INVESTIGATION OF CHEMICAL COMPOSITION

of essential oils of five different genotypes of *Origanum vulgare L.* distilled in pilot plant scale

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Introduction

The quality of essential oils and by means of that their possible economic use in cosmetics, pharmaceuticals, functional food and feed strongly depends on the scale of distillation process used, climatic and weather conditions of the years examined and in addition genetic conditions. It is well known, that the distribution of chemical components differs appreciably between e.g. *Origanum* species even within the same taxon. To ensure the use of essential oils in other economic fields than the well known fields of cosmetics and perfumery, e.g. use in fodder for animals as antibiotics, their quality through their chemical composition, especially the relative amount of carvacrol, and the oil yield have to be examined by cultivation over at least three years and distillation in pilot plant scale.

Essential oil of the herb *Origanum vulgare L.* is known for its antibacterial properties and 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 three successive cultivation years and scale of applied distillation process.

Essential oils of five different genotypes of oregano, all grown 2004, 2005 and 2006 by organic farming in one habitat in the northeast of Styria (Austria), were analysed.

The whole plant material was distilled as soon as possible after harvesting. 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 small plant material quantities and oil yields in summer of 2004, only distillation with UMWEX was carried out. In 2005 and 2006 both distillation methods were used.

After distillation (in average 40 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) on an Agilent Technologies 6890 N Network GC System instrument with helium as carrier gas. Separation was performed on a HP-5 MS capillary column (30 m length x 0.25 mm i.d. x 0.25 µm film thickness) coated with 5 % phenyl and 95 % dimethyl polysiloxane. Oven temperature program was started by 50 °C and risen with 7 °C/min to a final temperature of 240 °C (hold: 5 min). The samples were diluted 1:100 with n-hexane and 1 µl of the diluted samples was automatically injected in split mode. Sample compositions were determined by comparing the relative retention times of standards, linear retention indices (Kovats indices) and mass spectra from data library of essential oil components (NIST, WILEY). Relative percentages of the most predominant components (> 2 %) for each genotype were examined by calculating the peak areas. 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 differences in the chemical composition between the two distillation methods.

Results

2004

Because of small plant material quantities and oil yields in summer of 2004, only distillation with UMWEX was carried out (August 2004) and the results supplied first references to oil yield and oil composition. Carvacrol and its biosynthetic precursors γ-terpinene and p-cymene together with myrcene were determined as quantitatively predominant components of all essential oils of the five different genotypes.[5] Generally the results show, that the oil of the oregano genotypes 9 and 11 contain the highest quantities of carvacrol.

2005

All five genotypes were harvested twice (in June and September 2005) and its distilled oils consisted mainly of carvacrol and minor amounts of γ-terpinene, p-cymene, myrcene and β-caryophyllene. Essential oils of the oregano genotypes 8, 9 and 10 contained the highest percentages of carvacrol regarding distillation with both distillation plants (see figure 1 and 2). Amounts of carvacrol in the oils received with distillation by UMWEX of plants harvested in the year 2005 were in general higher than in the year 2004. With exception of genotype 8, the amount of carvacrol was higher for the second cut for distillation with Herba-Tec (see figure 3).

2006

Carvacrol and minor amounts of γ-terpinene, p-cymene, myrcene and β-caryophyllene were identified as components of the essential oil of the five genotypes of the first cut in June and July 2006. The genotypes 9 and 10 showed the highest amount of carvacrol for both sorts of distillation plants. In general the relative amounts of carvacrol of the first cut are similar to those of the previous year (see figure 1 and 2).

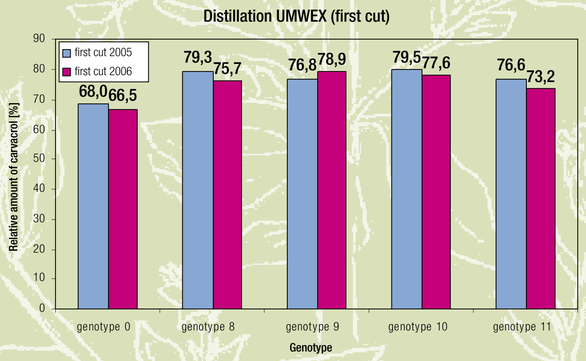

Figure 1: *Relative amounts of carvacrol of the first cut of five genotypes of oregano harvested und distilled with* ***UMWEX plant*** *in* ***2005*** *and* ***2006***

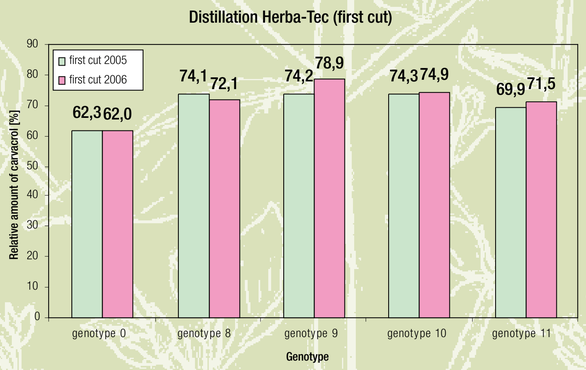

Figure 2: *Relative amounts of carvacrol of the first cut of five genotypes of oregano harvested und distilled with* ***Herba-Tec plant*** *in* ***2005*** *and* ***2006***

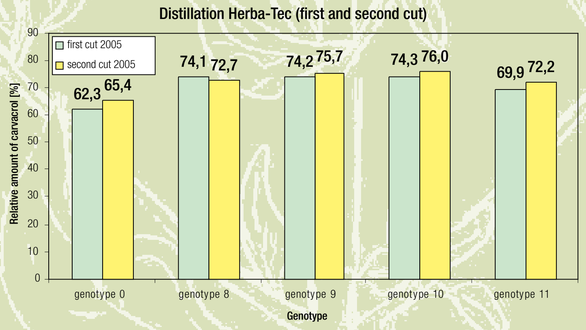

Figure 3: *Relative amounts of carvacrol of the* ***first and second cut*** *of five genotypes of oregano harvested und distilled with* ***Herba-Tec plant*** *in* ***2005***

Conclusions

The five investigated oregano genotypes belong to the carvacrol chemotype and contain minor amounts of the two monoterpene hydrocarbons γ-terpinene and p-cymene, the biosynthetic precursors of thymol and carvacrol, and of myrcene and β-caryophyllene. Regarding the highest amount of carvacrol, best results were achieved with the genotypes 8, 9 and 10. This is an important factor for the use of essential oils of oregano as antibiotics in fodder of animals. Essential oil obtained by distillation of plants harvested in the year 2004 (first cultivation year) contained a minor amount of carvacrol regarding distillation with UMWEX compared to 2005. With exception of genotype 8, the amount of carvacrol was higher for the second cut compared to the first cut for distillation with Herba-Tec plant in the cultivation year 2005. Percentages of carvacrol 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.

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Figure 4: *Genotype 9 in cultivation year 2006 (first cut)*

Figure 5: *Essential oil of genotype 9 after 30 minutes, 60 minutes and 90 minutes distillation time*

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