הרשות הלאומית למלחמה בסמים ואלכוהול

האוניברסיטה העברית בירושלים

המחקר של השוני הכימי של חשיש ממקורות שונים שנתפס בישראל

לומיר הנוש
המכון למדעי התרופה
בית הספר לרוקחות

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The study of chemical differences of hashish from different sources seized in Israel.

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תקציר

קנאביס, בצורת הצמח והשרף, הוא הסם הפופולרי ביותר בישראל בשנים האחרונות. עד 2005, היו המקורות העיקריים של שרף הקנביס (הידוע גם כחשיש) בשוק הסמים הישראלי לבנון והודו. החשיש ממקורות אלה יכול להיות מובחן על ידי המראה החיצוני שלו. מטרת מחקר זה הייתה לבדוק האם יש הבדל באיכות החשיש מכל מקור .לצורך כך, כימתנו את הקנבינואידים הראשיים, קנבידיול (CBD), תתרהידרוקנבינול (THC) וקנבינול (CBN) של חשיש שנתפס בתפיסות משטרה ממקורות ידועים - לבנון, הודו ומרוקו, שהועברו למעבדה לכימיה אנליטית של המחלקה לזיהוי פלילי במטה הארצי של משטרת ישראל, ולאחר מכן לאוניברסיטה העברית לאנליזה כמותית.

התוצאות, המבוססות על תפיסות רבות ושונות, הראו כי CBD של חשיש מלבנון השתנה מ-5.69% ל-12.79% (ממוצע של 8.98 ± 0.59%) , THC של חשיש מלבנון השתנה מ-0.93% ל-4.20% (ממוצע של 2.38 ± 0.27%) , CBD של חשיש ממרוקו השתנה מ-1.52% ל-5.14% (ממוצע של 3.72 ± 0.19%), THC של חשיש ממרוקו השתנה מ-5.08% ל-13.41% (ממוצע של 9.21 ± 0.40%), CBD של חשיש מהודו השתנה מ-0.78% ל-13.13% (ממוצע של 4.59 ± 1.07 %), ו-THC של חשיש מהודו השתנה מ-0.53% ל-16.45% (ממוצע של 6.35 ± 1.50%).

באותו זמן, זוהו כמה קנבינואידים אחרים, שנמצאו בדגימות בכמות נמוכה יותר (זוהו - cannabidivarol , CBDV Δ^9-tetrahydrocannabivarol - Δ^9-THCV , cannabivarol - CBV , cannabichromene - CBC , cannabielsoin - CBE , Δ^8- tetrahydrocannabinol - Δ^8 -THC , monomethyl cannabigerol - CBGM ו- cannabigerol – CBG) . הדגימות, בעיקר מלבנון, מרוקו והודו, הוערכו לפנוטיפ הכימי (סוג תרופה וסוג סיבים) במטרה לקבוע את המקור הגיאוגרפי של דגימות אלה.

דגימות של חשיש מזויף שנתפסו בישראל ובצ׳כיה עברו אנליזה רגילה כצמח קנביס. ״חשיש ״ כזה יכול לסכן את בריאות המשתמש.

בנוסף, הוערך אופן השימוש בקנביס רפואי בישראל. נחקרו ההומוגניות של צמרות התפרחת הנקביות עם וללא העלים הקטנים שמסביב וגם רק של העלים הקטנים שמסביב, בצמחים שונים מאותו זן הקנביס, ובתוך צמח קנביס אחד. מהתוצאות נראה כי יש חשש שמטופל, גם כאשר הוא משתמש באותו זן ובאותה כמות של קנביס רפואי, יכול לעשן כמויות שונות של החומר הפעיל במסגרת הטיפול. מכאן, שמטופל אינו יכול להשתמש בעישון בניצן אחד, אלא יש לספק לחולים חומר צמחי הומוגני בעל תוכן ויחס קבועים של הקנבינואידים החשובים.

אם מטופל אינו יכול לסבול את העוגיות או את הטיפות השמנוניות מתחת ללשון, השיטות הנותרות הן עישון או אידוי. הצמח צריך לעבור סטריליזציה לשימוש בצורת אינהלציה בקרב חולים עם פגיעה במערכת החיסונית. נחקרה יעילותם של סוגים שונים של סטריליזציה.

דגימות מאותו זן קנאביס הומוגני הראו ריכוזים שונים של קנבינואידים לאחר סינון עם מסננות בעלות גודל רשת שונה. סינון פשוט יכול לתת חומר בכמות THC של כמעט פי שניים גבוהה יותר מאשר בצמרות התפרחת.

ריכוז הקנבינואידים מהצמח יכול להיות מוגבר על ידי הכנה פשוטה שנקראת "חשיש בועה". הוכח כי באמצעות שיטה מכאנית פשוטה זו אפשר להכין קנבינואידים טהורים יותר.

זנים שונים של קנבאיס רפואי שגודלו בישראל הוערכו על פי תוכן קנבינואידי כמותי (CBD נמוך ו-THC גבוה, CBD גבוה ו- THC נמוך, CBD גבוה ו-THC גבוה, ובערך באותו ריכוז CBD ו-THC).

מוצגת סקירה של כל הזנים המשמשים לגידול קנאביס רפואי בישראל.

מוצגות תוצאותיהם של ניתוחים של מוצרי קנאביס שונים המיועדים לטיפול מכל המגדלים (צמרות התפרחת הנקביות, תמצית קנאביס בשמן צמחי, תמצית קנאביס, עוגיות קנאביס, חמאת קנאביס לאפיית עוגות, תמיסת קנאביס, קרם עור מקנאביס ותכשירים אחרים).

Abstract

Cannabis, both herbal and resin, has been the most popular illicit drug in Israel in recent years. Until 2005, the main sources of cannabis resin (known also as hashish) to the Israeli drug market were Lebanon and India. Hashish from these sources can be distinguished by its external appearance. The aim of this study was to find if there is any difference in the quality of the hashish from each source. For this purpose, we quantified the main cannabinoids, cannabidiol (CBD), Δ^9-tetrahydrocannabinol (Δ^9-THC), and cannabinol (CBN) of hashish from different police seizures of known origins, Lebanon, India and Morocco that had been submitted to the Analytical Chemistry Laboratory of the Division of Identification and Forensic Science (DIFS) at the Israeli National Police Headquarters and subsequently to the Hebrew University for quantitative analysis. The results, based on many different seizures showed that CBD of hashish from Lebanon varied from 5.69% to 12.79% (an average 8.98 ± 0.59%), THC of hashish from Lebanon varied from 0.93% to 4.20% (an average of 2.38 ± 0.27 %), CBD of hashish from Morocco varied from 1.52% to 5.14% (an average of 3.72 ± 0.19%), THC of hashish from Morocco varied from 5.08% to 13.41% (an average of 9.21 ± 0.40 %), CBD of hashish from India varied from 0.78% to 13.13% (an average of 4.59 ± 1.07%), and THC of hashish from India varied from 0.53% to 16.45% (an average of 6.35 ± 1.50 %).

At the same time several other cannabinoids, present in the samples in lower amount, were identified (cannabidivarol - CBDV, Δ^9-tetrahydrocannabivarol - Δ^9-THCV, cannabivarol - CBV, cannabichromene - CBC, cannabielsoin – CBE, cannabigerol monomethyl ether - CBGM, Δ^8-tetrahydrocannabinol - Δ^8-THC, and cannabigerol - CBG). The samples, predominantly from Lebanon, Morocco, and

India were evaluated for chemical phenotype (drug type and fiber type) in aim to determine the geographical origin of these samples.

Samples of false hashish seized in Israel and Czech Republic were worked-up for analysis and analyzed as usual for cannabis plant. Such “hashish” can endanger the health of a user.

I also evaluated the way of use of medicinal cannabis in Israel. Homogeneity of the female flowering tops with or without surrounding small leaves and just only surrounding small leaves from different plants of the same strain of cannabis and inside one cannabis plant was studied. From the results it is justified concern that patient even when using the same strain and the same amount of medicinal cannabis can smoke different amounts of the active compound for treatment. It means that patient cannot use for smoking just one bud, but it is necessary to supply patients with homogenized plant material with constant content and ratio of important cannabinoids.

If the patient cannot tolerate the cookies or the sublingual oily drops, the remaining methods are smoking or evaporation. The plant for inhalation must be for immunocompromised patients sterilized. The effectiveness of different kinds of sterilization was studied.

Samples of the same homogenized cannabis strain revealed different concentration of cannabinoids after sieving with different mesh size sieves. Simple sieving can give material with almost twice higher amount of THC than in the flowering tops.

Concentration of cannabinoids from the plant can be increased by preparation simple so called “bubble hash”. It was proved that with this simple mechanical method can be prepared in much more pure cannabinoids.

Different strains of medicinal cannabis cultivated in Israel were evaluated according to the quantitative cannabinoid content (low CBD and high Δ^9-THC, high CBD and low Δ^9-THC, high CBD and high Δ^9-THC, and approximately the same content of CBD and Δ^9-THC).

Review of all strains used for medicinal cannabis cultivation in Israel is presented.

Results of analyses of different cannabis products for treatment from all growers are presented (female flowering tops, cannabis extract in plant oil, cannabis extract, cannabis cakes, cannabis butter for cakes baking, cannabis tincture, cannabis skin cream, and the other preparations).

Introduction

הדו"ח הבא מתאר מחקר שנעשה במשך 3 שנים על דגימות חשיש. הנתונים מתייחסים למחקר שנעשה אחת לחצי שנה וכוללים אנליזה ואבלואציה של קנאביס רפואי.

This report gives a brief overview of a three-year study of seized hashish samples analyses and evaluation of medicinal cannabis samples.

Part I – Seized hashish samples

A scientific literary review.

Cannabis, both herbal and resin, is the most popular illicit drug in Israel and accounts for about 70% of all the drug seizures that were analyzed in the Analytical Chemistry Laboratory of the Division of Identification and Forensic Science (DIFS) at the Israeli National Police Headquarters in the years 1995-2005. In recent years, cannabis resin, known also as hashish, has become more popular among Israeli drug users, who prefer it on herbal cannabis use and seek for new sources of supply. Most of the hashish enters Israel from Lebanon while in recent years India and Morocco have become a popular source of hashish for Israeli drug consumers.

