Essential oils of five different genotypes of Origanum vulgare L.

Susanne Wagner [1], Michael Mandl [1], Angela Thaller [1], Hans Berghold [1], Sigrid Pasteiner [2] and Herbert Boechzelt [1]

ISO 9001:2000 certified

[1]JOANNEUM RESEARCH
Forschungsgesellschaft mbH

Institute of Sustainable Techniques and Systems

Division for Chemical- and Technical Plant Utilization

Susanne Wagner

Elisabethstrasse 16
8010 Graz, Austria

Phone: +43 316 876-24 18
Fax: +43 316 876-24 30

susanne.wagner@joanneum.at
www.joanneum.at/nts

[2]BIOMIN GmbH

Industriestraße 21
3130 Herzogenburg, Austria

Introduction

Genetic conditions and scale of distillation process strongly determine the quality of essential oils and their possible use in cosmetics, pharmaceuticals and feed. It is well known, that the distribution of chemical components as a function of distillation time differs appreciably between the Origanum species even within the same taxon. Essential oil of the herb Origanum vulgare L. has been characterized as thymol chemotype [1]. In other cases the relative percentages of carvacrol and thymol were almost equal [2]. In contrast to that, carvacrol instead of thymol was determined as main compound in oregano oils by other researchers [3] [4].

Methods

Essential oils of five different genotypes of oregano were analysed to state on the essential oil composition of various genotypes within different cultivation years and scale of applied distillation process.

The oregano genotypes were cultivated in the years 2004 and 2005 by organic farming in a habitat with altitude of 400 meters above sea level in the East of Styria (Austria).

The plant material was distilled using the whole plant as soon as possible after harvesting. Investigations were focusing on obtaining data corresponding to fresh herbs, as far as oil yield and the chemical composition of essential oils are concerned. Steam distillation was carried out using a hundred litres batch volume distillation plant of the type Herba - Tec 250–2000, which in average processes about 10 to 15 kilograms of fresh plant material per batch and a ten litres distillation plant of the type UMWEX 100–1000 with a maximum of 1 kilogram per batch. Because of the small oil yield in the summer of 2004 only distillation with UMWEX was carried out. In 2005 both distillation methods were used.

After distillation (in average 40–50 minutes for UMWEX and 90 minutes for Herba-Tec) samples were taken in order to investigate the essential oil composition and the relative amounts of main compounds of the chosen genotype. Taken samples represent therefore a mixture of the gained essential oil during the whole distillation time. Samples were subjected to capillary gas chromatographic analysis (GC/MS and GC/FID). Their compositions were determined by comparing the relative retention times of standards and mass spectra from data library of oil components (NIST, WILEY). Relative percentages of the most predominant components (>2%) were examined for each genotype. These are important factors for the various applications of essential oils. The results provide the possibility to determine the genotype with the highest relative amount of the main compound(s) and possibly differences in the chemical composition between the two distillation methods.

Figure 6: Steam distillation apparatus in pilot plant scale (Herba - Tec, TWE 250-2000)

Figure 7: Steam distillation apparatus in lab scale (UMWEX 100-1000)

Acknowledgement

Following organizations have provided financial support which is gratefully acknowledged:

■ REG plus – Funding Regional Innovation
(a Funding Programme of FFG – Austrian Research Promotion Agency)

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Results

2004

Carvacrol, γ-terpinene, p-cymene and myrcene were determined as quantitatively predominant components of all essential oils of the five different genotypes of oregano distilled with the UMWEX plant. In general the results show, that the oil of the oregano genotypes 9 and 11 contain the highest amounts of carvacrol and minor amounts of the precursors γ-terpinene and p-cymene.

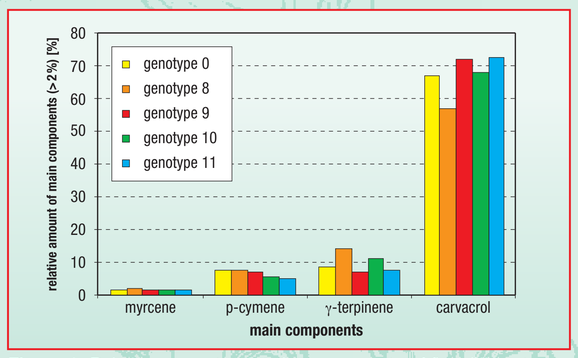

Figure 1: Relative amounts of main components of five different genotypes of oregano distilled with UMWEX distillation plant (2004, distillation time 50 minutes)

2005

The first cut of the different genotypes harvested in June 2005 and its distilled oils contained mainly carvacrol, γ-terpinene, p-cymene and β-caryophyllene for UMWEX and in addition myrcene for distillation with Herba-Tec. In general the results show, that the oil of the oregano genotypes 8 and 10 contain the highest percentages of carvacrol regarding distillation with UMWEX and 8, 9 and 10 for Herba - Tec. The amounts of carvacrol in the oils received with distillation by UMWEX of plants harvested in the year 2005 are in general higher than in the year 2004.

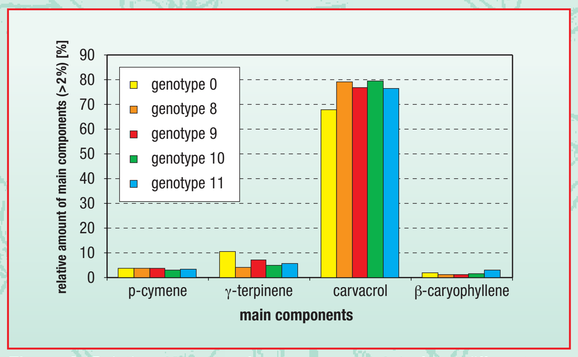

Figure 2: Relative amounts of main components of five different genotypes of oregano distilled with UMWEX distillation plant (first cut, June 2005, distillation time 40 minutes)

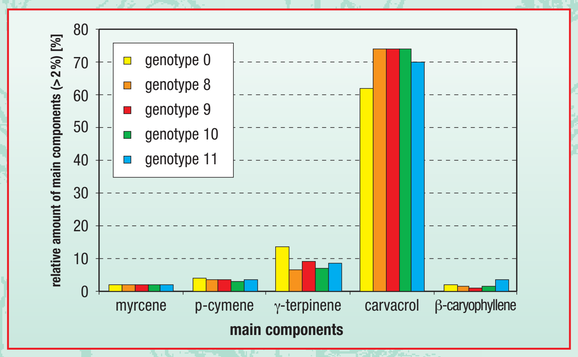

Figure 3: Relative amounts of main components of five different genotypes of oregano distilled with Herba - Tec distillation plant (first cut, June 2005, distillation time 90 minutes excluding genotype 10 with distillation time of 60 minutes)

Conclusions

As main outcome it can be postulated, that the five genotypes belong to the carvacrol chemotype. In addition the essential oils contain minor amounts of the two monoterpene hydrocarbons γ-terpinene and p-cymene, the biosynthetic precursors of thymol and carvacrol [5]. The oil obtained by distillation of plants harvested in the year 2004 contained a minor amount of carvacrol regarding distillation with UMWEX. The percentages of carvacrol in oil of plants harvested in the year 2005 were in general higher for distillation with UMWEX than for distillation with Herba-Tec, which may be put down to longer distillation time and dilution with distillation by Herba-Tec.

Figure 4: Field of oregano genotypes

Figure 5: Essential oil of oregano in distillation apparatus Herba - Tec

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