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# CHANGE IN ESSENTIAL OIL YIELD, CONTENT AND COMPOSITION OF CORIANDER (*CORIANDRUM SARIVUM* L.) VARIETIES, CULTIVATED FOR SEEDS

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**Abstract**: *Coriander essential oil is widely utilized in the food, pharmaceutical, and cosmetic industries due to its diverse applications. Extracted by steam distillation from dried Coriandrum sativum seeds, the clear or pale yellow oil has a distinctive, sweet, warm, and aromatic fragrance. In a three-year study, a field experiment was conducted in the land of the village of Voyvodinovo, where five coriander varieties (Yantar, Moroccan, Mesten Drebnoploden, Thüringen, and Marino) were tested for essential oil yield, essential oil content and chemical composition. Over 46 components were identified in coriander essential oil, representing 98.5% to 99.7% of the total composition. The oil contained a diverse array of compounds, including monoterpenoids, aldehydes, alcohols, and monoterpenes. The β-Linalool was the dominant component, with concentrations ranging from 60.3% to 71.4% across the tested cultivars. The Moroccan variety had the highest average linalool content (67.17%), while the Thüringen variety exhibited the lowest (65.73%). Geranyl acetate varied from 0.975% to 4.68%, α-pinene from 4.03% to 5.70%, and γ-terpinene from 5.81% to 8.42%. The fatty acid profile was analyzed, revealing the presence of myristic acid and palmitic acid. The Yantar variety exhibited the highest palmitic acid content (1.76%), followed by the Thüringen variety (0.89%), while the Mesten Drebnoploden variety had the lowest. myristic acid levels ranged from 0.09% to 0.43% on average. The essential oil content of the tested coriander cultivars ranged from 0.20% to 0.74%. Among them, the Yantar cultivar exhibited the highest average oil content -0.62%. The greatest essential oil yield for the period 2020-2021 was recorded in the cultivar Mesten Drebnoploden -11.4 kg ha$^{-1}$, whereas the lowest yield was observed in the Marino variety -5.6 kg ha$^{-1}$. These findings underscore the variability in coriander essential oil and composition, indicating the relevance of choosing the right cultivar in enhancing essential oil production in Bulgaria.*

Introduction: In recent years, there has been a growing global interest in essential oils and medicinal and aromatic plants, particularly in Europe. A major trend involves replacing synthetic compounds with natural plant-based substances due to their structural compatibility with the human body and their lower toxicity. Essential oils are especially valued for their antibacterial and antioxidant properties. Relating essential oil-bearing crops, coriander (Coriandrum sativum L.) ranks among the most important globally in terms of oil yield. Additionally, coriander fruits contain 9–24% non-volatile (fatty) oil, which is used in technical applications. A scientific opinion on the safety of coriander fruit fatty oil shows that it has the potential to be commercialized as a novel food additive for healthy individuals (AGOSTONI et al., 2013).

Material and method: The study involved five coriander (Coriandrum sativum L.) cultivars with diverse geographic origins and agrobiological characteristics. The cultivar "Yantar" originates from Russia and is noted for its resistance to lodging, small fruit size, and high essential oil content. The "Morrocan" cultivar, of Italian origin, is recognized for its high yield potential and good tolerance to elevated temperatures. "Mesten Drebnoploden" is a local Bulgarian cultivar, well adapted to regional agro-climatic conditions and characterized by early maturation. The "Thüringen" cultivar comes from the Thuringia, region of Germany. Lastly, the "Marino" cultivar, developed in the Netherlands, is distinguished by its large fruit size. Field trials were conducted in the Plovdiv region, Bulgaria, from 2020 to 2022, in a transitional-continental climate zone. Climatic conditions during the study period were generally favorable for coriander growth, with average daily temperatures either slightly above or comparable to the long-term norms. Notably, 2021 was the most favorable year due to evenly distributed rainfall and sufficient moisture during critical growth phases. A summary of monthly rainfall and temperature data during the experiment, along with long-term averages, is presented in Table below.

**Meteorological conditions in Plovdiv region (Bulgaria) during the experiments**

| Month | Monthly rainfall (mm) | | | | Mean monthly temp (°C) | | | |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2021 | 2022 | Long term years | 2020 | 2021 | 2022 | Long term years |
| **February** | 48.0 | 25.5 | 24.8 | 32.0 | 4.3 | 5.5 | 4.9 | 2.2 |
| **March** | 82.0 | 43.3 | 22.3 | 38.0 | 8.9 | 6.4 | 5.4 | 6.0 |
| **April** | 88.0 | 69.5 | 55.5 | 45.0 | 14.4 | 11.6 | 13.1 | 12.2 |
| **May** | 39.5 | 48.5 | 28.3 | 65.0 | 20.1 | 18.5 | 18.8 | 17.2 |
| **June** | 63.7 | 88.0 | 86.5 | 63.0 | 23.7 | 22.2 | 24.0 | 20.9 |
| **July** | 26.5 | 76.3 | 6.8 | 43.0 | 26.3 | 26.5 | 26.0 | 23.2 |
| | | | | | | | | |
| **Total** | 347.7 | 351.1 | 224.2 | 286.0 | | | | |
| **Mean** | | | | | 16.28 | 15.12 | 15.37 | 13.62 |