Cannabis sativa L. (hemp) is a plant native to Central Asia that has spread all over the world and is probably the most widely used recreational and illegal drug in the world. Cannabis is a dioecious plant. K-N-B (probably ka-na-ba or qu-nu-bu), the early Sumerian/Babylonian word for cannabis hemp, enters the Indo-Semitic-European language family base, making it one of humankind's longest surviving root words. Already nine or ten thousand years ago the earliest known fabric was woven from hemp. 4700 years ago the first written record of cannabis use is made in the pharmacopoeia of Shen Nung, one of the fathers of Chinese medicine [1, 2].

Today about 30,000 publications appeared on the *Cannabis* subject. In *Cannabis* and its phytochemical products, hashish and marihuana, almost 900 natural compounds up-to-date were identified. One hundred and twenty of them are so called cannabinoid compounds (cannabinoids), which are typical for and present only in *Cannabis* plant [3, 4].

To evaluate the quality of *Cannabis* plant (e.g. drug type versus fibre type), several classifications, based on so called phenotype, in the past were suggested. The phenotype ratio (percentage of cannabinol + percentage of Δ^9-tetrahydrocannabinol divided by percentage of cannabidiol) was used to differentiate between drug-type and fibre-type cannabis plants. When the phenotype ratio was greater than 1.0 the plant was classified as drug-type; when less than 1.0 it was classified as fiber-type [5, 6].

In the past we studied the influence of climatic, meteorological, agricultural, and ecologic conditions on different types of *Cannabis*, cultivated in the same region. We proved that different meteorological conditions during different seasons of vegetation period and in the course of one vegetation period can influence the amount of the cannabinoid compounds in the plants, what can influence also the phenotype of the plants. Such *Cannabis* plant cultivated for fibers can be in favorable year drug-type plant [7-10].

Today it is accepted, that if the content of the Δ^9-THC exceeds in the dry flowering tops 0.3%, *Cannabis* is classified as drug-type [11, 12].

Methodology

Standard samples of the main cannabinoid compounds (cannabidiol – CBD, Δ^9-tetrahydrocannabinol - Δ^9-THC, and cannabinol – CBN) were isolated and purified in our laboratory by extraction and separatory methods (column chromatography, preparative thin-layer chromatography).

Procedure

20 mg of ground hashish sample was extracted with methanol and filtered through cotton in a capillary. Final concentration equals extract from 2 mg of

hashish with 50 μg internal standard (tetracosane) in 1 ml. Marihuana was extracted by the same way for final concentration equals extract from 5 mg of marihuana with 50 μg internal standard (tetracosane) in 1 ml.

One μl of this sample was injected to GC/MS for analysis.

Instrumentation

For quantitative analysis the samples were analyzed by GC/MS in a Hewlett Packard G 1800B GCD system with a HP-5971 gas chromatograph with electron ionization detector. The software used was GCD PLUS CHEMSTATION.

Conditions of the analysis

Column: SPB-5 (30 m x 0.25 mm x 0.25 μm film thickness). Experimental conditions: inlet, 250°C; detector, 280°C; splitless injection/purge time, 1.0 min; initial temperature, 100°C; initial time, 2.0 min; rate, 10°C/min; final temperature, 280°C. The helium flow rate, 1 ml/min.

Standards and solutions

Concentrations in methanol from 25.0 to 100.0 μg/ml of cannabidiol, Δ^9-tetrahydrocannabinol, or cannabinol were used for calibration curve together with 50.0 μg/ml tetracosane as internal standard.

Results

Hashish samples worked-up in different external appearance – big "sole", thin "chocolate", and “disk” were analyzed quantitatively for the content of three main

cannabinoid compounds – CBD, Δ^9-THC, and CBN – with the help of GC/MS. After separation it was, of course, possible to identify the other minor cannabinoids. As it was not the aim of this work, only several other cannabinoids, easily visible on chromatograms were identified qualitatively (CBDV, Δ^9-THCV, CBV, CBC, CBE, CBGM, Δ^8-THC, and CBG).

The appropriate cannabinoid acids, which are thermally unstable, are real cannabinoids in the plant and neutral cannabinoids originate from them by decarboxylation during ripening, drying and storage of the samples. They are also decarboxylated after injection to the gas chromatograph.

Several typical gas chromatograms with identified cannabinoids in hashish are shown on Figs. 1 – 5. These are samples of known origin from Lebanon, Morocco, and India. For comparison of these different places of origin, samples were compared for cannabidiol (Chart bar 1), Δ^9-tetrahydrocannabinol (Chart bar 2) and cannabinol (Chart bar 3) content in descending order of the found amounts of the appropriate cannabinoids.

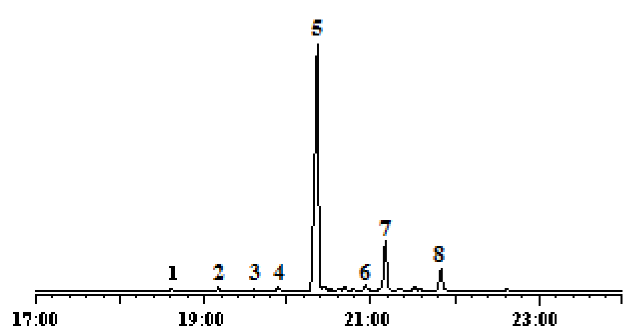


Fig. 1   Hashish sample (sole) from Lebanon.

Key: 1 – cannabidivarol (CBDV), 2 – mw 314□□3 - Δ^9-tetrahydrocannabivarol (Δ^9-THCV),□□ 4 – mw 314, 5 – cannabidiol (CBD; 17.24%), 6 – cannabielsoin (CBE), 7 - Δ^9-tetrahydrocannabinol (Δ^9-THC; 5.53%), 8 – cannabinol (CBN; 2.78%)

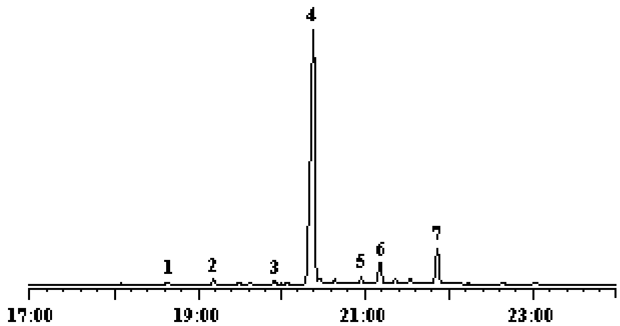


Fig. 2 Hashish sample (sole) from Lebanon.

Key: 1 – cannabidivarol (CBDV), 2 – mw 314, 3 – mw 314, 4 – cannabidiol (CBD; 9.42%), 5 – cannabielsoin (CBE), 6 - Δ^9-tetrahydrocannabinol (Δ^9-THC; 0.93%), 7 – cannabinol (CBN; 2.20%)

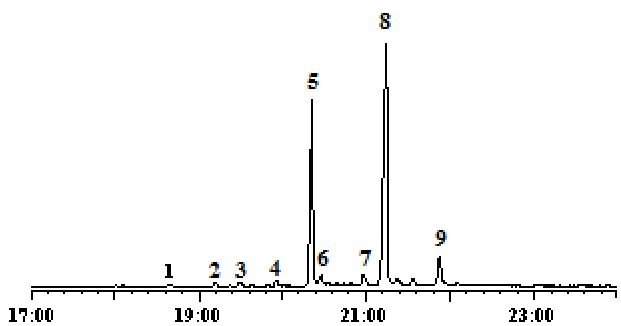


Fig. 3 Hashish sample (chocolate) from Morocco.

Key: 1 – cannabidivarol (CBDV), 2 – mw 314, 3 - Δ^9-tetrahydrocannabivarol (Δ^9-THCV), 4 – mw 314, 5 – cannabidiol (CBD; 2.98%), 6 – cannabichromene (CBC), 7 - cannabigerol monomethyl ether (CBGM), 8 - Δ^9-tetrahydrocannabinol (Δ^9-THC; 9.35%), 9 – cannabinol (CBN; 1.23%)

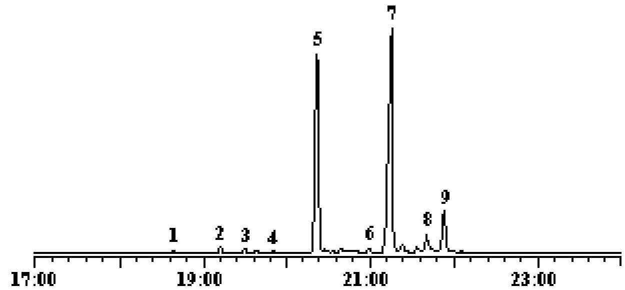


Fig. 4 Hashish sample (disk) from India.

Key: 1 – cannabidivarol (CBDV), 2 – mw 314, 3 - Δ^9-tetrahydrocannabivarol (Δ^9-THCV), 4 – mw 314, 5 – cannabidiol (CBD; 7.45%), 6 - Δ^8-tetrahydrocannabinol (Δ^8-THC), 7 - Δ^9-tetrahydrocannabinol (Δ^9-THC; 16.45%), 8 – cannabigerol (CBG), 9 – cannabinol (CBN; 3.33%)

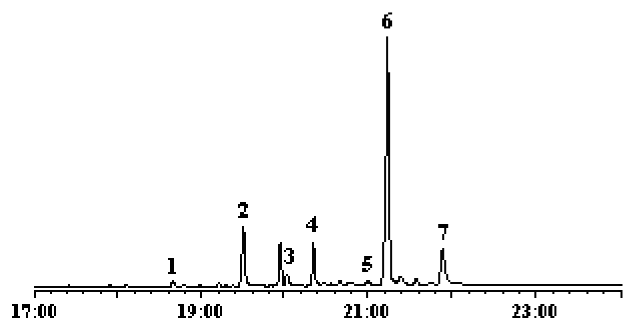


Fig. 5 Hashish sample (disk) from India.

