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Cannabis derived products: Agronomic production categorization to the best improvement

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INTRODUCTION

During last decade *Cannabis* legalization changed its consumption towards a broad market product. *Cannabis* varieties contain diverse types of non-psychotropic and psychotropic substances. Legalization conducts to the necessity to analyse and qualify them. Categories word derives from the ancient Greek κατηγορα. It means attributes. It is interesting to categorise the principles and the variants of *Cannabis* to evaluate properly its therapeutic property. This leads to the necessity to obtain an improvement on the product passed on the broad consumption market. Ground manipulation, soil microbiota manipulation for a differentiated culture and genetic variation offers a valid alternative to simplistic analyses on *Cannabis* products.

TAXONOMY

Kingdom: *Plantae (plants)*
Sub-kingdom: V*iridiplantae (green plants)*
Infra-kingdom: *Streptophydia (land plants)*
Super division: *Embryophyte*
Division: *Tracheophyte (vascular plants)*
Sub division: *Spermatophyte* (seed plants)
Class: *Magnoliopsida*
Superorder: *Rosanae*
Family: *Cammabidaceae*
Genus: *Cannabis*
Species: *Cannabis Sativa*

Subspecies: *Cannabis indica* (Smithsonian Institution, 2000) and *Cannabis ruderalis* (Elzinga S, et al., 2015).

GEOGRAPHIC INFORMATION

The *Cannabis* plant originated from Southeast Asia and Central and South America (Smithsonian Institution, 2000). While *Cannabis indica* variety grows in the Middle East, in places such as Afghanistan, Pakistan, and Tibet. *Cannabis ruderalis* grows wildly in the cold lands in Russia and the border between Hungary and Ukraine (Elzinga S, et al., 2015).

PHYTO-CANNABINOIDS

Cannabis contains Phyto-cannabinoids. Cannabinoids and Cannabidiols are two families of natural chemical hydrophobic compounds. *Cannabis sativa*, *Cannabis Indica* and *Cannabis Rudentalis* does not perform the same varieties of compounds but a diverse amount of Phyto-derivates. Moreover, fertile subspecies plants can derive from grafting the species themselves. Nowadays, research identified a wide variety of studied compounds. *Cannabis* plant produces over one hundred different substances. The following list contains the names of the main Phyto-cannabinoids. The lists share the compound by the psychotropic and non-psychotropic effects (Elzinga S, et al., 2015) (Table 1).

Table 1. Main Phyto-cannabioid (Elzinga S, et al., 2015), (Nachnani R, Raup-Konsavage WM, Vrana KE, 2021), (Danielle Dresden, 2020), (PubChem, 2004).

Phyto-cannabinoids	Phyto-cannabinoids
9-Δ-Tetrahydrocannabinol (THC, Δ9-THC)	Psychotropic
Cannabidiol (CBD)	Psychotropic
Tetrahydrocannabivarin (THCV)	Psychotropic

Cannabinol (CBN)	Psychotropic
Cannabicromen (CBC)	Psychotropic
Cannabicylol (CBL)	Non psychotropic
Cannabielsoin (CBE) metabolite synthetizes Cannabidiol	X
Cannabigerol (CBG)	Non-psychotropic
Cannabinydiol (CBND)	Non-psychotropic
Cannabitriol (CBT) precursor cannabidiol acid	X
Cannabivarin (CBV)	Non-psychotropic
Cannabidivarin (CBDV)	Non-psychotropic
Cannabicromevarin (CBCV)	Psychotropic
Cannabigerovarin (CBGV)	Non-psychotropic
Cannabigerol monomethylate (CBGM) the main precursor of most cannabinoids (Nachnani R, Raup-Konsavage WM, Vrana KE, 2021)	X
Three cannabinoids recently discovered	X
9 Δ tetra-hydro-cannabiforol (THCP)	X
Cannabidiforol (CBDP)	X
Cannabidibutol (CBDB)	X

Research on *Cannabis* developed a board scientific knowledge on its contents. The chance to develop medical products emerged form scientific research. Further studies conduct to synthetise a class of synthetic cannabinoids and identified a group of endogenous compounds, the endocannabinoids. They are mediators of the cannabinoid receptors in the human body.

During ages illegal market have cultivated *Cannabis* to obtain products for recreational use. *Cannabis sativa* and its varieties internally product a different percentage of Tetrahydrocannabinol as the following table shows (Nachnani R, Raup-Konsavage WM, Vrana KE, 2021) (Table 2).

Table 2. Illegal products and this Tetrahydrocannabinol percentage (Danielle Dresden, 2020), (PubChem, 2004).

