Clinopodium nepeta and *Clinopodium menthifolium*: agronomical and phytochemical potential of two species of calamint

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Introduction

Lesser Calamint (*Clinopodium nepeta* (L.) Kuntze; syn. *Calamintha nepeta*) and Woodland Calamint (*Clinopodium menthifolium* (Host) Stace; syn. *Calamintha sylvatica*) are two species of the Lamiaceae family, the former reminding the scent of pennyroyal, the latter a hypothetical cross between mint and marjoram (Fig. 1). In Mediterranean countries, calamints are used as spices, for herbal tea, and in ethnopharmacology. However, none of these species has ever been cultivated under the Swiss Alpine pedoclimatic conditions.

Aim of the study

The aim is to evaluate the agronomic and phytochemical potential of *C. nepeta* and *C. menthifolium* in the mountainous climatic conditions of the Swiss Alps in order to provide food and beverage local industries with innovative plant material.

Material and methods

Field trials following organic practices were carried out between 2014 and 2016 in Bruson, Valais Alps (1050 m) from seeds of *C. nepeta* CA 021 and *C. sylvatica* CA 019 obtained from Jelitto Staudensamen GmbH (Fig. 1). Plantation of four replicates was done on 25.06.2014 with a density of 9.4 plant/m2. Harvests were done with portable Supercut NT 2000 on 29.10.2014, 16.7.2015, 29.9.2015 and 23.08.2016. Yields in dry matter, leaves and essential oil (hydrodistillation 2h with 2-3 ml/min) were analyzed with XLSTAT. The essential oil composition was analyzed on a mix of replicates by UHPLC and GC-FID.

Results

For both species, yields reached 40 kg/are from the second year of cultivation (with two harvests), and the essential oil content fluctuated between 1.0 and 1.5% (Tab. 1). Rosmarinic acid content was higher in the *C. nepeta*, while chlorogenic acid was more present in *C. menthifolium* (Fig. 2). The major component in *C. nepeta* is pulegone (> 80%, Fig. 2), a ketone with antimicrobial, antibacterial, insecticidal, and allelopathic properties, though with demonstrated hepatic toxicity to mammals. The major component in *C. menthifolium* is carvone (33 to 38%, Fig. 2), another ketone used as a flavor goes since thousands of years.

Conclusions

- Both calamints have been successfully cultivated in the climatic conditions of the Swiss Alps following organic practices, with potential yields of 40 kg/are.
- *C. nepeta* is dominated by pulegone and *C. menthifolium* by carvone.
- Given their toxicity, the formulation of food products, drugs or bioinsecticides must take into account the legislation in force.
- A study of the phenotypic and phytochemical variability of native populations in Switzerland could help identifying the best ecotypes.

Fig 1. *Clinopodium nepeta* (left) and *C. menthifolium* cultivated in Bruson in the Swiss Alps (1050 m)

Tab. 1. Dry matter and essential oil yields over four harvests in three years, mix of four repetitions.

	C. nepeta	*C. menthifolium*
Dry matter	22.1	23.9
Essential oil [%]	1.2	1.3

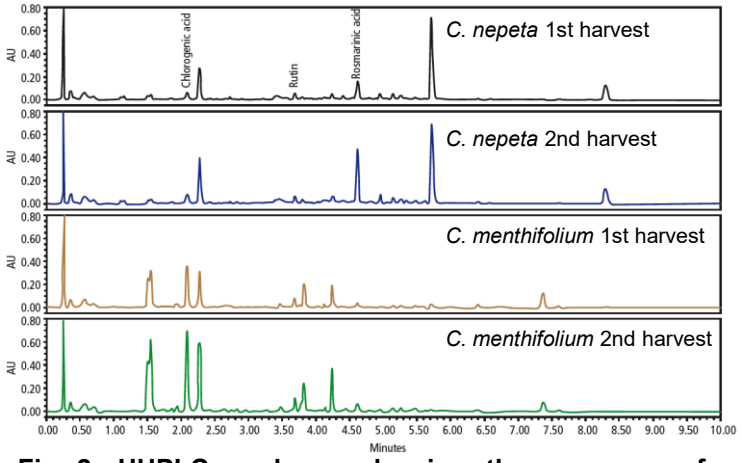

Fig 2. UHPLC analyses showing the presence of chlorogenic acid, rutin and rosmarinic acid (UV/Vis MAX plot).

Tab. 2. Essential oil composition [Area %] of the two Clinopodium species in 2016, mix of four repetitions.

Clinopodium	*nepeta*	*menthifolium*
α- and β-pinene	< DRL	0.78
Limonene	1.93	7.76
1,8-cineol	0.06	< DRL
Menthone	< DRL	0.09
Isomenthone	2.72	< DRL
Camphor	< DRL	0.44
Linalool	0.08	0.17
Bornyl acetate	0.10	< DRL
β-caryophyllene	2.13	3.86
Menthol	< DRL	< DRL
Pulegone	81.98	0.490
α-Humulene	0.32	0.98
Terpineol	0.11	0.17
Borneol	0.07	< DRL
Piperitone	< DRL	< DRL
Carvone	0.09	21.70
Sum [Area%]	**89.59**	**36.44**

< DRL : Disregard Limit

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