Key: 1 – cannabidivarol (CBDV), 2 – Δ^9-tetrahydrocannabivarol (Δ^9-THCV), 3 – cannabivarol (CBV), 4 – cannabidiol (CBD; 0.74%), 5 - Δ^8-tetrahydrocannabinol (Δ^8-THC), 6 - Δ^9-tetrahydrocannabinol (Δ^9-THC; 11.70%), 7 – cannabinol (CBN; 1.98%)

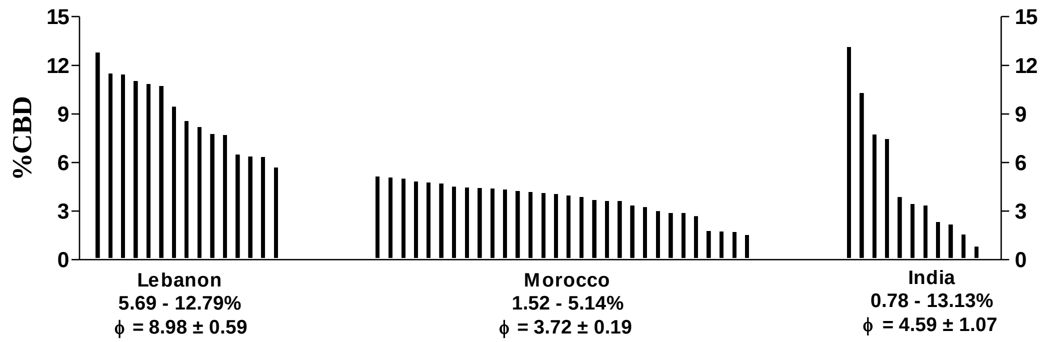


Chart bar 1. Cannabidiol content in the samples of known origin (samples arranged according to the descent content of CBD).

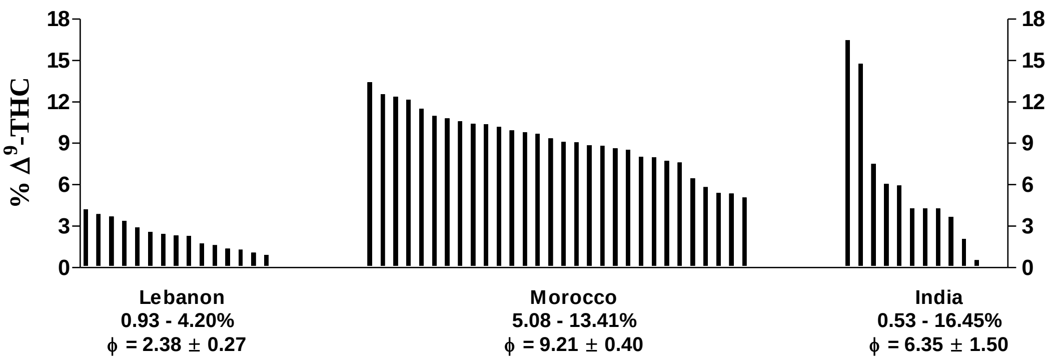


Chart bar 2. Δ^9-tetrahydrocannabinol content in the samples of known origin (samples arranged according to the descent content of Δ^9-THC).

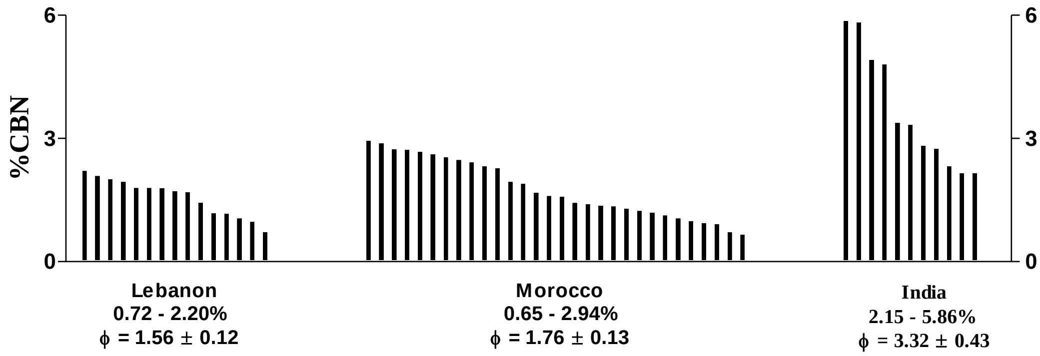


Chart bar 3. Cannabinol content in the samples of known origin (samples arranged according to the descent content of CBN).

Finally, each sample was evaluated according to the ratio of the three main cannabinoids (THC + CBN/CBD) and samples of different known origin were such compared (Chart bar 4).

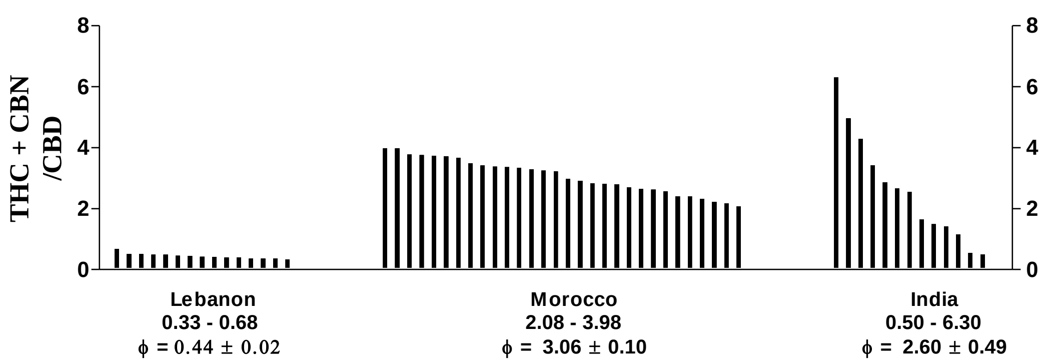


Chart bar 4. Phenotype of the samples of known origin (samples arranged according to the descending value of the phenotype) with three different used evaluations.

Discussion

To compare our result with the published ones is not such easy, as one can expect.

Different batches of cannabis resin from Lebanon were differentiated by comparing the principal cannabinoid contents – CBD, CBDA, CBN, and THCA [13]. Relations between chemical composition and geographical origin of cannabis studied Jenkins [14]. In cannabis of Morocco origin CBD, THC, and CBN were quantified. Cannabis plants from seeds of Morocco origin were cultivated in United Kingdom. In resin from Morocco illicitly imported to United Kingdom THC was quantified [15]. Quantitative determination the average levels of Δ^9-THC content of cannabis (leaves and inflorescences) in its 180 fresh male and female plants (0.1-2.2 per cent), 52 dry female plants (0.2-7.5 per cent) and 13 powdered plants (5.5-11.3 per cent) was published by Stambouli et al. [16] Male and female plant material (e.g. marihuana) was evaluated for CBD and THC content [17]. The aim to estimate geographical origin of cannabis samples with hydrocarbon content [18], cannabinoids content [7, 19, 20] and complex chemical profiles (cannabinoids and non-cannabinoids) [21] one can find in the literature [14,18].

Stability of Cannabis sativa L. samples (charas, ganja, and bhang) and their extracts, on prolonged storage was studied in India [22]. In all samples CBD, THC and CBN were quantified. Wild cannabis from different altitudes and locations, collected in northern India was analyzed quantitatively for ten different cannabinoids. The data obtained were compared with data obtained from the same variants grown in Mississippi [23].

Cannabinoid constituents (CBD and THC) of male and female Cannabis sativa from Lebanon and Morocco quantified Ohlsson et al. [24].

Variation in the THC content in illicitly imported Cannabis products of Lebanon, Morocco and India origin was determined [25, 26]. The same authors compared samples chemical features (CBD and THC content) in cannabis plants grown in United Kingdom from seeds of Morocco and India origin [27, 28].

Most of the hashish samples were of Lebanon, Morocco, and India origin. Analysis of these samples gave us possibility to compare the main cannabinoid amounts in samples of these three countries (Table 1). The chemotype appears to be genetically determined while the individual cannabinoid concentrations can be influenced by ecological factors.

Cannabidiol content (Chart bar 1) is high in hashish of Lebanon origin and low in Morocco ones. Samples from India showed spectrum from high to low CBD content. In all hashish samples of known origin CBD varied from 0.78% to 13.13%. Δ^9-Tetrahydrocannabinol content (Chart bar 2) is low in hashish of Lebanon origin and high in Morocco ones. Samples from India showed again spectrum from high to low Δ^9-THC content. The variation of Δ^9-THC content was from traces to 16.45%. Cannabinol content (Chart bar 3) is almost the same in the samples of Lebanon and Morocco origin and rather higher in hashish of India origin. All samples varied from 0.65% to 5.86% of CBN.

Phenotypic index is compared in Chart bar 4. Hashish of Lebanon origin shows fibre-type phenotype and Morocco drug-type phenotype. The only information we found in literature [20] concerning phenotype of hashish of Lebanon origin – 0.465 - is in agreement with our results (0.33 – 0.68). In hashish of Lebanon origin we detected also cannabielsoin. Hashish of India origin shows different hashish types from fiber- to drug-type phenotype. Phenotypic index and the amounts of the three main cannabinoids in the sample is very useful information about country of

origin, but one must take in account the history of the sample (country of origin, type of the plant [cultivated for fibers or for drug abuse], origin of the cultivated seeds, climatic and ecologic conditions in the year of cultivation and age of the analyzed sample), what usually in the seized samples is unknown.

Some samples of India origin showed higher amounts of propylcannabinoids. Cannabielsoin was identified rather in the samples of Lebanon origin. To identify country of origin of hashish samples, the three main cannabinoids have only informative value and it looks that some other compounds would be taken in account for this purpose (as for example terpenoid variation), but even in this small groups of samples were significant differences.

As there is not any generally used method for samples comparison (exact conditions how to work up the samples for analysis), we were unable to compare our results with the published ones. Nevertheless our results showed valuable values for comparison of resins of different sample origin.

Recommendation

Even when hashish became today already partly obsolete (as today cannot compete with highly active marihuana), analysis of it is still very important for forensic purposes. During analyses of hashish seized in Israel we can evaluate its activity, quality and ratio of so called cannabinoid compound, what can give us also picture about its origin. As common are seized hashish samples of Morocco or Lebanon origin, these two countries of origin can be easily distinguished after analysis of the three main cannabinoids (CBD, THC, CBN) as is described above. Samples of India origin are more complicated, but every time the content of

cannabinol is high. To distinguish between these three hashish samples the shape is also helpful.

Part II - Fake hashish

During the last years there is a new effort to earn money by illegal business with false hashish. The danger of this business is evident. Person buying these products obtain “hashish” which has almost nothing or nothing at all with real product (e.g. hashish) from Cannabis plant. The danger is serious – it is not only illegal sale, but also fraud and the last but not the least endangering the health of the buyer after smoking of such “hashish”. Such “hashish” can be especially dangerous when used as medicinal cannabis, as in many countries use of medicinal cannabis is prohibited and patients in effort to treat themselves buy cannabis products on black market, what is for them every time potentially dangerous as from health and/or economic point of view.

