

Chemotype Determination of German Chamomile (*Matricaria recutita* L.) in Ukraine

Ivan Salamon^{*1}, Maryna Kryvtsova², Miroslava Hrytsyna³

¹Department of Ecology, Faculty of Humanities and Natural Sciences,
University of Presov, 01, 17th November St., SK-081 01 Presov, Slovakia

²Department of Genetics, Plant Physiology and Microbiology, Biological Faculty, Uzhhorod National University
Biological Faculty, 32, Voloshyn St., UA-88000, Uzhhorod, Ukraine

³Department of Pharmacy and Biology, Faculty of Veterinary Hygiene, Ecology and Law, Stepan Gzhytskyi National
University of Veterinary Medicine and Biotechnologies, 55, Pekarská St., UA-79040 Lviv, Ukraine

Introduction

Chamomile (*Matricaria recutita* L.) is known and highly appreciated as a medicinal plant. Extracts, mono-drug as well as tea mixtures are used both for pharmaceuticals and in the foodstuff sector. In the cosmetic sector extracts and essential oil are used (Salamon, 1992).

The Ukraine traditional medicine comprises medical aspects of traditional knowledge that developed over generations within the folk beliefs of various societies before the era of modern medicine.

Despite its economic importance, however, chamomile is little known about the extent and nature of the essential oil variability and its composition of this species in Ukraine. Therefore, the information about extent of uses of various gene pools is extremely valuable for the development of future chamomile cultivation and breeding programs.

The aim of the study was the analysis of differences among chamomile plant populations growing naturally in different sites in all parts of Ukraine.

Materials and methods

Plant Material

Chamomile (*Matricaria recutita* L.) inflorescences were picked from the 21 localities in Ukraine in period 2018, 2019 and 2020. Chamomile population grows in a

wide range of open habitats, at varying altitudes and in a wide range of soil types.

The flower anthodia were separated and dried out in a sheltered, open air area at a temperature below 32 °C for 10 to 15 days with low humidity. The moisture content of the berry tissue was lowered to 15 % to prevent the infection with molds. The plant materials were cleaned, dried, packed, labelled and stored in a clean and dry place for extraction of essential oils.

Chamomile oil isolation

Each sample of dry chamomile flowers with weight of 20 g was grounded in a blender. The essential oil from this raw-material was prepared by hydro-distillation (2 hours) in Clevenger-type apparatus according to the European Pharmacopoeia and a mixture of hexane was used as a collecting solvent. The essential oils stored under N₂ at + 4 °C in the dark space before their GC-FID analysis.

GC-FID analysis

The analysis of the chamomile essential oils was carried out using a Vega Series Carloerba Gas Chromatograph, connected to a Spectrophysics SP 4270 integrator. The following operating conditions were used: column: DB5, 30 m × 0.32 mm inner diameter (i.d.), film thickness: 0.25 mm, carrier gas: nitrogen, adjusted to a flux of 1 ml per min, injection and FID-detector temperatures: 220 °C, respectively 250 °C. Components

*ivan.salamon@unipo.sk

were identified by their GC retention times, and the resulting values were comparable to those of literature. Oil component standards for comparison were supplied by Extrasynthese Ltd. (France).

Results and discussion

The differences among weights of 100 chamomile flower heads were very various. The markedly smallest and lightest flowers (1.70 ± 0.20 g) were collected at the locality in Zitomyr, where chamomile plants were grown. Approximate, average weight of flower anthodia from locality Tsvitne was 3.65 ± 0.11 which is 2.0 times more.

The quantities of essential oils in the present study were measured from 0.20 ± 0.05 % in Cherson to 0.85 ± 0.10 % in Chernihiv. The yield of volatile oil was depending on geography, altitude, and other factors, including stress influence on site (20) of plant population growth (Salamon, 2007).

The composition of essential oil is obviously genetically determined to a higher degree than the oil content. The oil content is more strongly influenced by environmental factors and shows considerable variation, even within a relatively small area (Salamon, 2004).

Essential oil extracted chamomile inflorescences was recorded to have from 52 to 72 chemical components. It was found that β -bisabolol and α -bisabolol were the major constituents in 16 samples collected from individual Ukraine sites and only 4 had dominant β -bisabolol (the most 55.17 % on site Katerinopols). The uniquely determined chemical type of chamomile wild populations in Ukraine is chemical type B (β -bisabolol > α -bisabolol > β -bisabolol oxide B) by a large majority.

The most important result of our study is the creation of the new map of the plant population distribution in order to the chamomile species in Ukraine with their chemotype determination.

Good proof of the existence of chemodemes has meanwhile been given and dates back to Schilcher (1987, 1973). With regard to the sesquiterpene alcohols original forms mostly show bisabololoxides. Forms being rich in β -bisabolol could be found endemically in Spain and to a smaller extent in other populations. Nowadays the origin of chamomile flowers from wild collections can easily be determined by means of the chemical composition:

- Types being rich in bisabolol are to be found endemically in Catalonia / Spain and spontaneous to a small extent in many local populations like in Malta and Crimea
- Bisabolol oxide A types originate from Egypt and Central Europe (e.g. Hungary, Czech Republic, Slovak Republic)

- Bisabolol oxide B types are from South American collections (especially Argentine), whereas in Chile dominates the bisabolol oxide A type.

- Bisabolone types originate from South East Europe and Turkey

- Types being poor in resp. free of matricine are to be found in Egypt, the Balkans (Romania and parts of Bulgaria) and Turkey (Menemen type); the types growing there are mostly those with yellowish-green oil.

But registered varieties with defined content are cultivated not only in the country of origin but also worldwide.

Conclusion

The commercial prospects for chamomile production in Ukraine are good. Growers, through extension of their current knowledge and infrastructure, should easily incorporate chamomile into their current suite of essential oils crops. Because the special crop is new to Ukraine agriculture, aspects of production require further research but these should not impede the adoption of this crop in the near future. The uniquely determined chemical type of chamomile wild populations in Ukraine is chemical type B (β -bisabolol > α -bisabolol > β -bisabolol oxide B) by a large majority.

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References

- Salamon, I., 2007. Effect of the Internal and External Factors on Yield and Qualitative-quantitative Characteristics of Chamomile Essential Oil. *Acta Horticulturae*, 749, 45-64, <https://doi.org/10.17660/ActaHortic.2007.749.3>.
- Salamon, I., 2004. The Slovak Genepool of German Chamomile (*Matricaria recutita* L.) and Comparison in its Parameters. *Horticultural Science*, 31(2), 70-75, <https://doi.org/10.17221/3795-HORTSCI>.
- Salamon, I., 1992. Chamomile: A Medicinal Plant. *The Herb, Spice, and Medicinal Plant Digest*, 10, 1-4, Corpus ID: 130046361.
- Schilcher, H., 1987. *Die Kamille*. Stuttgart : Wissenschaftliche Verlagsgesellschaft GmbH, 152 s., ISBN 3-8047-0939-7
- Schilcher, H., 1973. Neuere Erkenntnisse bei der Qualitätsbeurteilung von Kamillenblüten bzw. Kamillenöl. Teil 2: 2Qualitative Beurteilung des Ärtherischen Öles in Flores Chamomillae. Aufteilung der Handelskammillen in Vier bzw. Fünf Chemische Typen. *Planta Medica*, 28 (2), 133-144.