Researches concerning the chemical composition of essential oil from *Pelargonium radens* and applications upon microorganism cultures

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Abstract: Samples of *Pelargonium radens* H.E. Moore have been taken before the flowering period, for anatomical identification of the secretory structures and essential oil extraction and analysis. The essential oil of *P. radens* before the flowering period has been found in amount of approximately 0.33% from the fresh material weight. Essential oil was extracted by steam distillation using a modified Clevenger apparatus, whereas the chemical composition was analysed by GC – MS, and for *P. radens* it was found to have 64 components. The main components of *P. radens* essential oil are: citrinelol: 28.7%; mentone 27.3%; citronellil formate 8.4%, β-endsmol 4.81%, feniletil caproate 1.6%, geraniol 1.6%, isomentone 1.58%, as well as other components, in a concentration of less than 1.5%. The microorganisms tested were strains of *Escherichia coli*, G(−) and *Staphylococcus aureus*, G(+) using the antibiogramme method. Essential oil was tested in a concentration of 1000 ppm and 500 ppm, solved in DMSO. The effect of DMSO was tested and was found null. At these concentrations, the essential oil of *P. radens* was found to have no effect upon *E. coli* and inhibitory effect upon *S. aureus*.

Key words: plant anatomy, secretory structures, essential oil extraction, effects upon bacteria

Introduction

*Pelargonium radens* H.E. Moore belongs to *Geraniaceae* family and it is used mainly for ornamental purposes, as well as its aromatic properties [2,7], the last being the main criterion for the choice of this specie.

The present study intended to cover various aspects concerning the *P. radens* essential oil, as: anatomical secretory structures [5, 6], extraction efficiency, chemical composition and effects upon microorganisms. The purpose of the present study was to outline contingent aromatherapeutical properties [2] of essential oil extracted from *P. radens*, based on the aspect of its contingent antimicrobial effect [1, 3, 4], as well as to observe correlations between physiological parameters [4, 8] and essential oils effects.

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Materials and methods

Materials used consisted of *P. radens* plants taken from the collection of “Anastasie Fatu” Botanical Garden greenhouse, as well as microbial strains of *Escherichia coli* and *Staphylococcus aureus* respectively, taken from the collection of Biological Research Institute of Iasi.

Samples have been taken before the flowering period. As far as the employed methods are concerned, they have been carried out following the aspects shown below:

1. The biological material was multiplied using the cuttings technique, within the “Anastasie Fatu” Botanical Garden greenhouse; cuttings were planted directly on a soil mix made of 1.5 – 2 parts leaf earth, 1 part ground peat and 0.25 parts gardening soil.

2. In order to identify the secretory structures for the essential oils, there have been made cross sections through leafs, which have been analysed with a 20x magnifying lens microscope. The anatomical identification of the secretory structures was carried out within the Anatomy and Morphology laboratory from the Biology Faculty, “Al. I. Cuza University” of Iasi.

3. Extraction of the essential oils has been done by steam distillation, using a modified Clevenger apparatus. The report vegetal mass/ water was approximately 1:3; extraction time was approximately 3 hours. Extraction was made at the Plant Physiology Laboratory, within the Horticulture Faculy of the Agronomical Science and Veterinarian Medicine University, Bucharest.

4. The components of the essential oils have been studied by the gas – chromatography coupled with mass spectrometry method, using a GC – MS Agilant 6890. The chemical analysis was made also at the Plant Physiology Laboratory, within the Horticulture Faculty of the Agronomical Science and Veterinarian Medicine University, Bucharest.

5. The antimicrobial effect of *P. radens* essential oil was studied using the antibiogram difusimetrical method [1]. Oil was diluted with D.M.S.O. and was placed upon paper discs and inside glass cylinders.

Results

- The secretory structures of the *P. radens* essential oil were found to be multiple celled glandular hairs located both in upper and in lower epidermis. The length of the hairs is variable, according with the hair foot component cells (Figure 1 a, b).
Figure 1. Secretory structures of *P. radens* essential oils (multiple celled glandular hairs); longer hair foot (a); shorter hair foot (b).

- Extraction efficiency of *P. radens* essential oil was found to be approximately 0.33% before the flowering period and its chemical composition revealed an amount of 64 components. The main components have been identified and they are illustrated in Diagram 1.

![Diagram 1. *P. radens* essential oil main components (%)](image-url)
• The effect of D.M.S.O. upon the microbial cultures was null, for both *E. coli* and *S. aureus* (Figure 2 a, b).

![Image](image1.png)

**Figure 2.** Effect of solvent (D.M.S.O.) upon: (a) *Staphylococcus aureus* strains and (b) *Escherichia coli* strains.

• The effect of *P. radens* essential oil is null upon *E. coli* strains (Figure 3 a, b) using both paper discs (Figure 3, a) and glass cylinders (Figure 3, b).

![Image](image2.png)

**Figure 3.** Effect of *P. radens* essential oil upon *Escherichia coli* strains using (a) paper discs and (b) glass cylinders.
The effect of *P. radens* essential oil can be noticed upon *S. aureus* strains using paper discs (Figure 4, a). Inside glass cylinders there are no microbial colonies (Figure 4, b).

**Figure 4.** Effects of *P. radens* essential oil upon *Staphylococcus aureus* strains using (a) paper discs and (b) glass cylinders.

**Conclusions**

- The secretory structures for the *P. radens* essential oil are multiple celled glandular hairs, located both in the upper and in the lower epidermis.
- Extraction efficiency of *P. radens* essential oil was found to be approximately 0.33% before the flowering period and its chemical composition revealed an amount of 64 various components.
- The solvent used for the essential oil (D.M.S.O) has no influence upon the microbial cultures.
- *P. radens* essential oil has no influence upon *E. coli* strains and has inhibitory effects upon *S. aureus* strains.
- Further studies are required for the establishing of the minimum inhibitory concentration of the essential oil, in the case of *S. aureus.*
References

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