Recently was seized in Israel and Czech Republic false hashish, which after analyses proved, that there are even no traces of the compounds, typical for Cannabis products. This gave us an opportunity to compare these samples after its analyses.

Samples of false hashish seized in Israel with strong smell of henna (Lawsonia inermis) were worked-up for analysis and analyzed as usual for cannabis plant. The conditions for analysis stayed the same as for cannabinoids. There was no other effort to find any compounds outside these conditions. The only exception was to check if there are as adulterations any other psychoactive compounds. The aim of

this study was to provide information without any additional analyses after such sample is analyzed for forensic purposes.

The sample seized in Czech Republic was without any typical smell and was worked-up by the same way as the sample from Israel.

For qualitative analysis the samples were analyzed by GC/MS in a Hewlett Packard G 1800B GCD system with a HP-5971 gas chromatograph with electron ionization detector. The software used was GCD PLUS CHEMSTATION.

Identification of some peaks was based on matching of their MS spectra with pure standards, reference information and the NIST 2005 and Wiley 7th Mass Spectral Libraries.

All the main identified compounds are in presented in Table 1. Several typical gas chromatograms with identified compounds in false hashish are shown on Figs. 6 – 9. As there is evident, that the main content compounds are from coniferous plants (the most probably from certain pine) and henna (Lawsonia inermis), we bought henna powder and compared the studied part of spectrum with this samples (light and dark henna). We did not find any other compound, typical for any other plant when analyzed samples using above mentioned conditions.

Table 1. Comparison of the compounds identified in two false hashish samples with the same one which are present in coniferous plants and henna.

compound	**Israel**	**Czech republic**	**pine resin**	**dark henna**	**light henna**
1 tetradecanoic acid	x	x		x	x

2 hexadecane-1-ol	x	x		x	x
3 palmitoleic acid	x	x		x	x
4 hexadecanoic acid	x	x		x	x
5 9-octedecen-1-ol	x	x		x	x
6 octadecan-1-ol	x	x		x	x
7 linoleic acid	x	x		x	x
8 oleic acid	x	x		x	x
9 α-linolenic acid	x	x		x	x
10 octadecanoic acid	x	x		x	x
11 pimaric acid	x	x	x		
12 sandaracopimaric acid	x	x	x		
13 palustric acid	x	x	x		
14 isopimaric acid	x	x	x		
15 dehydroabietic acid	x	x	x		
16 abietic acid	x	x	x		
α-humulene	x	x	x		
β-caryophyllene	x	x	x		
caryophyllene oxide	x	x	x		
dehydroabietic acid methyl ester	x	x	x		
α-longipinene	x		x		
(+)-longicyclene	x		x		
longifolene	x		x		
δ-cadinene	x		x		
isopimara-7,15-diene	x		x		
neoabietic acid	x		x		

linoleic acid	x				x
dodecanoic acid		x		x	
palmitelaidic acid		x		x	
cyclohexadecane	x	x			
oleyl alcohol	x	x			
1,4-benzenedicarboxylic acid	x				
D-glucose	x				
nonanoic acid		x			

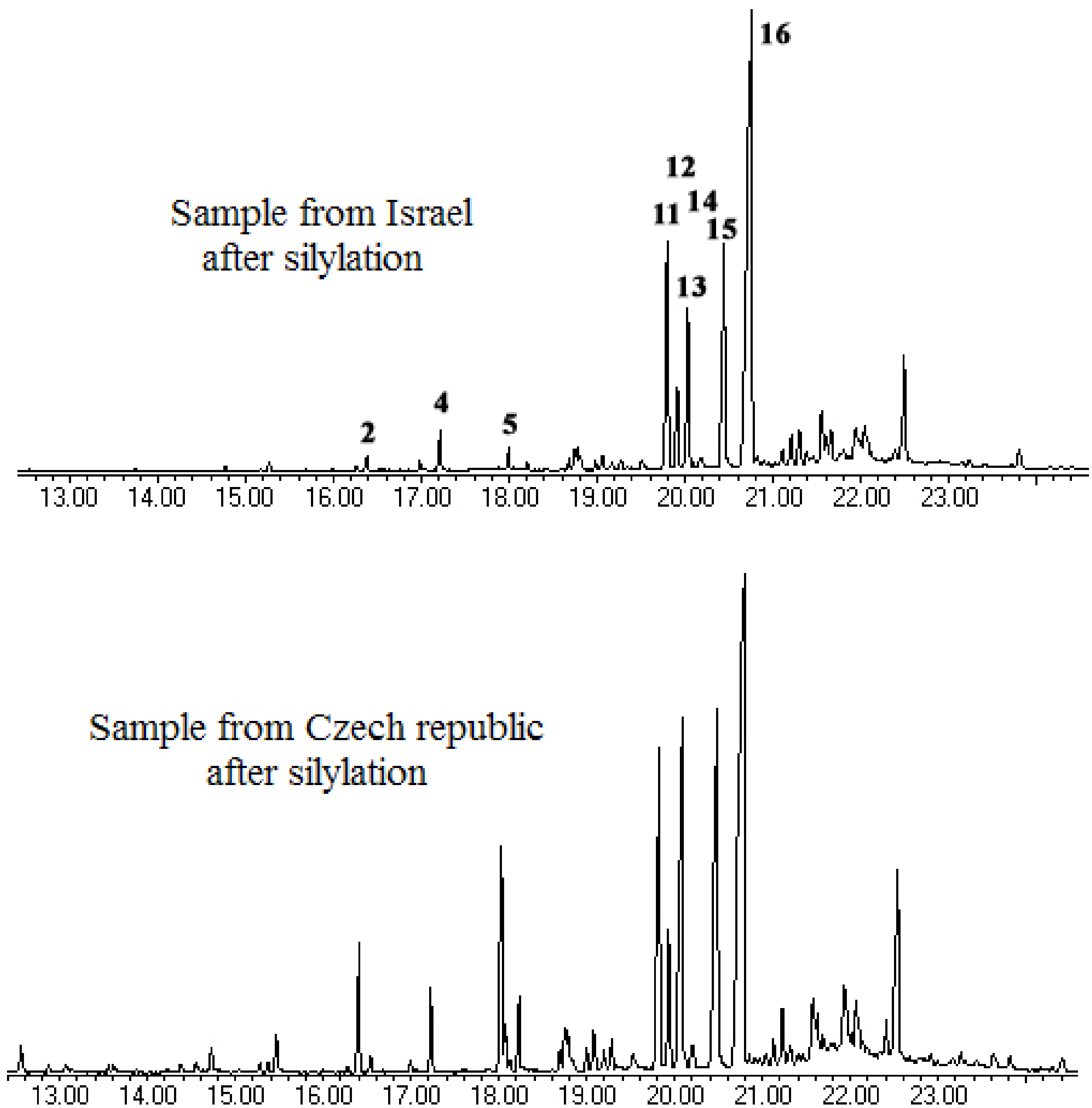


Fig. 6. Two different false hashish samples comparison under the same experimental conditions. Key: see Table 1.

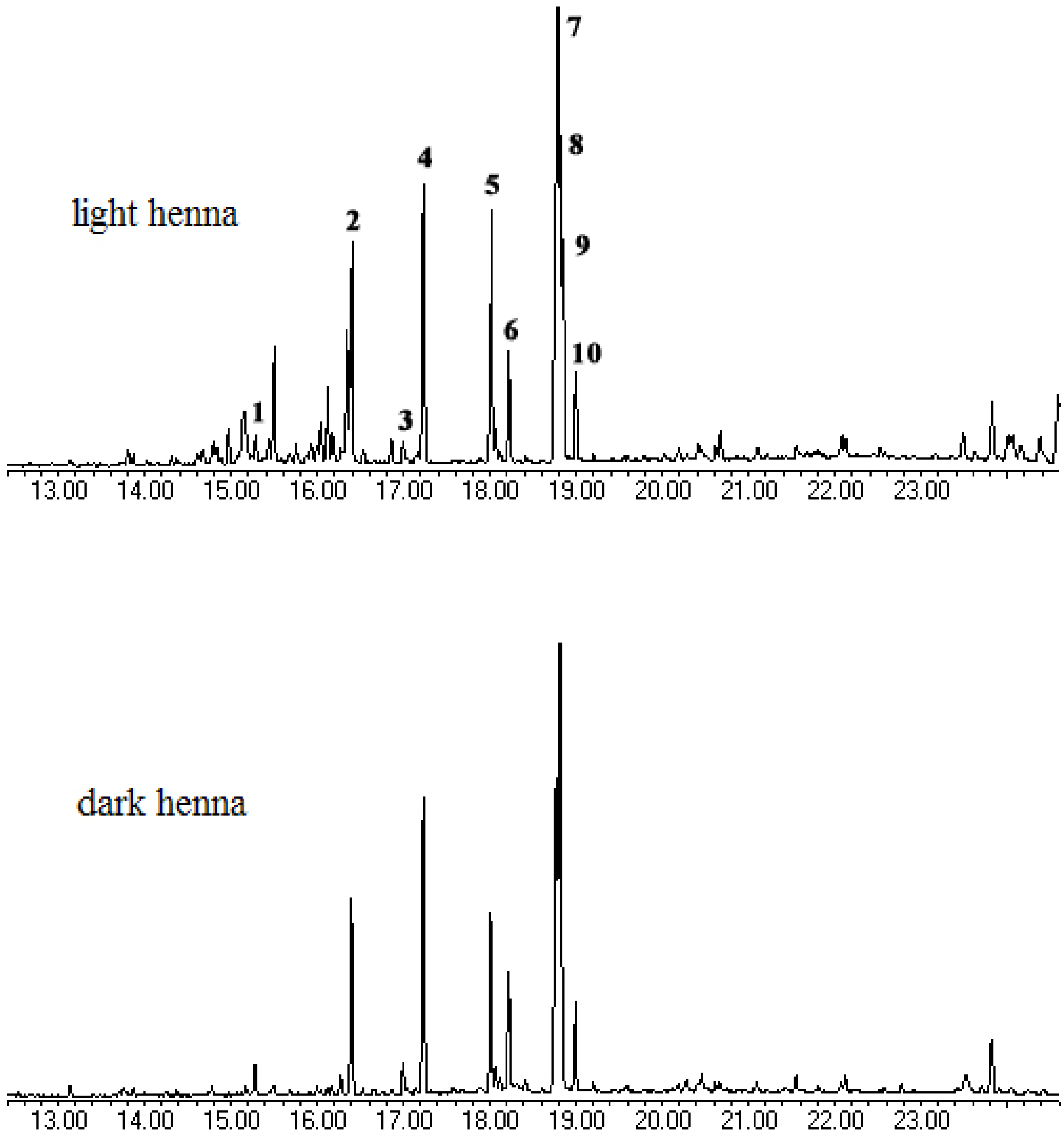


Fig. 7. Light and dark henna comparison under the same experimental conditions as false hashish. Key: see Table 1.

