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FATTY ACID COMPOSITION OF THREE *Camelina sativa* VARIETIES GROWN IN ROMANIA

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Abstract

The chemical diversity of biological active components from vegetal oils impose a selection based on structure /activity profile in order to define the requirements for a new raw material in pharmaceutical / cosmetic / food industry.

The aim of this study was the chemical characterization of three *Camelina sativa* oils extracted from three different varieties grown in Romania, in order to define their fatty acid composition, as a starting point for further applications and product capitalization.

We performed GC-MS analyses and calculated the percent of the following fatty acids in the oil samples: erucic acid, linolenic acid, linoleic acid, oleic acid, eicosenoic acid, miristic acid, pentadecanoic acid, palmitic acid, palmitoleic acid, vaccenic acid, stearic acid. The data show a very good similarity of the oils from the three varieties cultivated in Romania: GP 202, GP 204 and Madalina. The Madalina variety could be choose for further investigations and extensive cultivation due to its productivity, freeze resistance and more oil content in the seeds.

Key words*: Camelina sativa*, cold extraction, fatty acids, GC-MS analyses, *Madalina* variety.

Introduction

The Camelina sativa is a culture oleaginous plant, belonging to the *Brassicaceae* family, preponderantly used for the biofuel production on marginal lands [1, 2, 3]. Its seeds contain about 40% oil in its weight (twice more than the soya seeds) [4, 5], that can be easily turned into industrial lubricants, biodiesel [6], and the camelina seeds flour can be used for the animal consumption. The preoccupation for the extension of EPA (**Eicosapentaenoic acid)** and DHA (docosahexaenoic acid) sources, besides those coming from fish also let to the exploitation of vegetal sources of oleaginous seeds, zooplankton or microalgae [7, 8]. The content of the Camelina sativa seeds up to 40% oil containing high proportions of α-linolenic acid (ALA, 28%) and linoleic acid (LA, 19%) [9], makes this plant to be a vegetal oil source rich in omega-3. Taking into account these properties, there are studies of genetic manipulation by which it is possible to amplify the content of unsaturated far acids [10, 11, 12]. Another important aspect is the resistance of

this plant to pests, the camelina is considered to be very resistant to blackening (*Maculans lepotospaeria*), it is tolerant to alternariose, *Alternaria brassicae*, the earth flees (*Phyllotreta cruciferae Goeze*), attacking the camelina, but without considerable damages [13]. The camelin produces camalexine, substance synthesized by the plants as a protection against the pests [14], being also resistant to *Sclerotinia sclerotiorum* [15].

The interests of the introduction of the cameline culture in our country consists in the exploitation of the oil as biofuel and its seeding on marginal, uncultivated, even contaminated lands, in order to fertilize the substrate [16, 17, 18]. The cosmetic uses of the cameline oil represent another pioneering field. There are several patents related to its use, due to its properties of reconstruction of the cutaneous barrier, of the collagen synthesis I and II, fibronectine, laminin and elastin, with effect of hydrating, firmness and cutaneous reconstruction [19]. Another American patent claimed the association of the cameline oil with other oils rich in omega-3 and omega-6, for the anti-free radicals, for the acceleration of the processes of cutaneous renewal, the collagen protection and the fight against the pigmentation spots [20]. The antioxidant action at the cellular level is also supported by several scientific works [21], however, there are still unexplored molecular and cellular mechanisms for whose modulation the cameline oil could be beneficial and that we are going to investigate.

Based on these considerations about *Camelina sativa* importance, we design a screening of fatty acids composition for the most relevant varieties grown in Romania: GP 202, GP 204 and Madalina.

Materials and Methods

***Camelina sativa* cultures**:

All varieties of *Camelina sativa* have been grown by traditional technology of cultivation.

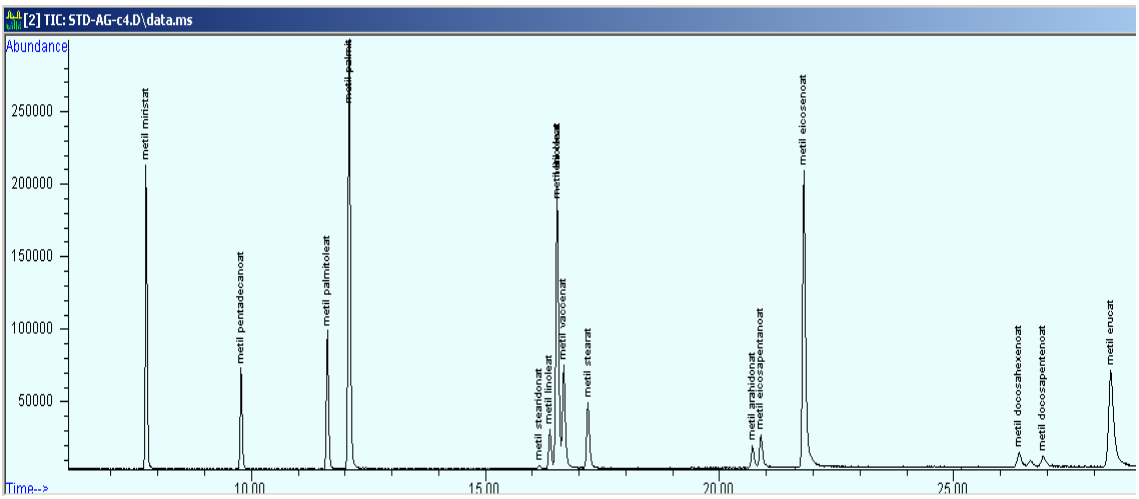
Extraction of Camelina oil: cold pressed seeds on a laboratory press (5kg/h) type H 0002, CZR 109-Pure Nature / ANKERSMID-M7C-Belgium.

