Coffee Flower as a Promising Novel Food - Chemical Characterization and Sensory Evaluation

Kathrin Wirz[1,2], Steffen Schwarz[3], Elke Richling[2], Stephan G. Walch[1], Dirk W. Lachenmeier[1]

[1]Chemisches und Veterinäruntersuchungsamt (CVUA) Karlsruhe, Weissenburger Straße 3, 76187 Karlsruhe, Germany
[2]Technische Universität Kaiserslautern, Erwin-Schrödinger-Straße 52, 67663 Kaiserslautern
[3]Coffee Consulate, Hans-Thoma-Straße 20, 68163 Mannheim, Germany

I.   Introduction

The use of the flowers (blossoms) of the coffee plant (genus *Coffea*) has been neglected over the years, as the focus was primarily on cost-efficient production of coffee beans. Because of societal changes and economic pressures, there is an increasing demand for sustainability, so that the focus also widened towards the various by-products of the coffee production [1]. The coffee flower is **a by-product** because it **can be harvested following pollination without any risk to bean production** [2]. They can be used as a whole or as floral water in some food and cosmetic products [1,3,4]. The flower can also be prepared as a tea with hot water infusion [1,5]. Another side-chain product in coffee plantations is the so-called coffee flower honey, which is rarely monofloral due to the short flowering period [6,7]. To date, there have been few studies on coffee flowers and their sensory characterization. In this work, various compounds in *Coffea arabica*, *C. canephora* and *C. liberica* flowers **were identified, quantified and a sensory evaluation of the coffee flower was performed.**

Figure 1: Coffee flower

II. Methods

The coffee flowers samples contained 35 of the *C. arabica*, *C. canephora* and *C. liberica* varieties. All varieties were analyzed in the air-dried state. Also, a roasted coffee flower tea of the Arabica variety from the trade was analyzed. To ensure the homogeneity of the samples, each of them was finely ground and stored in air- and light-impermeable bags until use. The following methods were applied:

1. **ISO 14502-2:2007-12 [8]**, which is used for testing for the determination of caffeine, catechins and other characteristic substances in green tea, by high performance liquid chromatography, followed by detection with a diode-array detector. The Sample preparation is containing an extraction method, using 70 % methanol, preheated to a temperature of 70 °C.

2. **DIN 10809 [9]**, which is generally applied for sensory analysis with a hot water infusion for tea.

3. Nuclear magnetic resonance (NMR) spectroscopy methods for water- and fat-soluble compounds in coffee analysis [10,11]

4. Near-Infrared (NIR) spectroscopy for identification and quantification of different analytes [12].
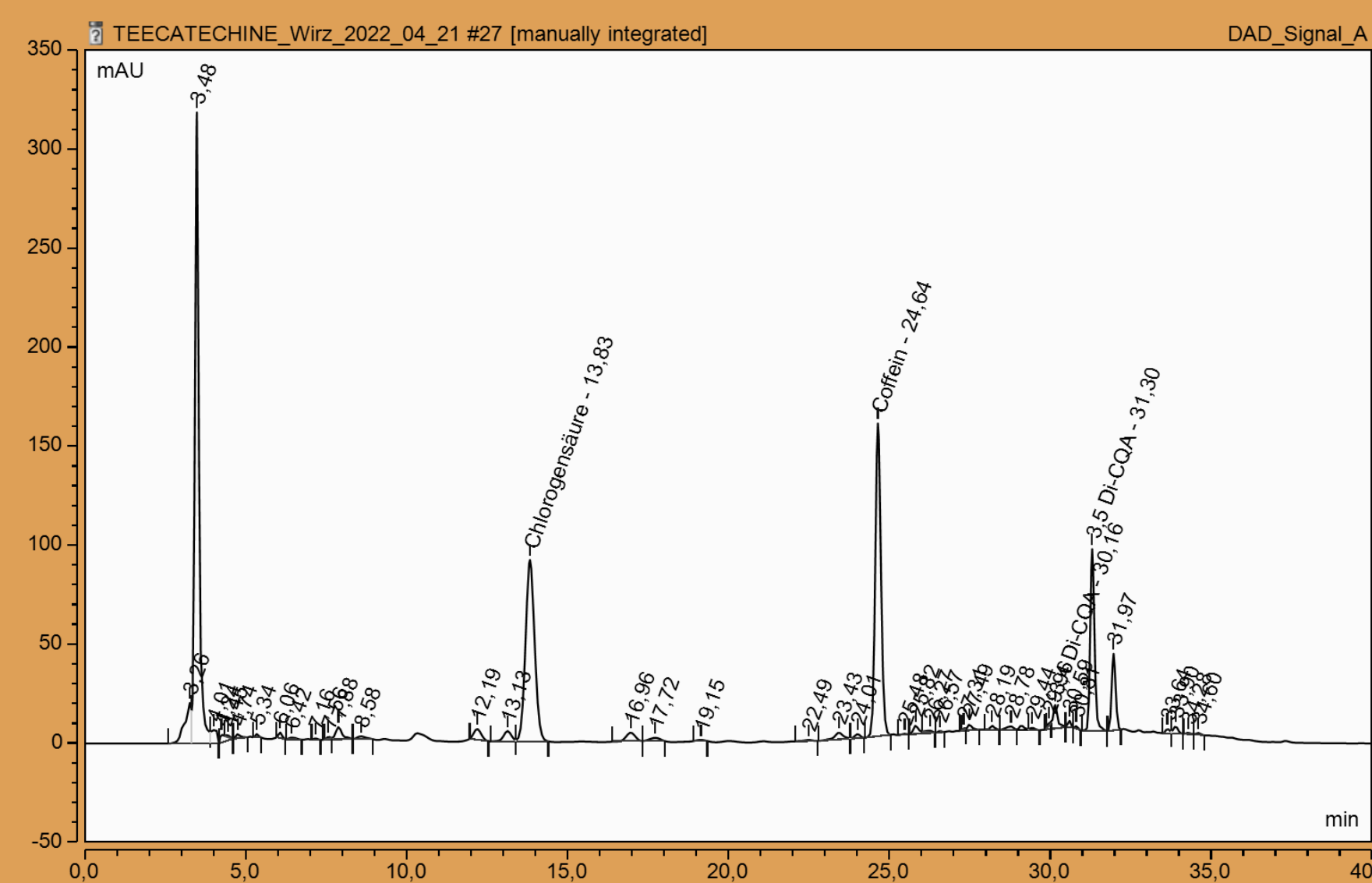
Figure 2: Chromatogram resulting from the determination of the catechin and caffeine content of a coffee flower sample.