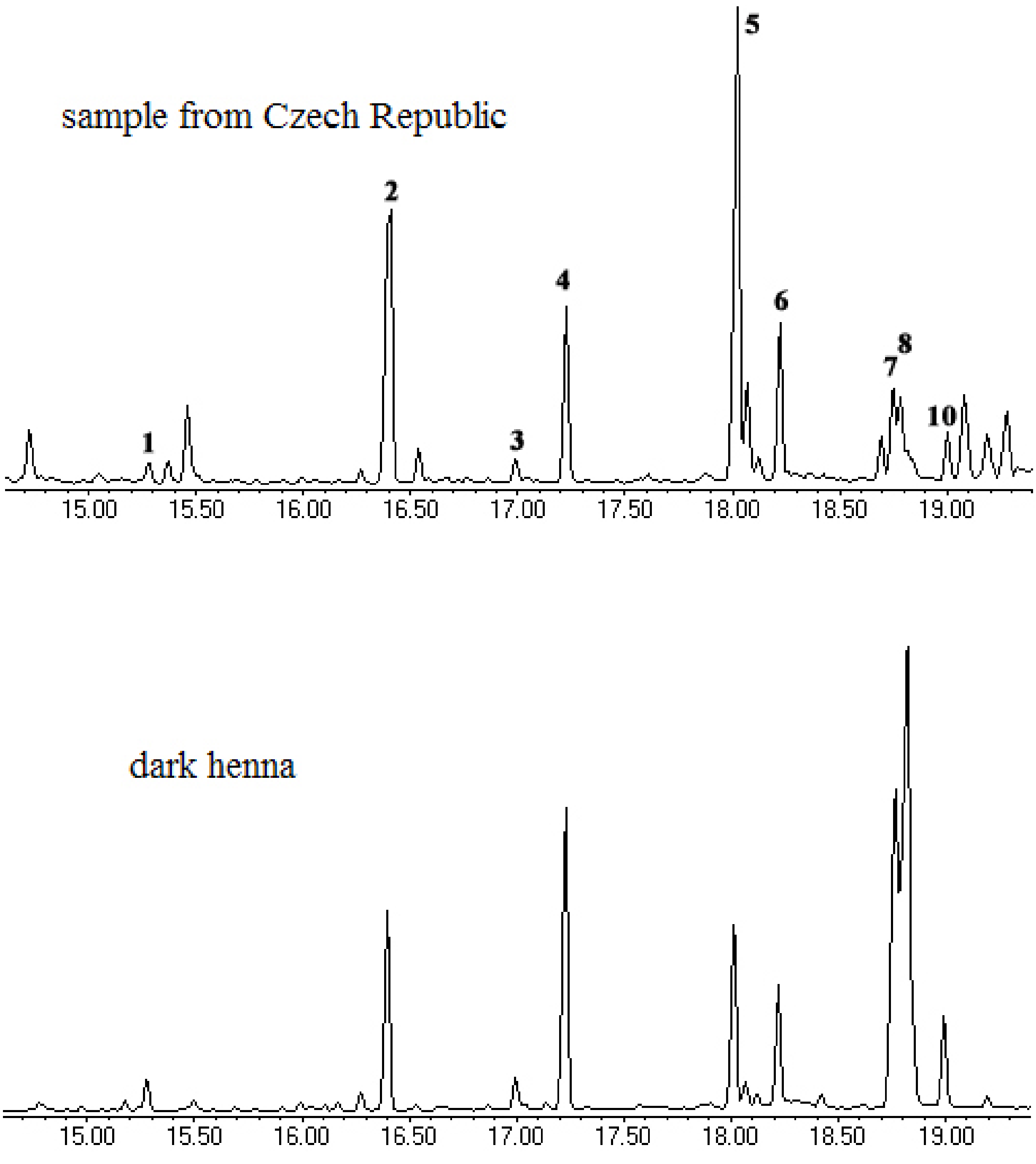


Fig. 8. Sample from Czech Republic and dark henna comparison (selected a part of chromatogram with for henna interesting compounds). Key: see Table 1.

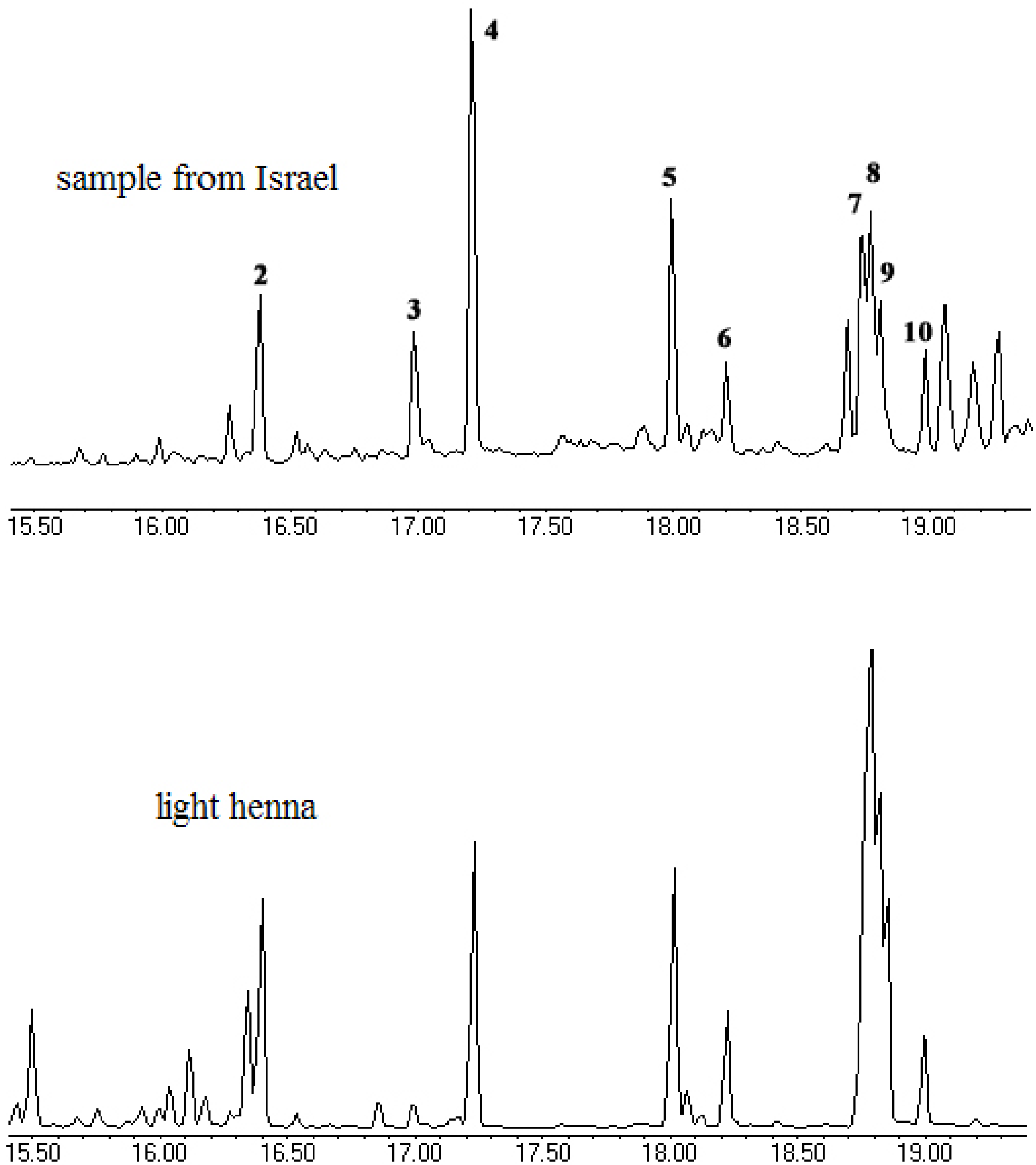


Fig. 9. Sample from Israel and light henna comparison (selected a part of chromatogram with for henna interesting compounds). Key: see Table 1.

Samples seized in Israel and Czech Republic we describe for the first time, as they look as real hashish, but have nothing at all with real hashish. There were not find even traces of any compound typical for cannabis sample. Seized “hashish”, as we proved, has nothing with real hashish at all even when it looks as real hashish. The main ingredients of this “hashish” samples were identified as henna powder (Lawsonia inermis) and oleoresin of pine (Pinus spp.).

Part III – Medicinal cannabis samples

The second part of this study was analyses of medicinal cannabis, distributed in Israel to the patients as plant and its products (flowering tops, oil, cookies etc.).

A scientific literary review

At present time there is almost nothing known about medicinal cannabis concerning content compounds important for treatment of different illnesses. After discovery of CB_1 and CB_2 cannabinoid receptors and endocannabinoids which bind to these receptors scientist started to understand the mechanism of effects of cannabinoid compounds on human organism [29-49]. At present time cannabis is used in Israel (and several other countries around the world) for medicinal purposes. As palliative medicine is today cannabis moreless understood. Concerning the active content compounds we know today only about medicinal properties of cannabidiol and tetrahydrocannabinol but we are not fully sure about the optimal dose for treatment. Today 10 to 15 % patients stop cannabis treatment

as it does not help them or they do not feel good after cannabis treatment and we do not know why. Real therapeutic values of medicinal cannabis are at present “in shadow” and must be studied scientifically. In the fact there are almost no studies concerning quality of medicinal cannabis. One must also understand that medicinal cannabis can be abused as sometime it is more potent than very good quality hashish which one can find on the black market.

Methodology

Procedure

200 mg of ground female flowering tops of cannabis sample were extracted with methanol and filtered through cotton in a capillary. Final concentration equals extract from 1 mg of female flowering tops sample with 50 μg internal standard (tetracosane) in 1 ml.

One μl of this sample was injected to GC/MS for analysis.

Instrumentation, Conditions of the analysis, Standards and solutions

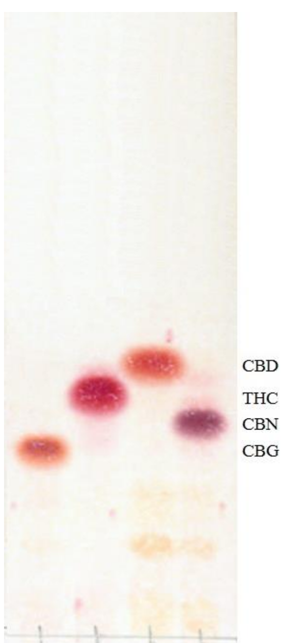
The same as with hashish (see Part I).

