Antimicrobial Activity of an Achillea millefolium L. †

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1. Introduction

Yarrow (Achillea millefolium L.) is one of the best-known and most widespread species, listed among the most commonly used plant species in both folk and conventional medicine for over 3000 years [1], primarily for wounds, digestive problems, respiratory infections, and skin conditions, and secondarily, among other uses, for liver disease and as a mild sedative [2]. Pharmacological effects are due to the presence of several chemical constituents, essential oils, sesquiterpenes, phenolic compounds, etc. [3]. In particular, it was suggested that the presence of various secondary metabolites such as phenols and flavonoids is responsible for antibacterial activity of yarrow [4].

Different extracts (hexane, petroleum ether and methanol) of A. millefolium aerial parts were found to be active towards Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Salmonella enteritidis, Aspergillus niger and Candida albicans [5]. Methanol extract is also active against Helicobacter pylori at a MIC of 50 μg/mL [6].

This study reveals the antimicrobial potential (towards Gram-positive and Gram-negative bacteria, a fungus and a yeast) of a hydroalcoholic extract of A. millefolium growing in Romania.

2. Materials and Methods

The vegetal material consisting of Achillea millefolium L. flowers (Millefolii flores) was obtained from culture, dried and ground as a fine powder (sieve VII).

Preparation of extracts: The method consisted of two repeated extraction of the active substances from 100 g dried plant, with 30% ethyl alcohol v/v (vegetal material/solvent ratio = 1/10 m/v) at boiling temperature of the solvent for 2 h per extraction with continuous mechanical stirring, followed by cooling and filtration of the extracts. The reunited hydroalcoholic solutions were concentrated for alcohol removal, let to settle at 4–6 °C for 6 days and further centrifugated. At the end, 15% alcohol was added to the solution up to 5/1 v/g (solution/ dried herb).

Chemical analysis: Flavones were quantified by a colorimetric method based on their property to form intensely yellow complex with Al3+, (rutin was used as reference substance) and polyphenolcarboxylic acids by a colorimetric method based on the property of phenols to form nitrocompounds or nitro oxime with nitrous acid which give red stain when dissolve in alkaline solutions due to their weak acid character (caffeic acid was used as reference substance).
(Roumanian Pharmacopoeia the Xth Edition) Saponins were also quantified by a spectrofotometric method, using Merck saponin as reference substance.

Test Organisms and Antimicrobial Assay: The organisms used comprised of Gram-negative (Escherichia coli ATCC 25922, Proteus vulgaris, NTTC HK, Yersinia enterocolitica IP76, Klebsiella pneumoniae, Salmonella typhimurium TA100), Gram-positive (Staphylococcus aureus ATCC 25923, Streptococcus salivarius IP 55126) bacteria, a fungus (Candida albicans ATCC10231) and a yeast (Aspergillus niger ATCC 16404). The antimicrobial activities of the extracts were determined by the cylinder-plate diffusion method according to Romanian Pharmacopoeia X/2000 edition [7].

3. Results and Discussion

We conducted a screening of antimicrobial potential of a yarrow hydroalcoholic extract containing 0.24% g/g flavonoids expressed as rutin, 0.0625% g/g polyphenolcarboxylic acids expressed as caffeic acid, 0.5% triterpenic saponins (determined spectrophotometrically).

Achillea millefolium extract exhibited weak antimicrobial activity towards Yersinia enterocolitica and Streptococcus salivarius (mean inhibition zone of 10–11 mm) and strong activity towards Staphylococcus aureus (mean inhibition zone of 21 mm). No antifungal effect was detected.

Similar results were found previously; ethanol extract of aerial parts of A. millefolium was screened for antimicrobial activity against E. coli, B. cereus, P. aeruginosa, S. enteritidis and C. albicans and it was found that the highest MIC value of 62.50 mg/mL was observed against B. cereus and S. enteritidis, while no activity was observed in other three tested strains.

On the other hand, different results regarding antifungal effect were showed by Fierascu et al., They found that the Achillea millefolium L. hydroalcoholic extract strongly affected the growth of some fungi (70.19% for Aspergillus niger and 47.40% for Penicillium hirsutum, compared with negative control) [3].

4. Conclusions

Achillea millefolium L. hydroalcoholic extract exhibits strong antibacterial effect against Staphylococcus aureus and it could be used as active ingredient in various formulations (cosmetic, nutritive, etc.).

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