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ASSESSMENT OF ANTIMICROBIAL ACTIVITY OF Silphium perfoliatum LEAVES AND ROOTS EXTRACTS.

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Abstract: *Biological control of diseases in plants is a modern, effective, and non-polluting approach. Combating different types of pathogens that affect plant organisms by using biological preparate derived from different organs of plant species such as garlic, nettle, mint, thyme, etc. have demonstrated their efficacity over the time. The present study concerned the laboratory evaluation of the efficacy of alcoholic extracts obtained from leaves, roots and rhizomes of Silphium perfoliatum to inhibit the growth of certain fungi species such as Botrytis cinerea, Fusarium graminearum and Aspergillus flavus that attack cultivated plants.*

The obtained results show that, in general, alcoholic extracts obtained from the roots, stems and leaves of S. perfoliatum inhibited the growth of the tested fungi species, on the culture media. The extracts from the rhizomes of the 2nd year plants showed the strongest inhibitory effects especially in Aspergillus flavus and Fusarium graminearum, and those in the leaves inhibited the growth of colonies of Botrytis cinerea. Therefore, the alcoholic extracts of S. perfoliatum represent a viable alternative in combating fungi specific to cultivated plants, with a wide range of use especially in organic farming.

• Introduction

The species of *Silphium* (family Asteraceae) are perennials found mainly in the plain and hilly areas, in the open forests and bush areas of the eastern and central parts of the United States and Canada.

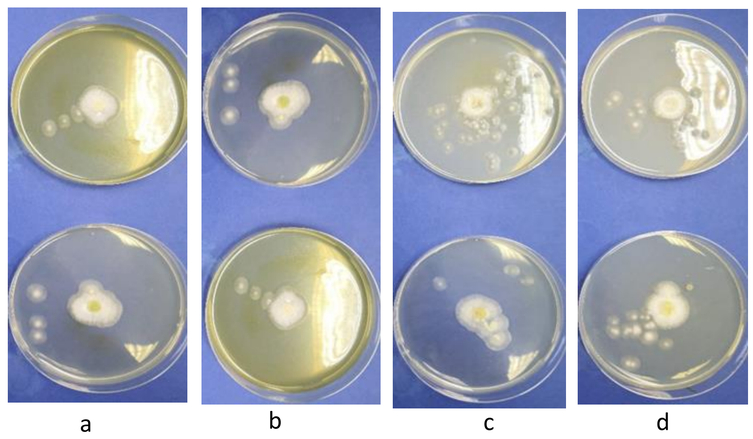
The medicinal properties of the plants were exploited by the North American Indian tribes who used the different organs of the for their antirheumatic, analgesic, tonic and diaphoretic effects, fighting some diseases of the liver and diseases of the spleen, also in combating fever and ulcers.

To date, studies on the biological activity of alcoholic extracts of *S. perfoliatum* L., have demonstrated beneficial regenerative action in the healing of post-scalding wounds in rats, reducing cholesterol by using silphiozides (saponins) isolated from the leaves. In addition, it was found that the saponins in the leaves of S. perfoliatum inhibited the development of phytopathogenic fungi *Drechslera graminea*. (Rabh) Ito, *Rhizopus nodosus* Namysl, and *Rhizopus nigricans* Des.

• Material and method

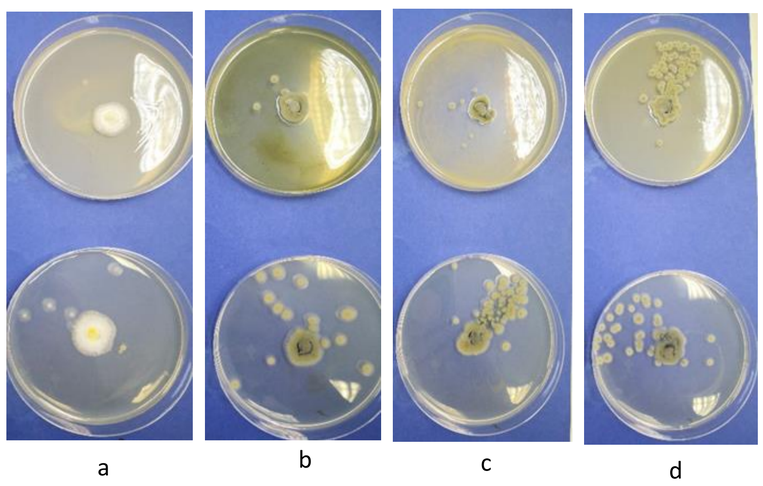
Plant material
Leaves, stems, and roots of *S. perfoliatum* from experimental cultivation of the Department of Plant physiology, University of Life Sciences „King Mihai I„ from Timisoara, Faculty of Engineering and Applied Technologies, were collected for study in June 2020. The biologic material were dried in an owen at 45 0C, under air flow until at constant weight (72 h).

Plant extracts
Extracts were obtained by extraction of 40 g of powdered raw material from each organ (leaves, rhizomes and roots) using hexane and methanol (1:10) in a Soxhlet's apparatus (12 h). Achieved extracts were condensed in a rotation evaporator up to 10 mL.
Plant extracts were re-dissolved in methanol and the prepared extract solutions were sterilized using Millipore (0.22 µm pores) before the testing. Two grams of each extract was dissolved in 10 ml methanol to yield a concentration of 100 mg/m.
Experimental variants: V1 -11 µl/ml; V2-22 µl/ml; V3-44 µl/ml; V4- 88 µl/ml; V5- 176 µl/ml.



a b c d

Inhibition of mycelium growth for *Aspergillus flavus*, leaf extract and roots of the first year (a,b); extract leaves and stems year II (c,d)



a b c d

Inhibition of mycelial growth for *Botrytis cinerea*, extract leaves and roots I year (a,b); extract leaves, stems and roots year II (c,d,)

• Results and discussion

The data analysis on the polyphenols structure in different organs (leaves, stems and rhizomes) of two years old S. perfoliatum plants reveals the accumulation of higher amounts of riboflavine, pyrocatechol, catechin and cafeic acid. Generaly the highest quantities of phenols were determined in leaves and rhizomes (i.e. ascorbic acid).

