P 7: Variability of total flavonoid and mucilage content of wild growing chamomile (*Matricaria recutita* L.) populations

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Abstract

During our investigation 50 wild growing chamomile populations' active substance content, among them total flavonoid content and swelling index referring to mucilage content were examined in 2009 in the main chamomile collection areas of Hungary. Swelling index was determined according to the general and specified descriptions of *Althaeae folium* monograph of European Pharmacopoeia, while total flavonoid content was measured by the method described in the monograph of *Crataegi folium cum flore*. The 50 Hungarian wild growing chamomile populations proved to be very heterogeneous in terms of the examined features. The swelling index of their flower drug samples changed between 15.8 and 80.8 and their total flavonoid content varied from 0.94 to 2.28 %.

Significant correlation was also found between meteorological conditions and evaluated characteristics: there was medium strong positive correlation between spring total heat unit (sum of daily 10 °C higher average temperatures of the period lasted from 1st of March, 2009 until the day before flower collection) as well as total heat unit of 10 days before harvest and swelling index (r = 0.50-0.56), furthermore medium strong negative connection could be seen between total heat units and total flavonoid content (r = -0.60-0.65). Based on these findings it can be ascertained that raising temperature affects the mucilage accumulation positively, however, it has a negative effect on the amount of flavonoids.

Keywords: chamomile, environment, heat unit, mucilage, swelling index, total flavonoid content

Introduction

Chamomile is one of our most important medicinal plants. The dried flowers, the blue essential oil distilled from them and its different phytotherapeutic preparations are used in medicine mainly because of their anti-inflammatory, antispasmodic, skin regenerating and antiseptic effects.

Many studies have already dealt with the essential oil content and composition (chemotypes) of chamomile and according to most of them environmental factors can influence the accumulation level of essential oil and the amount of essential oil components significantly, but the typical essential oil composition (chemotype) is independent of the external environmental conditions (D'Andrea, 2002; Franz et al., 1986; Galambosi et al., 1988; Gasič et al., 1989; Gosztola et al., 2010; Letchamo, 1990; Šalamon and Hončariv, 1994).

However, in connection with the changeability and variability of other important active substances of chamomile responsible for its pharmacological effects, such as musilage or flavonoid content already much less information is available. The most important constituents of chamomile mucilage is glucose and glucuronic acid, but D-galacturonic acid, xylose (approx. 21 %), arabinose (approx. 10 %), galactose (approx. 15 %) and rhamnose (approx. 2 %) are also found in it (Janecke and Weisser, 1964). It accumulates in large mucilage containing cells of flowers and its amount changes between 3 and 17 % in the drug (Schilcher et al., 2005). The easiest and cheapest way to measure the mucilage content is to determine the swelling index of the drug according to Ph. Eur.

In relation to total flavonoid content we do not have a lot of research data, either. Roemisch (1960) measured 1.0-2.5 % accumulation levels in case of 102 commercially available samples, while Schilcher (1987) found 0.30-2.96 % total flavonoid content in the drug samples of 12 cultivated chamomile populations with different origin. Determination of total flavonoid content is carried

out by photometric method which has many advantages but the absolute values are actually about 20-30 % higher (SCHILCHER et al., 2005).

Materials and Methods

At the beginning of May, 2009 50 wild growing chamomile populations were involved in our study native to the Great Hungarian Plain of Hungary. For chemical analysis we collected representative amount of flowers by chamomile comb in full flowering stage in each population. Flowers were dried in natural way and after drying we removed the unnecessary, too long stem parts. After this we stored the samples on a dry place, protected from moisture, until the chemical measurements.

For the characterisation of mucilage content the swelling index was determined according to the general and specified descriptions (for *Althaeae folium*) of European Pharmacopoeia 8.0 by using 0.2 g dry, powdered drug. In case of the analysis of total flavonoid content measurements were carried out following the descriptions of method described in *Crataegi folium cum flore* monograph of European Pharmacopoeia 8.0. Examinations were performed in 5 repetitions in each case.

Climatic conditions were evaluated by using the data of nearest meteorological stations to the analysed chamomile populations. We counted the spring total heat unit by means of data (the sum of daily 10 °C higher average temperatures of the period lasted from 1st of March, 2009 until the day before flower collection) as well as the total heat unit of 10 days before harvest.

