Polyphenolic Acids of Female and Male Forms of *Urtica dioica*

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Abstract

The content and chemical composition of polyphenolic acids in dry leaves of male and female forms of nettle (*Urtica dioica* L.) were investigated at different vegetative seasons. In both forms the concentration of polyphenolic acids increased up to the stage of full blooming and than decreased. The male form was characterized by a distinctly higher content of these compounds, especially m-hydroxybenzoic, p-hydroxybenzoic and elagic acids. The female form was characterized by a higher concentration of elagic acid, particularly in the fraction obtained after acid hydrolysis.

INTRODUCTION

Nettle leaves are a raw material used both in the food and pharmaceutical industries. The biological activity is related to the presence of many chemical compounds (vitamins, organic acids, flavonoids, polyphenolic acids, mineral compounds and other) (Ellnain-Woytaszek et al., 1986; Sapronova et al., 1989; Borkowski, 1993; Ostrowska and Rzemykowska, 1998). Polyphenolic acids are less known constituents of nettle.

MATERIALS AND METHODS

The aim of the investigation was to find out the differences between female and male forms of nettle in respect of the accumulation and chemical composition of polyphenolic acids in leaves. Two-year old plants were utilized The herb was collected three times: in May (vegetative phase), in July (full blooming) and in October (senescence phase). The content of polyphenolic acids in dry leaves was determined according to the Polish Standard. Dried leaves were extracted with water. The UV spectrum for that extract was recorded on a PU 8740 UV/Vis scanning spectrophotometer (λ=490ηm). For qualitative evaluation of polyphenolic acids, the leaves were extracted with methanol. Hydrolysis and isolation of polyphenolic acid fractions were done in accordance with general procedure (Krzaczek, 1984). The compounds were identified by a GC method (Gas chromatograph – HP 6890) by comparison with standards.

GC analysis: FID (temperature of detector = 250)°C); temperature of injector: 220°C; temperature program: 60°C – 280°C, 8°/min.; capillary column – HP-5, 30m x 0,32mm; carrier gas: helium, flow rate 2mL/min.

RESULTS AND DISCUSSION

Previous investigations by us showed that male and female forms of nettle differ in their morphological and developmental characteristics (height and shape of plants, number of leaves, area of leaf blade and mass of herb), as well as in the content and chemical composition of biologically active compounds (Węglarz and Rosłon, 2000). Polyphenolic acids seem to be very important constituents of nettle and can share the responsibility for the therapeutic features of the drug. For example caffeic, p-hydroxybenzoic and ferulic acids show biligenic effect; gallic and elagic acids, an antiseptic, antidiabetic and haemostatic effect (Borkowski, 1993).

In the present study the male form was characterized by a distinctly higher content of polyphenolic acids. However, the rate of their accumulation during the vegetative period was similar for both studied forms. Their concentration increased up to the stage of full blooming and then decreased (Fig.1).

The qualitative analysis showed the presence of both free and bound polyphenolic acids. Fifteen compounds were identified. There were markedly more compounds in the fraction of free polyphenolic acids than in the fractions obtained after alkaline and acid hydrolysis. The male form of nettle was characterized by higher concentrations of m-hydroxybenzoic and elagic acids in the vegetative phase and p-hydroxybenzoic acid in the senescence phase. The female form was rich in elagic acid, but only in the fraction obtained after acid hydrolysis (Tab. 1).

CONCLUSIONS

1. The male form was characterized by a distinctly higher content of polyphenolic acids.
2. The content of polyphenolic acids and their number increased up to the stage of full blooming and then decreased.
3. The fraction of free polyphenolic acids was characterized by markedly more compounds.
4. The male form was characterized by higher concentrations of m-hydroxybenzoic acid and elagic acid in the vegetative phase and p-hydroxybenzoic acid in the senescence phase.

Literature Cited

Borkowski, B. 1993. Phenolic acids and their esters. Part II. Herba Pol. 3:139-145.

Ellnain – Woytaszek, M., Bylka, A.W. and Kowalewski, Z. 1986. Flavonoid compounds in *Urtica dioica* L. Herba Pol. 3–4:131-136.

Krzaczek, T. 1984. Phenolic acids in some tannin drugs of the Rosaceae family. Farmacja Pol. 8:475-477.

Ostrowska, B. and Rzemykowska, Z. 1998. Antioxidative activity of polyphenolic plant crude drugs in the prophylaxis and antiatherogenic therapy. Herba Pol. 4:417-428.

Sapronova, N.N., Grinkevich, N.I., Orlova, L.P., Kucherov, E.V. and Tonkonogova, R.N. 1989. The content of vitamin K and certain microelements in *Urtica dioica* L. Rast. Res. 2:243-247.