Analysis method: Composition of fatty acids by GC, by methylation with KOH in methanol and heptane extraction in which case the fatty acids as components of glycerides are esterified, and dilution (Cf. European Pharmacopoea, Ed. 8.0). Quantitation was performed by external standard calibration from a mixture of methylated fatty acids: Larodan product no 89-5550, containing fatty acids previously identified in camelina oil. *Equipment:* Gas-chromatography coupled with Mass Spectrometer (Agilent: 7890A/5975C). *Acquisition method*: Oven Program 170 °C for 2 min, then 3 °C/min to 230 °C for 8 min, Run Time 30 min; Injector temperature: 250 °C; Syringe Size 10 µL, Injection Volume 1 µL; Multimode Inlet He, Split, Pressure 15.928 psi, Split Ratio 20 :1; Column: DB-

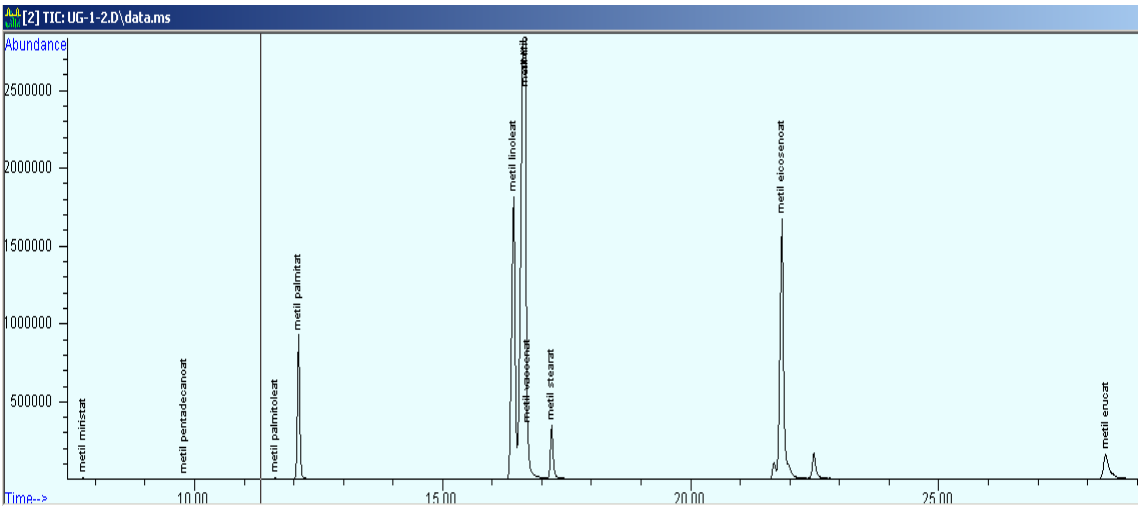
5msDB-5ms, 30 m x 250 µm x 0.25 µm; Flow Program: 1.2 mL/min for 30 min; Solvent Delay : 6.00 min; Source : 230 C; MS Quad : 150 C

Results and Discussion

The composition of fatty acids (erucic acid, linolenic acid, linoleic acid, oleic acid, eicosenoic acid, miristic acid, pentadecanoic acid, palmitic acid, palmitoleic acid, vaccenic acid, stearic acid) in *Camelina sativa* breeds cultivated in Romania was analyzed. The following chromatograms show their distribution in *Camelina* oils compared with standards.



A. Mixture of methylated fatty acids standard.



B. Esterified Camelina fatty oil

Fig.1: Fatty acids composition of Camelina oil

Table 1: Fatty acids composition of Camelina oil from three varieties cultivated in Romania

***Percent report for fatty acids composition* % Ratio**	***GP-202 breed***	***Madalina breed***	***GP-204 breed***
methyl miristate	0,16	0,21	0,21
methyl pentadecanoate	0,09	0,12	0,11
methyl palmitoleate	0,22	0,26	0,25
methyl palmitate	6,31	6,54	6,55
methyl linoleate	18,60	15,86	15,45
methyl oleate	20,02	17,25	19,14
methyl linolenate	31,30	34,61	33,71
methyl vaccenate	1,68	1,85	1,78
methyl stearate	2,74	2,84	2,76
methyl eicosenoate	15,95	17,28	16,77
methyl erucate	2,92	3,18	3,27

