

Terpene profiles of different Cannabis plant varieties, cultivated in NYSK Holdings, Skopje

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Introduction

Different *Cannabis* varieties for medicinal use are cultivated in NYSK Holdings, Skopje, under strict, controlled conditions. Most of them are hybrids of *C. Sativa* & *C. Indica* and all have characteristic morphological features and poses different genomic potential for cannabinoid synthesis.

Medicinal use of *Cannabis* is not only based on cannabinoids, but also on the presence of terpenes, that have an entourage effect (Russo, 2011).

This synergistic action of terpenes and cannabinoids can improve the benefit of treatment of inflammation, pain, depression, epilepsy, cancer, anxiety (Koltai et al., 2020, Russo, 2011, Baron, 2018).

Terpenes are natural products, predominantly produced by plants, consisting of compounds with formula (C₅H₈)_n, therefore also called isoprenoids. Based on the number of isoprene units in the molecule, the terpene hydrocarbons are classified as monoterpenes, sesquiterpenes, diterpenes, triterpenes and tetraterpenes.

Some varieties in genus *Cannabis* are highly aromatic, rich with terpenes, that are produced in trichomes along with the cannabinoids, on whose composition the specific aromas and flavors depend (Pertwee, 2014).

More than 100 terpene molecules are identified in *Cannabis* plants. Terpene yield and distribution in the plant vary according to numerous parameters, such applied processes, environmental conditions, or maturity of the plant (Andre et al., 2016).

Terpene profile is a unique characteristic, that can be even used as chemotaxonomic markers, for determination and identification of different varieties (Fischedick et al., 2010).

In this paper we set out to present distinct morphological characteristics of *Cannabis* plants in parallel with the terpene profiles of some varieties that are cultivated in NYSK Holdings, Skopje.

The presence of 35 different terpenes was tested in the dried flowers of *Cannabis* varieties with validated and accredited method.

Materials and methods

Plant material was used from 6 *Cannabis* strains: Heriuanu, Strawberry Glue, Gelato, La Sage, Afhaniberry.

For qualitative and quantitative analysis of volatile terpenes in the dry *Cannabis* flowers from different varieties, a HS GC/MS instrument: Shimadzu GC system-2010, MS detector-QP2020 was used; GC column Rxi-624, Sil MS.

Testing was performed on samples of *Cannabis* flowers, directly placed in the headspace vials, employing Helium as carrier gas and split injection mode.

The MS detector worked with Selected (single) Ion monitoring mode that increased the sensitivity and reduced the background noise.

Reference standards were purchased from Restek and Sigma Aldrich.

Results and discussion

Results for terpenoid profiles were obtained of duplicate samples analyzed for each variety.

Strawberry glue is a selection with moderately lush, to lush habitus, 40%-60% hybrid Sativa/Indica. The internodes are visibly stratified. Transpiratory leaves are of moderate size and soft green color. The inflorescences are mainly of bouquet and loose type and with a pleasant fruity (strawberry-citrus-apple) scent. They have abundance of trichomes.

Most common terpenes in this variety are beta-Myrcene, d-Limonene, beta-Caryophyllene and alpha-Terpineol.

Gelato is a medium habitus selection, hybrid strain 45%-55% Sativa/Indica. The internodes are decently stratified. Transpiratory leaves are large and powerful with dark green color. The inflorescences are mainly of bouquet and compact type. decently overgrown with trichomes. Flowers are dark in a perfect contrast to the bright white large trichomes that cover it the orange hairs.

Terpene composition is exceptional, powerful, creamy, fruity. Most predominant terpenes are d-Limonene, beta-Caryophyllene, Linalol and alpha-Pinene.

French Cookies is a hybrid strain 60%-40% Sativa/Indica that produces medium dense to lose inflorescences that are high in resin production and feature bright orange calyxes. This strain boasts a highly unique palette of colors ranging from light green and yellow to deep purple. Transpiratory leaves are big, powerful and dark green. The plant reaches heights up to 130 cm with bushy and lateral growth. Most dominant terpenes are beta-Myrcene, d-Limonene, beta-Caryophyllene and alpha-Humulene.

Afghaniberry is a 100% Indica strain and one of the earliest cannabis varieties known in the world. The plant is with medium to short height and produces dense, resinous buds with a sweet and spicy berry aroma.

Herijuana is a 20%-80% hybrid Sativa/Indica. It produces large dense flowers on an open, stretchy plant. Terpenes are presented with abundance of beta-Myrcene and moderate presence of d-limonene and alpha-Pinene.

La Sage is a hybrid strain 60%-40% Sativa/Indica. Its unique aroma is a mixture of the dominant Terpinolene and beta-Caryophyllene and less represented, D-Limonene and beta Myrcene.

Conclusion

Cannabis plant varieties, cultivated in NYSK Holdings, Skopje are rich in terpenes, which is of exceptional significance for the synergistic effect with cannabinoids. Also, the aromas and flavors that they express make the cannabis flowers and cannabis extracts pleasant for use.

References

- Andre, C.M., Hausman J.F., Guerriero, G., 2016. *Cannabis sativa*: The plant of the thousand and one molecules. Front. Plant Sci. 7, 19. doi: [https://10.3389/fpls.2016.00019](https://doi.org/10.3389/fpls.2016.00019).
- Baron, E.P., 2018. Medicinal properties of cannabinoids, terpenes, and flavonoids in cannabis, and benefits in migraine, headache, and pain: An update on current evidence and cannabis science. Headache J. Head Face Pain. 58, 1139.
- Fischedick, J.T., Hazekamp, A., Erkelens, T., Choi, Y.H., Verpoorte, R., 2010. Metabolic fingerprinting of *Cannabis sativa* L., cannabinoids and terpenoids for chemotaxonomic and drug standardization purposes. Phytochemistry 71, 2058-2073. doi: [https://10.1016/j.phytochem.10.001](https://doi.org/10.1016/j.phytochem.10.001).
- Koltai, H., Namdar, D., 2020. Cannabis Phytomolecule 'Entourage': From Domestication to Medical Use. Trends Plant Sci. 25, 976.
- Pertwee, R. ed. Handbook of Cannabis. New York: Oxford University Press; 2014
- Russo EB., 2011. Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects. Br. J. Pharmacol. 163, 1344-1364.