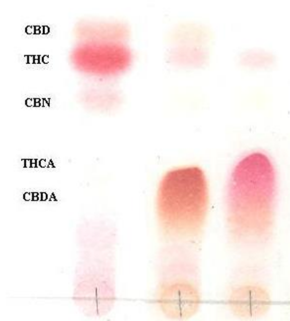
Thin-layer chromatography was performed with the samples prepared for quantitative analyses in solvent systems n-hexane – dioxane (4 : 1) and petroleum ether – ether (4 : 1).

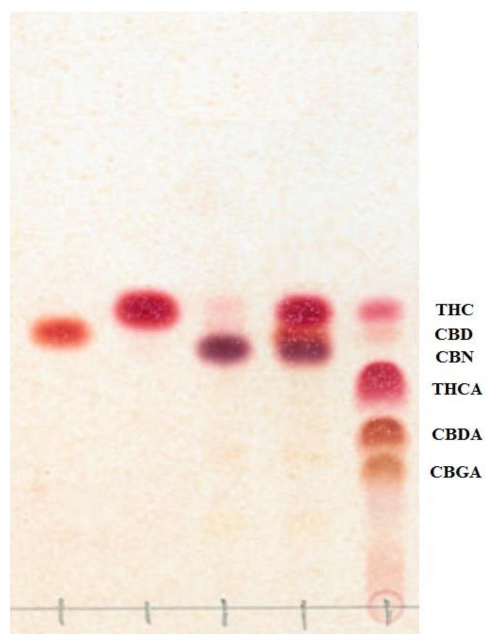
Results

Samples of medicinal cannabis were analyzed qualitatively with the help of thin-layer chromatography and quantitatively by gas chromatography/mass spectrometry to evaluate quality of cannabis strains cultivated and used in Israel for medicinal purposes. The type of medicinal cannabis use and homogeneity was also studied.

Example of *thin-layer chromatograms* of the main standards and real samples:



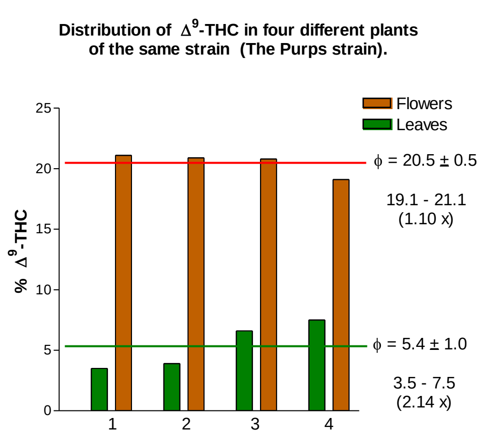




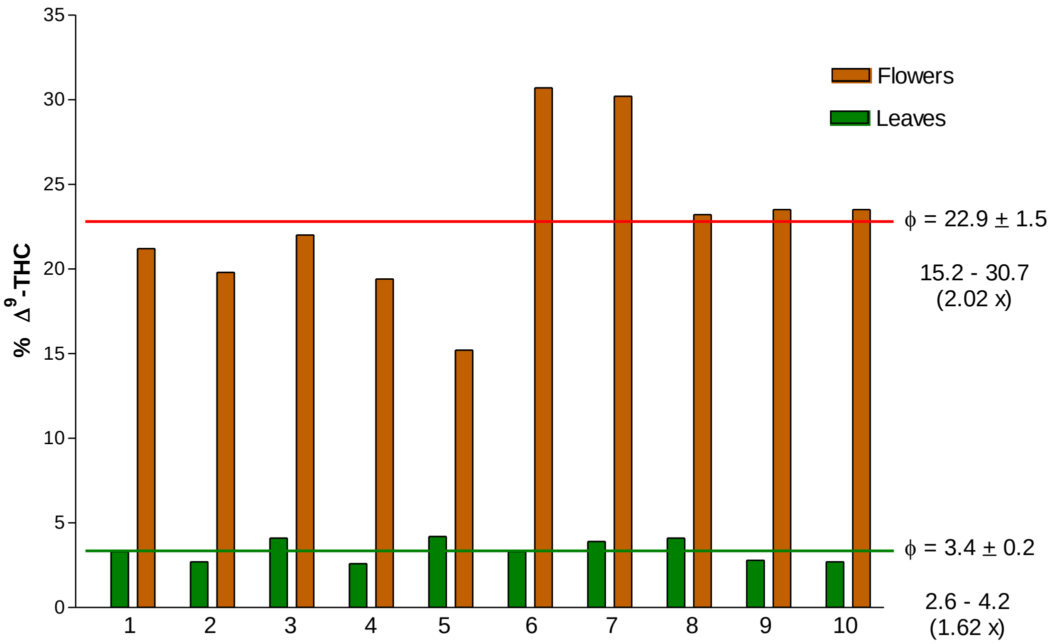
A. Homogeneity of the buds (female flowering tops without surrounding small leaves) from different plants of the same strain of cannabis and inside one cannabis plant.

The study of homogeneity of different strain samples is very important as many patients in Israel use medicinal cannabis by smoking. It is very important that patient has for his/her treatment every time the same amount of active compounds. Larger sizes of samples (up to fifty samples from one strain of medicinal cannabis) were analyzed. Already happened that patient after use of the same amount of medicinal cannabis (by weight of the same strain) was influenced by different way. Because of that were studied differences in Δ^9-THC content in samples of the same strain. Analyzed were different samples from the same plant and from different plants of the same strain and also from different strains.

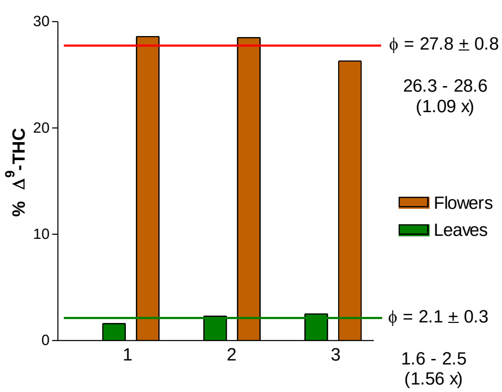
Courtesy of the **CannDoc company** were obtained cannabis samples for research purposes used in this study. Cannabis flowers and surrounding leaves were analyzed and compared inside each cannabis strain. Results, averages for the whole group of samples and differences between the lowest and the highest values inside each particular strain are in each graph.
Used strains: **Purps**, **Northen Light**, and **Free Leonard**.



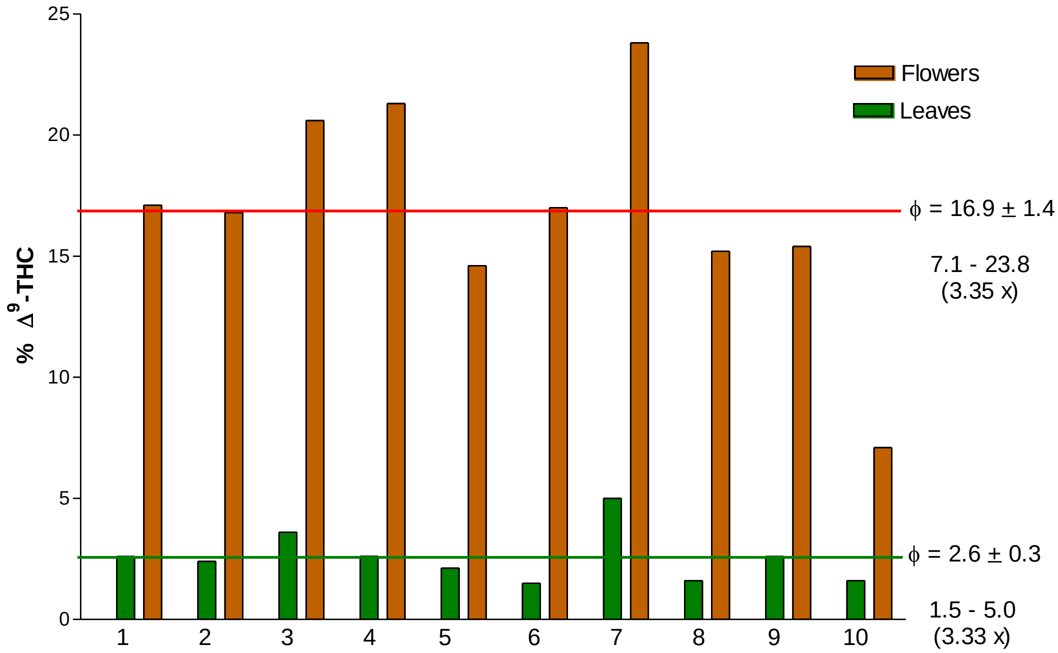
Distribution of Δ^9-THC in the samples from 10 plants collected at the height 1.5 m above ground level (Northen Light strain)



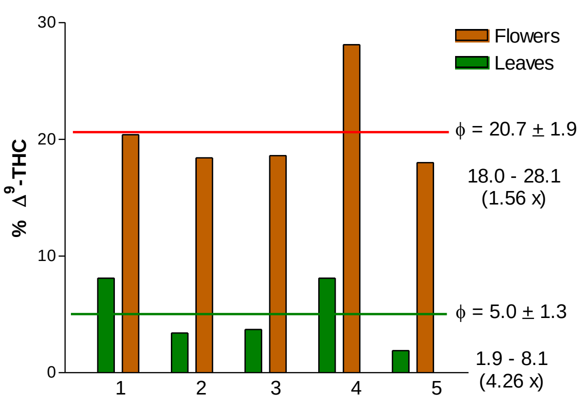
Distribution of Δ^9-THC in single plant (Northen Light strain). 1 - 3, samples from the top to the bottom of the plant.



Distribution of Δ^9-THC in the samples from 10 plants collected at the height 1.5 m above ground level (Free Leonard Cola strain)



Distribution of Δ^9-THC in single plant (Free Leonard Cola strain). 1 - 5, samples from the top to the bottom of the plant.

