

THE SCIENTIFIC REPORT OF PROJECT PN-III-P1-1.1-PD-2016-0892 – STAGE II

Project title: *The valorisation opportunities of natural products, separated from secondary resources through biorefining process*

Project code: PN-III-P1-1.1-PD-2016-0892

Acronym: BIOPHENOL

Project lead: Corneliu Tanase

Stage II - Testing the biological activity of beech bark polyphenolic extracts on the growth and development of sage (*Salvia officinalis* L.) and lavender (*Lavandula angustifolia* L.) plants

The degree of achievement of the indicators: all stage II indicators have been met.

The aim of this stage (2019) included the following activity:

Act 2.1 - Treatment of sage and lavender plants with beech bark polyphenolic extracts

Results: 6 experimental lots

Act 2.2 – Assessment of the beech bark polyphenolic extracts effects on the germination, growth and development of treated plants

Results: The recorded data indicate that the tested products have a stimulating influence on germination capacity compared to the control.

It is found that in *Salviae herba*, there are no significant differences in biomass accumulation between the experimental variants, compared to the control. In contrast, the amount of leaves biomass accumulated is significantly ($p \leq 0.05$) higher, in the experimental variants, compared to the control. There were no significant differences ($p \leq 0.05$) in the lavender plants regarding the accumulation of biomass (grass / floss) compared to the control.

An effect of stimulating the accumulation of assimilative pigments in sage and lavender leaves was observed for all experimental variants compared to the control.

Act 2.3 – Assessment of the beech bark polyphenolic extracts effects at histo-anatomical level

Results: The histo-anatomical effects were analyzed at the level of the root, stem and leaf of sage and lavender after treatment, with beech bark polyphenolic extract. From the statistical analysis it is found that, at the level of the root and stem, there are no significant differences, compared to the control. At the leaf level, the statistical analysis shows that there are significant differences, compared to the control, which appear for the lamina thickness in the experimental variants. At the level of the median nerve, there are significant differences between all experimental variants, compared to the control.

Act 2.4 - Obtaining volatile oil from treated plants by hydrodistillation

Results: Following the extraction of the volatile oil, from *Salviae officinalis herba* / *Salviae officinalis folium* there were values between 1.16 -1.56% (grass) and 1.60-1.79% (folium), values that correspond to the pharmacopoeia. Significant differences compared to the control appear in experimental variant, where the highest amount of volatile oil was obtained. Following the extraction of volatile oil, values between 1.33-1.92% were recorded from *Lavandulae flos*, values that correspond to the pharmacopoeia. Significant differences compared to the control were not recorded.

Act 2.5 - Analysis of the chemical composition of the volatile oil obtained

Results: The extraction and then separation of volatile compounds from sage and lavender samples was performed using the ITEX / GC-MS technique ("in-tube extraction" coupled with gas chromatography and mass spectrometry). The working hypothesis for this activity was that the polyphenolic extracts applied to sage and lavender plants will influence the chemical composition of the essential oil produced.

In the case of essential oil obtained from *Salviae folium* it is observed that the composition is in accordance with Pharmacopoeia. The compounds found in high amounts are: eucalyptol, beta-pinene, beta-thujone, borneol, caryophyllene and alpha-caryophyllene. In the experimental variants there is an increase in the amount for alpha-pinene, beta-pinene, beta-thujone, alpha-caryophyllene and viridiflorene.

The chemical composition of the essential oil obtained by "in-tube extraction" from the inflorescences of *Lavandula angustifolia* was analyzed. Its composition is in accordance with the Pharmacopoeia. The compounds found in high amounts are: linalool, linalyl acetate, beta-trans-ocymene, beta-cis-ocymene, lavandulyl acetate, 4-terpineol, neo-allo-ocimen. In the experimental variants there is an increase in the amount for beta-trans-ocymene, neo-allo-ocimen and linalool.

The dissemination of the results obtained within the project, in 2019 was achieved by:

- 1. Participation in the International Conference - ICMPSM 2019 :** 21st International Conference on Medicinal Plants and Sustainable Medicine, Narita-Tokyo, Japonia, 11 - 12 noiembrie, 2019, with work "The Bark of Woody Vascular Plants: A Source for Bioactive Compounds", autori: Corneliu Tanase, paper award for the best presentation.
- 2. Participation at Scientific Communications Session „D. BRANDZA “XXV edition,** Bucharest, November 9, 2019, with the work "Histo-anatomical and physiological aspects of *Salvia officinalis* L. plants cultivated in the presence of aqueous extract obtained from

beech bark”, authors: Corneliu Tanase, Diana Gheorghieș, Loredana Dandu, Mihaela Sămărghișan, Silvia Oroian.

Publications:

1. **Tanase C.**, Mocan A, Coșarcă S, Gavan A, Nicolescu A, Gheldiu AM, Vodnar DC, Muntean DL, Crișan O. Biological and Chemical Insights of Beech (*Fagus sylvatica* L.) Bark: A Source of Bioactive Compounds with Functional Properties. *Antioxidants* (Basel). 2019 Sep 19;8(9). 417, doi: 10.3390/antiox8090417, **FI: 4,520, (Q1 red zone)**.
2. **Tanase, C.;** Nișca, A.; Mirica, A.; Milan, A.; Boz, I. Wood Bark as Valuable Raw Material for Compounds with a Bioregulator Effect in Lemon Balm (*Melissa officinalis* L.) *Plants. Appl. Sci.* 2019, 9, 3148, doi.org/10.3390/app9153148, **FI: 2,217, (Q2 – yellow zone)**.
3. **Tanase, C.;** Coșarcă, S.; Muntean, D.-L. A Critical Review of Phenolic Compounds Extracted from the Bark of Woody Vascular Plants and Their Potential Biological Activity. *Molecules* 2019, 24, 1182, doi: 10.3390/molecules24061182, **FI: 3,06 (Q2 – yellow zone)**.
4. Sanda-Liliana Coșarcă, Elena-Alina Moacă, **Corneliu Tanase**, Daniela Lucia Muntean, Ioana Zinuca Pavel, Cristina Adriana Dehelean, Spruce and beech bark aqueous extracts: source of polyphenols, tannins and antioxidants correlated to *in vitro* antitumor potential on two diferent cell lines, *Wood Science and Technology*, 2019, (2019) 53: 313–333, doi:10.1007/s00226-018-1071-5, **FI:1,912, (Q1 –red zone)**.

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