Węglarz, Z. and Rosłon, W. 2000. Developmental and chemical variability of female and male forms of nettle (*Urtica dioica* L.). Acta Hort. 523:75–80.

Table 1. Composition of polyphenolic acid fractions from leaves in three phases of plant development (% in particular fraction)

Phenolic acid	Vegetative phase						Full blooming phase						Senescence phase					
	Female form			Male form			Female form			Male form			Female form			Male form		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Gentisic	-	-	-	0,70	1,22	0,88	-	-	1,79	-	-	0,80	1,43	1,14	-	0,64	-	-
Benzoic	2,61	-	3,59	1,72	0,90	0,84	2,81	-	-	-	-	3,69	-	-	-	1,42	-	-
Elagic	0,94	7,79	1,38	6,73	9,61	8,58	6,28	8,94	2,77	8,13	7,35	5,55	-	1,63	-	0,69	-	-
Chlorogenic	1,86	3,76	1,37	-	1,12	1,03	1,29	1,54	-	-	-	0,56	0,96	1,26	-	-	-	-
m-Hydroxy-benzoic	0,65	-	-	13,10	1,53	3,97	0,66	-	-	2,48	-	1,47	1,06	-	1,29	1,08	-	-
o-Hydroxy-phenylacetic	1,04	1,26	0,46	0,66	0,96	-	-	-	0,52	-	0,80	-	0,96	-	-	0,71	-	-
p-Hydroxy-benzoic	2,42	-	-	2,84	-	0,82	2,18	-	-	3,07	0,68	3,03	1,24	1,15	1,45	4,86	-	2,32
Vanillic	1,02	1,71	-	0,84	-	-	1,25	1,01	0,49	0,97	0,63	1,48	1,51	-	-	1,57	-	-
o-Coumaric	1,07	1,38	-	0,98	1,27	-	1,71	-	-	0,83	1,02	1,38	1,02	-	-	1,40	-	-
Protocatechuic	1,09	-	-	0,98	1,23	0,79	1,08	-	-	1,13	0,81	0,59	-	-	-	1,92	-	-
Syringic	-	-	-	-	0,94	0,76	-	-	-	0,97	-	0,80	-	1,03	-	0,63	-	-
p-Coumaric	1,46	-	1,66	0,65	-	2,09	1,06	-	0,55	0,95	-	2,42	1,71	2,34	-	1,34	2,97	2,49
Gallic	1,21	1,53	0,94	3,55	-	4,29	1,58	2,01	0,51	5,52	1,03	1,36	1,41	1,38	-	1,12	5,77	2,20
Ferulic	1,09	-	-	-	-	-	1,20	1,05	-	0,73	0,84	-	1,37	-	-	1,29	-	2,60
Caffeic	0,78	-	-	2,15	1,47	3,06	1,34	1,08	-	1,59	0,83	2,12	2,09	1,00	-	0,66	-	3,06

A – Free polyphenolic acids fraction B – After acid hydrolysis fraction C – After alkaline hydrolysis fraction

Figures

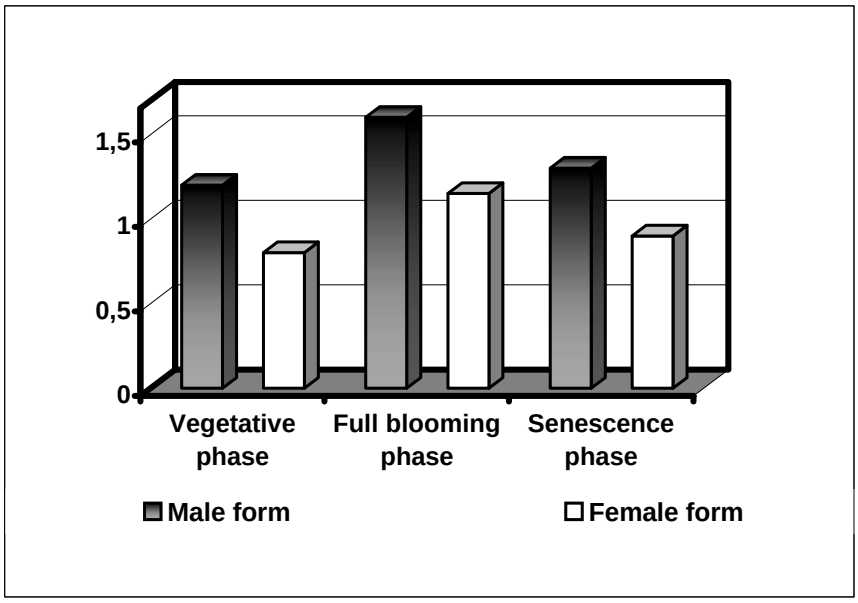

Fig. 1. The polyphenolic acid content of dry leaves (%)