Name	***Sativa or Indica***	**Average THC content (%)**	**Minimum THC content (%)**	**Maximum THC content (%)**
Afghan Kush	*Indica*	17.6%	14.7%	22%
Blackberry Kush	*Indica*	15.9%	12.5%	18%
Bubba Kush	*Indica*	15.5%	10.2%	19.4%
Harlequin	*Sativa*	5%	2.5%	12.6%
Strawberry Cough	*Sativa*	15.3%	8.7%	18.1%
Sour Diesel	*Sativa*	16.6%	7.7%	22%
True OG	*Indica*	18.5%	13.4%	22.2%

The table shows the huge variation of Tetrahydrocannabinol content as low as 7.7% or as high as 22% across illegal products. Where True OG derived by *Cannabis Indica* express the maximum percentage of Tetrahydrocannabinol such as 22.2%. On the other hand, Sour Diesel derived by *Cannabis Sativa* expresses the minimal percentage of Tetrahydrocannabinol such as 7.7%. The percentage of Tetrahydrocannabinol varieties within the products themselves. Clandestine production gives a huge variation of psychotropic ingredients. Categorizing their molecule production improves its derivatives (Danielle Dresden, 2020), (PubChem, 2004). Adjustment is necessary as *Cannabis* production became part of the broad market due to medical and non-medical product consumption. Thus, defining molecules directly on the cultivation facilitates this goal. Nevertheless, chemical fertilization improves *Cannabis* production. A further step is soil microbiota manipulation as well as biomass improvement. It is an excellent way to improve the final product, certainly.

ANALYTICAL TECHNIQUES ON PRODUCT STANDARDIZATION

A wide consumption of *Cannabis* derivates made necessary standardization products protocols to assess and categorize products contents. The extraction method pays a key

role in the final characterization and assessment. Analytical techniques made possible to guarantees the individuation of its Phyto-derivates. Innovative extraction techniques are mandatory to obtain well stabilized extracts. Liquid chromatography can profile Cannabinoids accurately since it does not involve thermal processes. As the terpenes are volatile and *Cannabis* contains them the same. Gas Chromatography foresees a pre-heating process which tourns cannabinoids acid into their neutral forms. High Performance Liquid Chromatography appropriately assesses the variety of compound by both terpene and cannabinoid, simultaneously. The aim is to obtain different type of accurate analytical techniques. Different type of protocol improvements is still study objective. They aim to obtain competitive analytical techniques in other to obtain a further optimization of standardization process. They look for quality improvement for current market production. Chemical analyses make possible to distinguish cannabis products drug type and non-drug type cannabis. In most European countries the content of THC Tetrahydrocannabinol represents the way to classify the *Cannabis* plant as HEMP (≤ 0%-2% of Tetrahydrocannabinol) or Marijuana (≥ 0%-2% of Tetrahydrocannabinol). Different legislation and always new products make necessary the continuous improvement of standardisation techniques. They categorise the molecule and their percentage in a wide variety of medical and non-medical products (Micalizzi G, 2021).

ADJUSTMENT ON PRODUCTS BY AGRONOMIC TECHNIQUES

Horticulture techniques makes the difference to improve *Cannabis* production and obtain differential product characterization. *Cannabis* growing associate different microbes to differential acquisition of nutrients. Even if a proper fertilization is an optimal way to obtain product improvement. As NPK fertilizer (five parts Nitrogen, three parts Phosphorous, five parts Potash) can increase Cannabigerol (CBG), Cannabinoids main precursor (Nachnani R, Raup-Konsavage WM, Vrana KE, 2021), concentrations to 71% in *Cannabis* flowers and to decrease Cannabinol (CBN) concentrations by 38% in flowers and 36% in inflorescence leaves. Beneficial variation can derive from microbes influences cannabinoid biosynthesis from soil amendant. Thus, bacterial, and fungal colonies associate the high throughputs sequencing technologies. Microbial interaction influences cannabinoids and cannabinoids genesis as secondary derivates of *Cannabis* metabolites. The trichomes of *Cannabis* plants produces cannabinoids and derivates. *Cannabis* plants varies its cannabinoids contents by environmental climatic conditions as well. Thus, microbiota plays a crucial role into soil processes. Microbes bound the roots. Recent evidence emerged in literature shows root associated microbes' stimulation on metabolite root exudation. It occurs affecting transcriptomes and so the levels of produced metabolites. Bioinoculants in *Cannabis* plant can improve the quality of its production by sustainable agricultural practice. Biomass improvement is available for any plant cultivation, but it is still uncommon for *Cannabis* cultivation. Yield improvement is the future for *Cannabis* production improvement, indeed (Ahmed B, Hijri M, 2021). Furthermore, recent metanalytic studies determined the main factors contributing to *Cannabis* yield for its differential growth. Plants classification by their diversification proposed the role of plant growth promoting rhizobacteria for grow proportion, regulation of cannabinoids biosynthesis and biocontrol. Diversification of inducted cultural system for *Cannabis* represent the future of *Cannabis* cultivation based on crop-yield enhancing technologies (Backer R, 2019), Genomic manipulations on *Cannabis* plants led to transgenic plants. Clones can even produce a determined quantity of cannabinoids for pharmacological screening proposes (Littleton J, Rogers T, Falcone D, 2005).

CONCLUSION

Cannabis production requires huge progresses by its product characterization and standardization. Instead, its agronomic improvement techniques are the best tool to correct internal cannabinoid expression. Therefore, it makes possible to categorize and to assess final product quality.

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