III. Results

The results showed that compounds such as caffeine, chlorogenic acids, organic acids, trigonelline and sugars were quantified as well as fatty acids were identified. With the acquired data from the sensory analysis, a principal component analysis (PCA) was performed in which hay, hops, sage, dried apricot and honey were identified as major flavor descriptors in addition to the floral coffee flower flavors.

It was also possible to distinguish between red and yellow coffee cherries by the sensory differences of the coffee blossom.

Figure 3: Dried *arabica* coffee flowers

The coffee flower is judged as a promising novel food product, which needs to be further assessed regarding its possible approval within the novel food regulation of the European Union.

Literature

[1] Lachenmeier, D.; Schwarz, S.; Rieke-Zapp, J.; Cantergiani, E.; Rawel, H.; Martín-Cabrejas, M.A.; Martuscelli, M.; Gottstein, V.; Angeloni, S. Coffee By-Products as Sustainable Novel Foods: Report of the 2nd International Electronic Conference on Foods— „Future Foods and Food Technologies for a Sustainable World." *Foods*. **2022**, 11, doi:10.3390/foods11010003.

[2] Lachenmeier, D.W.; Rajcic de Rezende, T.; Schwarz, S. An Update on Sustainable Valorization of Coffee By-Products as Novel Foods within the European Union. *Biol. Life Sci. Forum* 2021, 6, 37. https://doi.org/10.3390/Foods2021-10969.

[3] Arrillaga, N.G. A new perfume oil from coffee flowers. *Rev. de Agr. de Puerto Rico.* **1942**, 34, 82–84.

[4] Berry-Caillet, V.; Husson, J.; Barro, L. Floral Water from Coffee Flowers. Patent WO2022053 605A1, filed 10 September 2021, and issued 17 March 2022.

[5] Bi, X.; Huang, J.; Hu, F.; Yang, Y.; Li, Y.; Lyu, Y.; Li, G.; Huang, W.; Zhang, X.; He H. et al. Preparation method of coffee flower tea. Patent CN110959719A, filed 16 December 2019, and issued 07 April 2020.

[6] Chuttong, B.; Buawangpong, N.; Burgett, M. Honey Bees and Coffee. *Bee World.* **2015**, 92, 80–83, doi:10.1080/0005772X.2015.1091230.

[7] Schiassi, M.; de Souza, V.; Lago, A.; Carvalho, G.; Curi, P.; Guimarães, A; Queiroz, F. Quality of honeys from different botanical origins. *Journal of Food Science and Technology* **2020**, 58, 11, 4167-4177, doi: 10.1007/s13197-020-04884-7.

[8] DIN ISO 14502-2:2007-12. etermination of substances characteristic of green and black tea- Part 2: Content of catechins in green tea – Method using high-performance liquid chromatography (ISO 14502-2:2005 + Corrigendum 1:2006).

[9] DIN 10809:1988-08 Analysis of Tea; Preparation of Liquor for Use in Sensory Tests; *Beuth Verlag*, Berlin, Germany.

[10] Claassen, L.; Rinderknecht, M.; Porth, T.; Röhnisch, J.; Seren, H.Y.; Scharinger, A.; Gottstein, V.; Noack, D.; Schwarz, S.;Winkler, G.; *et al.* Cold Brew Coffee—Pilot Studies on Definition, Extraction, Consumer Preference, Chemical Characterization and Microbiological Hazards. *Foods* **2021**, 10, 865, doi: 10.3390/foods10040865.

[11] Okaru, Alex O.; Scharinger, Andreas; Rajcic de Rezende, Tabata; Teipel, Jan; Kuballa, Thomas; Walch, Stephan G.; Lachenmeier, Dirk W.. Validation of a Quantitative Proton Nuclear Magnetic Resonance Spectroscopic Screening Method for Coffee Quality and Authenticity (NMR Coffee Screener). *Foods* **2020**, *9(1), 47.* doi:10.3390/foods9010047.

[12] Steger, M.C.; Rigling, M.; Blumenthal, P.; Segatz, V.; Quintanilla-Belucci, A.; Beisel, J.M.; Rieke-Zapp, J.; Schwarz, S.; Lachenmeier, D.W.; Zhang, Y. Coffee Leaf Tea from El Salvador: On-site Production Considering Influences of Processing on Chemical Composition. *Preprints* **2022**. doi: 10.20944/preprints202206.0321.v1.