Results and discussions: Coriander seeds' value in growing is decided by their essential oil concentration. The values of this indicator are influenced by varying climatic circumstances over time. Dry, hot weather promotes essential oil content, as does less precipitation during seed ripening. The highest oil content was noted in 2022, when there was a notable drought with a temperature during ripening that was 2.8 ºC higher than average for a multi-year period and 6.75 mm of precipitation compared to a norm of 49 mm. The essential oil content of the tested varieties is 0.45 to 0.74%. ). In 2021 and 2022, the highest yield of essential oil was recorded for the Mesten drebnoploden variety, namely 9.0 kg ha$^{-1}$ and 13.2 kg ha$^{-1}$, respectively. During the three years of the trial, the variety Marino produced the least amount of essential oil, ranging from 3.4 to 7.2 kg ha$^{-1}$. The evaluated coriander cultivars can be ranked in the following descending order based on the average values of the essential oil yield indicator: Mesten drebnoploden > Moroccan > Yantar > Thüringen > Marino.

**Qualitative indicators in coriander seed varieties**

| Variable | | Essential oil content (%) | Essential oil yield (kg) | Crude (fatty) oil (%) |
|---|---|---|---|---|
| **Years (Y)** | 2020 | 0.55 | 9.8 | 14.11 |
| | 2021 | 0.35 | 6.6 | 10.90 |
| | 2022 | 0.61 | 10.6 | 13.85 |
| **Variety (V)** | Yantar | 0.62 | 8.9 | 12.27 |
| | Moroccan | 0.51 | 10.9 | 12.65 |
| | Mesten Drebnoploden | 0.55 | 11.4 | 13.29 |
| | Thüringen | 0.48 | 8.1 | 13.19 |
| | Marino | 0.34 | 5.6 | 13.35 |
| **2020** | Yantar | 0.67 | 9.7 | 13.86 |
| | Moroccan | 0.57 | 12.1 | 13.16 |
| | Mesten Drebnoploden | 0.59 | 12.1 | 14.84 |
| | Thüringen | 0.54 | 9.1 | 14.81 |
| | Marino | 0.38 | 6.2 | 13.90 |
| **2021** | Yantar | 0.45 | 6.9 | 10.40 |
| | Moroccan | 0.36 | 8.0 | 10.09 |
| | Mesten Drebnoploden | 0.42 | 9.0 | 11.15 |
| | Thüringen | 0.32 | 5.7 | 11.13 |
| | Marino | 0.20 | 3.4 | 11.71 |
| **2022** | Yantar | 0.74 | 10.3 | 12.56 |
| | Moroccan | 0.61 | 12.7 | 14.72 |
| | Mesten Drebnoploden | 0.64 | 13.2 | 13.89 |
| | Thüringen | 0.59 | 9.4 | 13.64 |
| | Marino | 0.45 | 7.2 | 14.43 |
| **Anova** | Y | ** | ** | ** |
| | V | * | ** | * |
| | YV | n.s | * | * |

Both essential and crude (fatty) oil are present in coriander fruits. Because of the 27.25 mm greater rainfall during ripening in 2021 than in the prior and third trial years, the crude (fatty) oil content was at its lowest levels. The investigated varieties had values ranging from 10.09 to 11.71%. During the three experimental years, 46 components were identified in the coriander essential oil, constituting between 98.8% and 99.8% of it. The primary ingredient in matured fruits' essential oil was linalool, an oxygenated monoterpene. All evaluated cultivars had linalool contents ranging from 60.3% to 71.4% during the testing period, while reference values for the indicator ranged from 65.0% to 78.0. Geraniol is a monoterpenoid with concentrations varying from 2.59% to 4.13% during the experiment. In the second and third years, the presence of myristic and palmitic acids was found in all experimental varieties. The highest levels of palmitic acid (1.67-1.84%) and myristic acid (0.41-0.45%) are found in the Yantar cultivar. Finally, we can conclude that the main component for the five tested coriander varieties over the trial period was linalool with average values from 65.71 % to 67.17%, followed by γ-terpinene (5.81-8.42%), α-pinene (4.02-5.70%), camphor (3.42-4.2%), limonene (1.23-1.52%) and geranyl acetate (0.97-4.68%), while other compounds (camphene, p-cymene, β-pinene, myrcene and sabinene) were present in less than 1%.

Conclusions: The study shows that the cultivar's genetics, the annual weather conditions, and most importantly, the amount and distribution of vegetative precipitation all have a substantial impact on the production and quality traits of the assessed coriander varieties. In the five tested coriander varieties through the year with the lowest average daily temperatures during the growing season, the quality indicators of essential oil content, oil yield, and crude (fatty) oil content are understated. The cultivar Mesten drebnoploden exhibits the highest average crude (fatty) oil content at 13.29%, whereas the variety Yantar demonstrates the greatest average essential oil content at 0.62%. The findings of the study could help recommend coriander cultivars for this region.