Results

Swelling index (SI)

The average swelling index referring to mucilage content changed between 15.8 and 80.8 in case of wild growing chamomile populations (Table 1). The relative st. dev. between populations was definite ($CV_{\%}$ = 41.2 %) and we also found significant differences between them (p = 0.000; $SD_{5\%}$ = 2.9). According to this it can be established that chamomile stands with different origin were very diverse in terms of their mucilage content. Most of the populations (60 %) had 20-40 SI values.

There were unambiguous connections between meteorological data and SI data of chamomile stands too. Plants' swelling index had medium strong, positive correlation with both spring total heat unit (r = 0.56) and total heat unit of 10 days before harvest (r = 0.50). Based on these findings it can be seen that SI referring to mucilage content is a very variable characteristic which is influenced by the temperature significantly. The higher temperature helps the accumulation of polysaccharide compounds.

Total flavonoid content

The average total flavonoid content of examined wild chamomile stands varied from 0.94 to 2.28 % (Table 1). According to this populations could be considered heterogeneous ($CV_{\%}$ = 22.2 %), between them significant differences also can be proved (p = 0.000; $SD_{5\%}$ = 0.09). More than half of the populations (60 %) had 1.20-1.80 % accumulation level.

Analyzing the meteorological data and populations' total flavonoid contents we could find clear connections again. There was a medium strong, negative correlation between amount of flavonoids and spring total heat unit (r = -0.63) as well as total heat unit of 10 days before harvest (r= -0.60). Based on this it seems that total flavonoid content – similarly to swelling index – significantly depends on the temperature. Warmer weather is unfavourable but cooler spring and lower average temperature before harvest can favour the accumulation of flavonoids.

Tab. 1 Swelling index and total flavonoid content of examined wild growing chamomile populations (2009)

Population code	Swelling index		Total flavonoid content (%)		Population code	Swelling index		Total flavonoid content (%)	
	Mean	St. Dev.	Mean	St. Dev.		Mean	St. Dev.	Mean	St. Dev.
1	16.7	1.4	2.24	0.03	**26**	34.2	1.4	1.28	0.01
2	19.2	1.4	1.86	0.03	**27**	45.0	0.0	1.72	0.13
3	25.0	2.5	1.71	0.05	**28**	54.2	3.8	1.26	0.02
4	29.2	1.4	2.05	0.04	**29**	56.7	1.4	1.52	0.05
5	25.8	1.4	1.62	0.08	**30**	31.7	1.4	1.48	0.00
6	28.3	1.4	1.91	0.05	**31**	56.7	1.4	1.07	0.03
7	29.2	1.4	1.55	0.04	**32**	27.5	2.5	1.50	0.03
8	24.2	1.4	1.43	0.03	**33**	26.7	1.4	1.45	0.08
9	26.7	1.4	1.43	0.09	**34**	27.5	0.0	1.45	0.04
10	15.8	1.4	1.70	0.04	**35**	42.5	2.5	1.44	0.03
11	22.5	2.5	2.06	0.01	**36**	40.0	2.5	1.56	0.00
12	25.8	1.4	1.48	0.10	**37**	35.0	2.5	1.25	0.02
13	38.3	1.4	1.82	0.03	**38**	40.0	0.0	1.07	0.05
14	15.8	1.4	1.98	0.04	**39**	33.3	1.4	1.21	0.01
15	15.8	1.4	1.89	0.01	**40**	44.2	1.4	1.14	0.02
16	17.5	2.5	2.12	0.05	**41**	24.2	1.4	1.48	0.05
17	26.7	1.4	2.28	0.02	**42**	26.7	1.4	1.60	0.03
18	52.5	0.0	0.98	0.01	**43**	25.8	1.4	1.50	0.02
19	38.3	1.4	1.15	0.03	**44**	58.3	1.4	1.10	0.05
20	33.3	1.4	1.62	0.02	**45**	22.5	2.5	1.21	0.03
21	36.7	1.4	1.25	0.05	**46**	19.2	1.4	1.15	0.02
22	31.7	1.4	1.02	0.07	**47**	35.0	0.0	1.83	0.01
23	22.5	2.5	1.75	0.00	**48**	80.8	1.4	1.31	0.01
24	45.0	0.0	1.35	0.03	**49**	41.7	2.9	1.29	0.06
25	47.5	2.5	0.94	0.02	**50**	67.5	2.5	1.67	0.03

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