All the Camelina sativa varieties had the same profile of fatty acid composition, with a special mention for Madalina breed. We must point out the important content of linolenic acid found in all varieties of Camelina oil, well preserved by the gentle extraction method used. Linolenate (in the form of esters of linolenic acid) is reported as the fatty acids: α-Linolenic acid, an omega-3 (n-3) fatty acid and γ-Linolenic acid, an omega-6 (n-6) fatty acid, their balance being an important anti-inflammatory and protective agent for human metabolism. As well as, the eicosenoic acid improve the skin condition and balances the sebum secretion. We coult also mention the identification of *gamma-tocopherol* in all breeds of *Camelina sativa*, conferring antioxidant properties to this vegetal oil.

Conclusions

All the *Camelina sativa* varieties cultivated in Romania, namely GP 202, GP 204 and Madalina, have similar composition of fatty acids. *Madalina variety could be selected for further investigations and extensive cultivation due to its productivity (*2500kg/ha), compared with GP 202 and GP 204 (2000kg/ha), more oil content in the seeds (with 2% comparing the G202 breed) and a small advance in the linolenic acid content. As well as, Madalina variety is more adapted to climatic conditions from Romania (frost resistant), as it was demonstrated in the experimental fields.

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References:

1. J.T. Budin, W.M. Breene, D.H. Putnam, *J Am Oil Chem Soc.*, **1995**, 72(3), 309–15.
2. J. Zubr, *Ind Crop Prod.*, 2003, 17(3), 161–9.
3. J. Dalal, H. Lopez, N. B. Vasani, Z. Hu, J. E. Swift, R. Yalamanchili, M. Dvora, X. Lin, D. Xie, R. Qu, H. W. Sederoff, *Biotechnol. Biofuels*, 2015, 8, 175.
4. J. Vollmann, T. Moritz, C. Kargl, S. Baumgartner, H. Wagentrist, *Ind. Crop Prod.*, 2007, 26(3), 270–7.
5. BR. Moser, *Biofuels*, 2012, 3(2), 193–209.
6. A. Bernardo, R. Howard-Hildige, A. O'Connell, R. Nichol, J. Ryan, B. Rice, *Ind. Crop Prod.*, 2003, 17(3), 191–7.
7. A. Frohlich, B. Rice, *Ind Crop Prod.*, 2005, 21(1), 25–31.
8. T.C. Adarme-Vega, D.K. Lim, M. Timmins, F. Vernen, Y. Li, P.M. Schenk, *Microb Cell Fact*, 2012, 11- 96.
9. N. Tejera, D. Vauzour, M. B. Betancor, O. Sayanova, S. Usher, M. Cochard, N. Rigby, N. Ruiz-Lopez, D. Menoyo, D. R. Tocher, J.A. Napier, A.M. Minihane, *The Journal of Nutrition*, 2016, 227-235.
10. J.T. Budin, W.M. Breene, D.H. Putnam, *J. Am. Oil Chem. Soc.*, 1995, *72*, 309–315.
11. J.R. Petrie, P. Shrestha, S. Belide, Y. Kennedy, G. Lester, Q. Liu, U.K. Divi, R.J. Mulder, M.P. Mansour, P.D. Nichols, *PLoS One,* 2014, *9*, 85061.
12. M. P. Mansour, P. Shrestha, S. Belide, J. R. Petrie, P. D. Nichols, P.S. Singh, *Nutrients* 2014, *6*, 776-789.
13. D.H. Putnam,J. Budin, L.A. Field,W.Breene, *New crops. Wiley, New York*, 1997, 314-322.
14. I. Ahuja, R. Kissen, A. M. Bones, *Trends in Plant Science,* 2012, 17(2), 73–90.
15. M. Purnamasari, G. R. Cawthray, M. J. Barbetti, *Plant Desease*, 2015, 99(11), 1544-1549
16. F. Matei, F. Sauca, P. Dobre, Ș. Jurcoane, *New Biotechnology*, 2014, (31), 93.
17. S. M. Petre, A. Moraru, P. Dobre, Ș. Jurcoane, *Romanian Biotechnology Letters*, 2015, 20(4), 10561- 10571.
18. F. Matei, A. Moraru, S. Jurcoane, *Proceedings of 6th European Bioremediation Conference*, 2015, Crete, Greece.
19. M. Hocquaux, C. Masson, *Composition cosmétique destinée au soin de peaux agressées*, brevet nr. EP 2 165 698 A1, 2010.
20. J-L. Pierrisnard, Y. Millou, K. Fontes, C.Tourel, *Cosmetic composition based on polyunsaturated fatty acids and its uses,* brevet nr. US 2009/0269419 A1, 2009.
21. K. S. Telichowska, K. H. Derkacz, T. Gwbarowski, A. Kulma, H. Moreira, K. Kostyn, K. Gwbczak, A. Szyjka, *Oxidative Medicine and Cellular Longevity*, 2015, 2016,1-13.