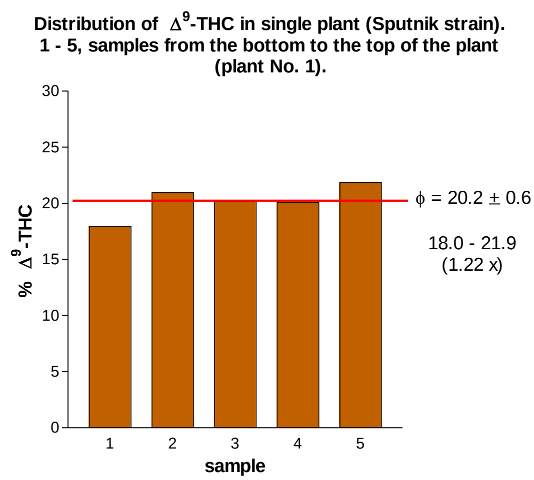


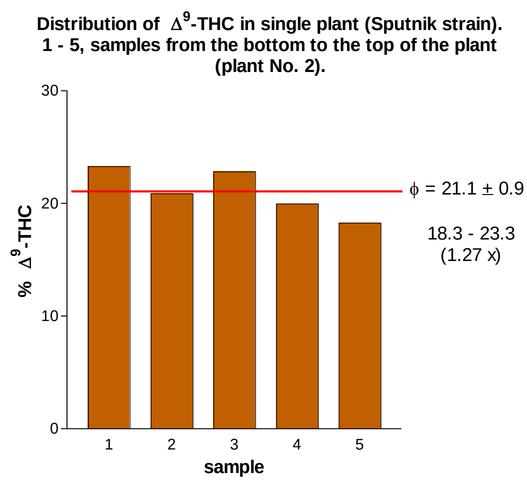
Differences in Δ^9-THC content inside one strain between different plants and inside one plant can explain why patients smoking medical cannabis sometime complain that it too much influenced their psyche. This is also one of the reasons, why I suggest using medicinal cannabis by different way (even when by smoking

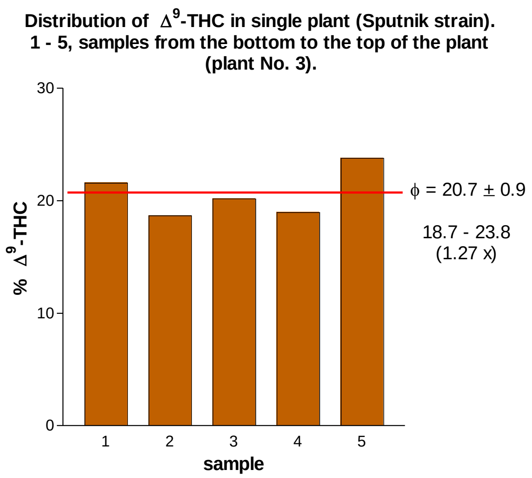
palliative influence of medicinal cannabis is the fastest) – e.g. as cakes, oil, suppository etc.

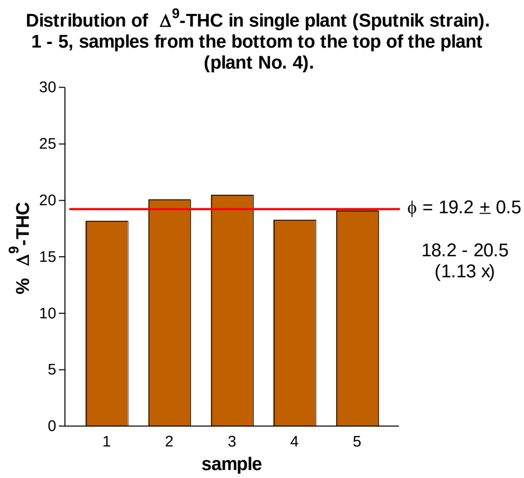
Courtesy of the **IMC Chaklaut company** were obtained cannabis samples for research purposes used in this study. Cannabis female flowering tops without surrounding small leaves and surrounding leaves were analyzed and compared inside this strain. Results, averages for the whole group of samples and differences between the lowest and the highest values inside each particular strain are in each graph.

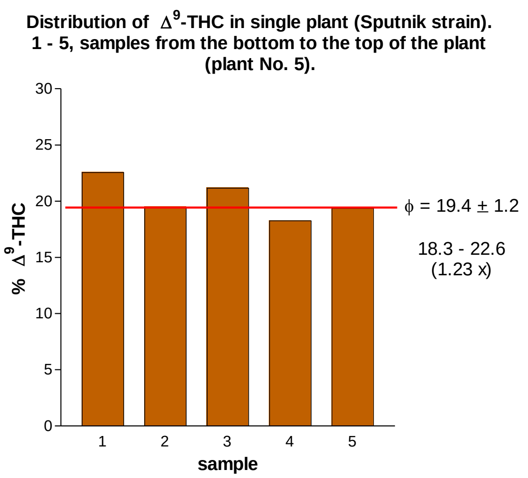
Used strain: **Sputnik strain**

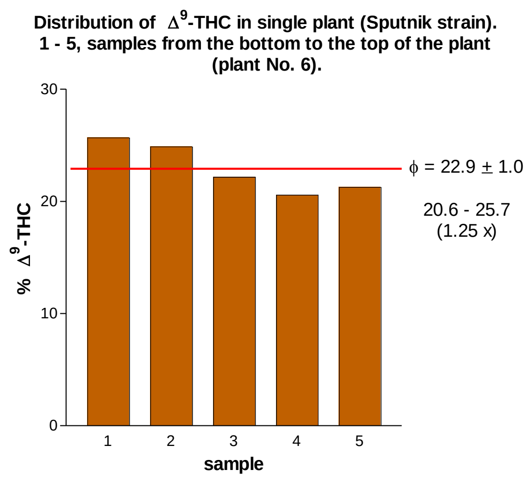




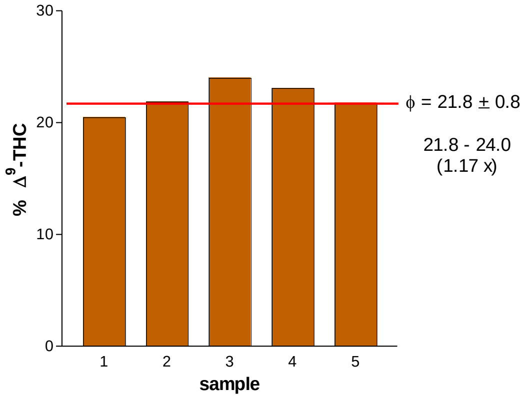

Distribution of Δ9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 3).
% Δ9-THC
sample
ϕ = 20.7 ± 0.9
18.7 - 23.8
(1.27 x)


Distribution of Δ9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 4).
% Δ9-THC
sample
ϕ = 19.2 ± 0.5
18.2 - 20.5
(1.13 x)

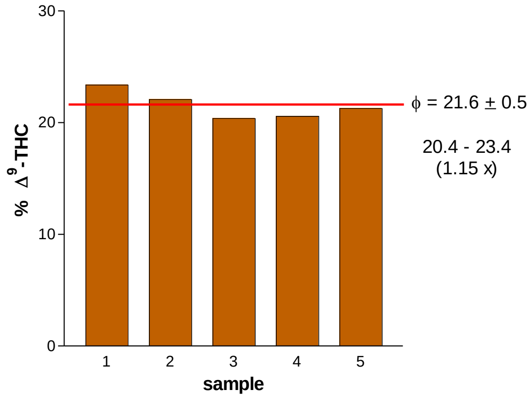

Distribution of Δ9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 5).
% Δ9-THC
sample
ϕ = 19.4 ± 1.2
18.3 - 22.6
(1.23 x)


Distribution of Δ9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 6).
% Δ9-THC
sample
ϕ = 22.9 ± 1.0
20.6 - 25.7
(1.25 x)

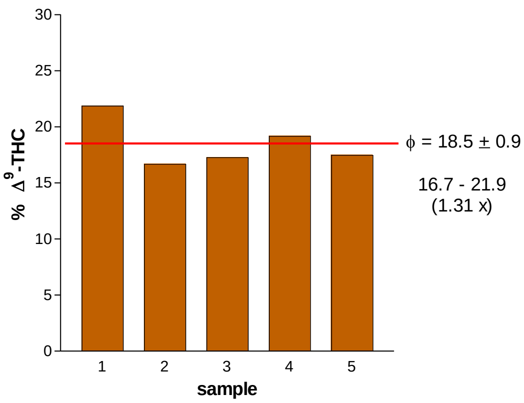
Distribution of Δ^9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 7).



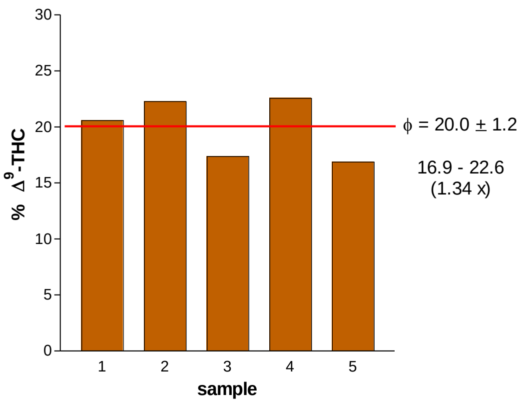
Distribution of Δ^9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 8).



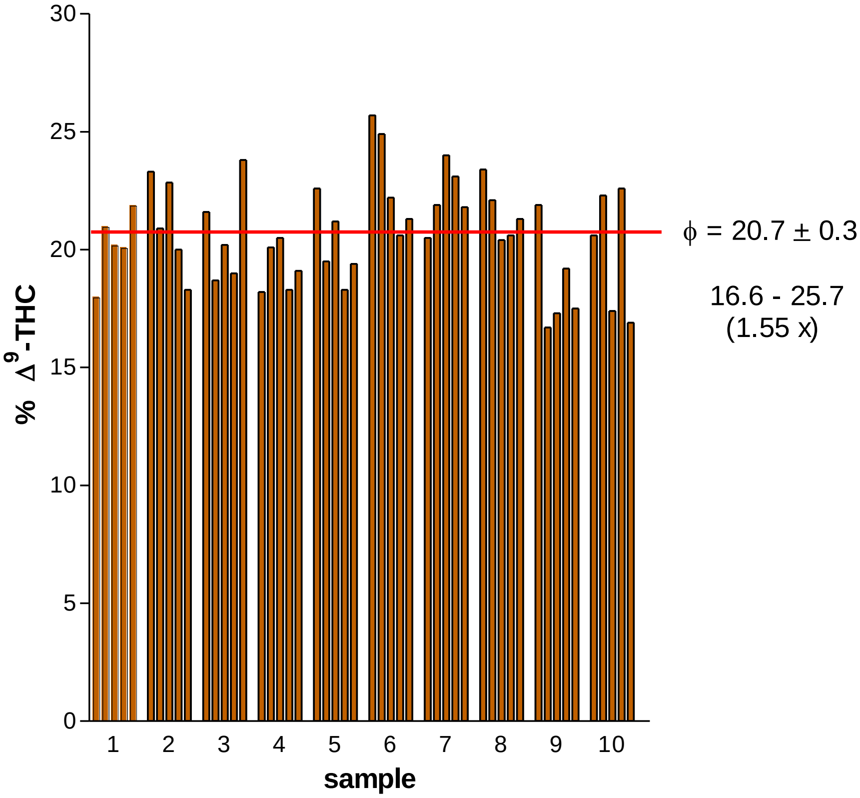
Distribution of Δ^9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 9).