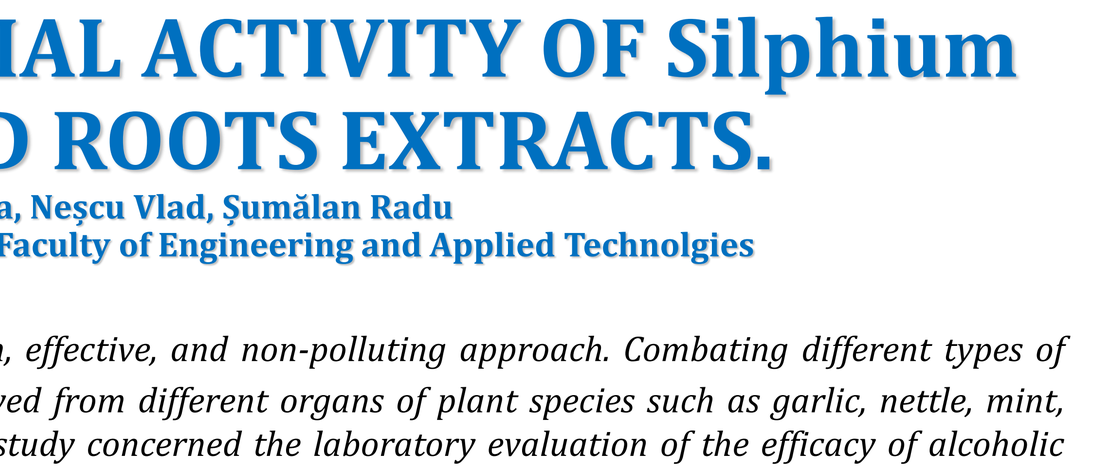


Fig.2.The structure of polyphenols in the organs of *S. perfoliatum* plants (2nd year)

The use of alcoholic extracts of *S. perfoliatum* to inhibit growth in *Botrytis cinerea* demonstrated that the leaf extract inhibited the most, followed by the stem extract, and the rhizome extract had the least effect (fig.3). The most effective was the leaf extract in variant 4 (88 µl/ml), while the alcoholic extract from the stems showed high efficiency in variant 2 (22 µl/ml).

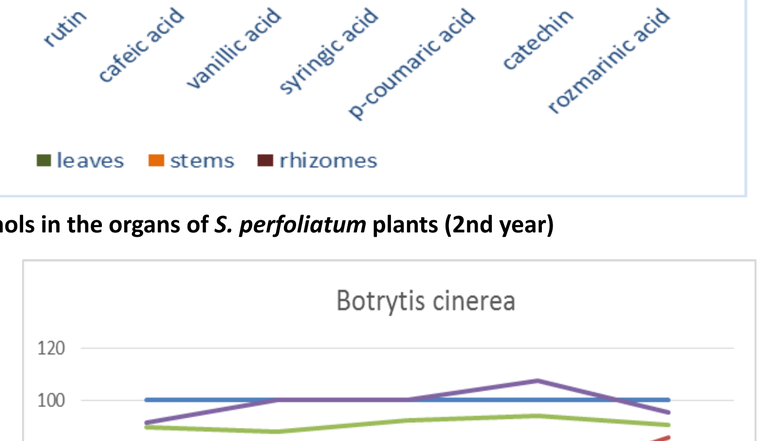


Fig.3. The effect of alcoholic extracts in inhibiting the growth of *Botrytis cinerea* colonies

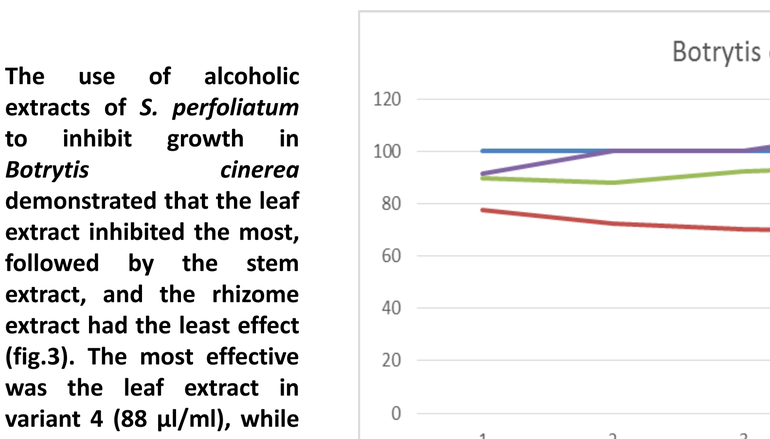


Fig.4. The effect of alcoholic extracts in inhibiting the growth of *Aspergillus flavus* colonies

The use of S. perfoliatum extracts from different organs, in the fight against fungi of the *Aspegillus flavus* shows that the best results were obtained in variant 4 (88µl/ml), both in the case of leaves extracts and those from rhizomes. The stem extracts showed increased efficacy at concentrations below 11 and 22 µl/ml.

Conclusions:

The alcoholic extract of *S. pefoliatum* has manifested antifungal effects on the analyzed pathogens.
The best efficacy was manifested in the case of leaves and rhizomes extracts obtained from two-year-old plants.
The concentrations that ensured a higher eficacity were those of 88 µl/ml.