increasing emergence of antimicrobial resistance has encouraged the search for alternative antimicrobial agents from natural sources. The present study aimed to evaluate the antimicrobial activity of the hydroethanolic extract of *Tussilago farfara* L. against several pathogenic microorganisms, including Gram-positive bacteria (*Staphylococcus aureus, Bacillus cereus, Listeria monocytogenes*, and MRSA), Gram-negative bacteria (*Escherichia coli and Salmonella enterica*), and fungal strains (*Candida albicans and Alternaria solani*). The extract was obtained by hydroethanolic maceration and tested using the disc diffusion method, as well as minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) assays. The results showed that the extract exhibited variable antimicrobial activity depending on the tested microorganism. Gram-positive bacteria were generally more susceptible than Gram-negative bacteria and fungi, with *Staphylococcus aureus* showing the highest sensitivity. These findings suggest that *Tussilago farfara* L represents a promising natural source of antimicrobial compounds and deserves further investigation.

Keywords: *Tussilago farfara* L*,* antimicrobial activity, hydroethanolic extract, pathogenic bacteria, MIC, MBC, antimicrobial resistance.

RESUME

L'émergence croissante de la résistance aux antimicrobiens a encouragé la recherche d'agents antimicrobiens alternatifs issus de sources naturelles. La présente étude avait pour objectif d'évaluer l'activité antimicrobienne de l'extrait hydroéthanolique de *Tussilago farfara* L. contre plusieurs microorganismes pathogènes, notamment des bactéries à Gram positif (*Staphylococcus aureus, Bacillus cereus, Listeria monocytogenes* et MRSA), des bactéries à Gram négatif *(Escherichia coli et Salmonella enterica*), ainsi que des souches fongiques (*Candida albicans et Alternaria solani).* L'extrait a été obtenu par macération hydroéthanolique et testé à l'aide de la méthode de diffusion sur disque, ainsi que par la détermination de la concentration minimale inhibitrice (CMI) et de la concentration minimale bactéricide (CMB). Les résultats ont montré que l'extrait présentait une activité antimicrobienne variable selon le microorganisme testé. Les bactéries à Gram positif étaient généralement plus sensibles que les bactéries à Gram négatif et les champignons, *Staphylococcus aureus* présentant la sensibilité la plus élevée. Ces résultats suggèrent que *Tussilago farfara* L constitue une source naturelle prometteuse de composés antimicrobiens et mérite des investigations complémentaires.

Mots-clés : *Tussilago farfara* L, activité antimicrobienne, extrait hydroéthanolique, bactéries pathogènes, CMI, CMB, résistance aux antimicrobiens.

الملخص

أدى التزايد المستمر لمقاومة الكائنات الدقيقة للعوامل المضادة للميكروبات إلى تشجيع البحث عن بدائل علاجية ذات أصل طبيعي. هدفت هذه الدراسة إلى تقييم النشاط المضاد للميكروبات للمستخلص الهيدروإيثانولي لنبات *Tussilago farfara* L. ضد مجموعة من الكائنات الدقيقة الممرضة، شملت البكتيريا موجبة الغرام (*Staphylococcus aureus*، *Bacillus cereus*، *Listeria monocytogenes* وMRSA) ، والبكتيريا سالبة الغرام (*Escherichia coli* و*Salmonella enterica*) ، بالإضافة إلى السلالات الفطرية (*Candida albicans* و*Alternaria solani*). تم الحصول على المستخلص بواسطة النقع الهيدروإيثانولي، وتم تقييم نشاطه المضاد للميكروبات باستخدام طريقة الانتشار بالأقراص، إلى جانب تحديد التركيز المثبط الأدنى (MIC) والتركيز القاتل الأدنى (MBC). أظهرت النتائج أن المستخلص يمتلك نشاطًا مضادًا للميكروبات يختلف باختلاف الكائن الدقيق المختبر. وكانت البكتيريا موجبة الغرام أكثر حساسية بشكل عام مقارنة بالبكتيريا سالبة الغرام والفطريات، حيث أبدى *Staphylococcus aureus* أعلى درجة من الحساسية. وتشير هذه النتائج إلى أن نبات *Tussilago farfara* L يمثل مصدرًا طبيعيًا واعدًا للمركبات المضادة للميكروبات ويستحق المزيد من الدراسات المستقبلية

الكلمات المفتاحية: *Tussilago farfara* L ، النشاط المضاد للميكروبات، المستخلص الهيدروإيثانولي، البكتيريا الممرضة، التركيز المثبط الأدنى (MIC) ، التركيز القاتل الأدنى (MBC)، مقاومة مضادات الميكروبات.

Introduction

Introduction

Medicinal plants have been used for centuries as an important source of therapeutic agents for the prevention and treatment of numerous diseases. A large proportion of the world's population still relies on traditional medicine and medicinal plants for primary healthcare (**WHO, 2023**). These plants contain various bioactive compounds such as flavonoids, phenolic acids, tannins, and alkaloids, which are known for their antimicrobial, antioxidant, and anti-inflammatory properties **(Cowan, 1999).**

In recent years, antimicrobial resistance has become one of the most serious global public health challenges. The increasing resistance of pathogenic microorganisms to conventional antibiotics reduces treatment effectiveness and promotes the emergence of multidrug-resistant strains such as *Methicillin-Resistant Staphylococcus aureus* (MRSA) **(WHO, 2024**). Consequently, the search for new antimicrobial agents from natural sources has attracted considerable scientific interest (**Ventola, 2015).**

Among medicinal plants*, Tussilago farfara* L., a perennial species belonging to the Asteraceae family, has long been used in traditional medicine for the treatment of respiratory disorders, including cough, asthma, and bronchitis **(Hosseinzadeh et al., 2015).** Several studies have demonstrated that this plant possesses important biological activities, including antimicrobial, antioxidant, and anti-inflammatory effects, mainly due to its richness in flavonoids, phenolic compounds, sesquiterpenes, and caffeoylquinic acids **(Chen et al., 2021).**

The objective of the present study was to evaluate the antimicrobial activity of the hydroethanolic extract of *Tussilago farfara* L against several pathogenic microorganisms, including Gram-positive bacteria (*Staphylococcus aureus, Bacillus cereus, Listeria monocytogene*s and MRSA), Gram-negative bacteria (*Escherichia coli and Salmonella enterica*), and fungal strains (*Candida albicans and Alternaria solani*).

This manuscript is divided into three chapters.

- The first chapter presents a bibliographic review of *Tussilago farfara* L and the studied microbial strains.
- The second chapter describes the materials and methods used during the experimental work. The third chapter presents and discusses the obtained results concerning the antimicrobial activity of the plant extract.

Finally, this work contributes to the valorization of medicinal plants as promising