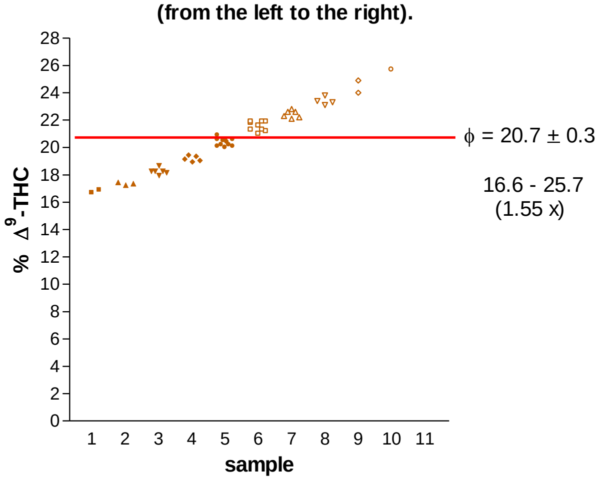
Distribution of Δ^9-THC in single plant (Sputnik strain).
1 - 5, samples from the bottom to the top of the plant
(plant No. 10).

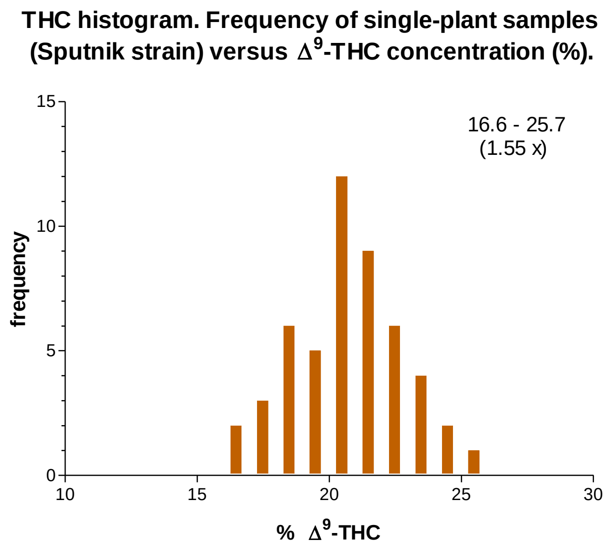


Distribution of Δ9-THC in ten single cannabis plants of the same strain (Sputnik strain). Five samples from the bottom to the top of the each plant (from the left to the right).



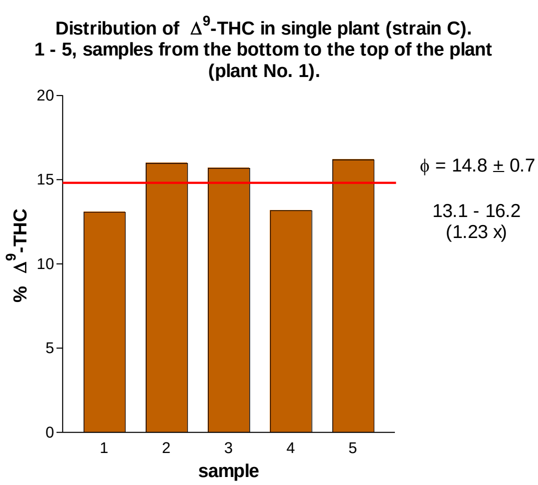
Distribution of Δ9-THC in single cannabis plants of the same strain (Sputnik strain). Five samples from the bottom to the top of the each plant (from the left to the right).

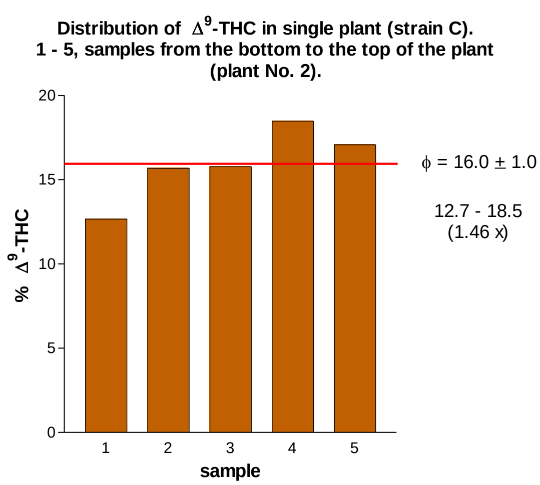


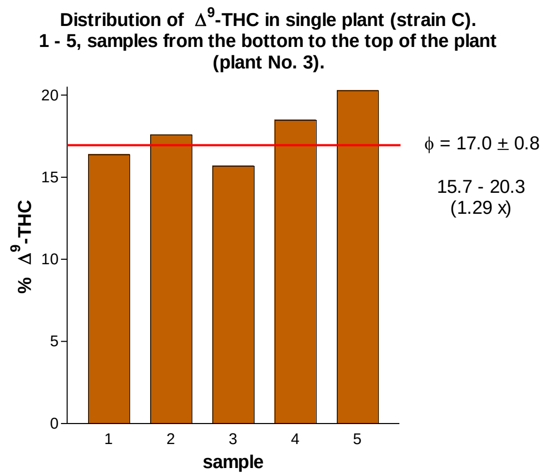


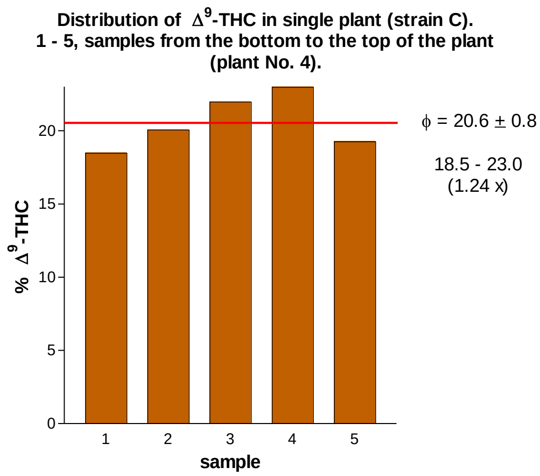
Courtesy of the **Chevrat Sijach company** were obtained cannabis samples for research purposes used in this study. Cannabis female flowering tops without surrounding small leaves and surrounding leaves were analyzed and compared inside this strain. Results, averages for the whole group of samples and differences between the lowest and the highest values inside each particular strain are in each graph.

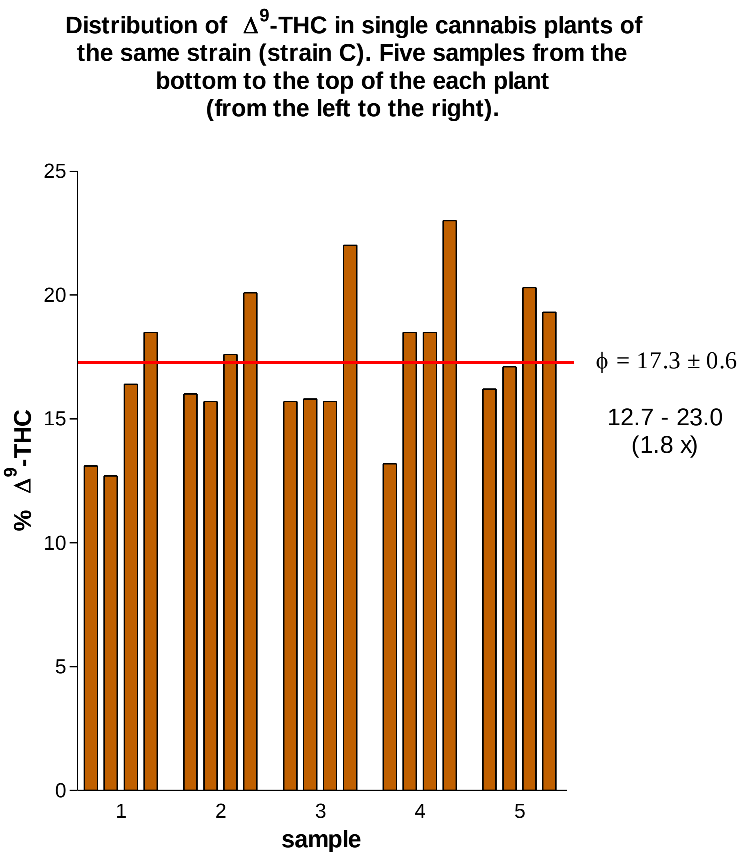
Used strain: **strain C**



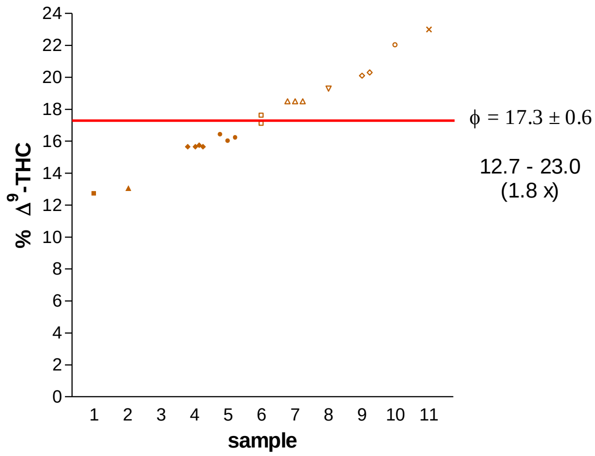



Distribution of Δ9-THC in single plant (strain C).
1 - 5, samples from the bottom to the top of the plant
(plant No. 3).
% Δ9-THC
sample
ϕ = 17.0 ± 0.8
15.7 - 20.3
(1.29 x)

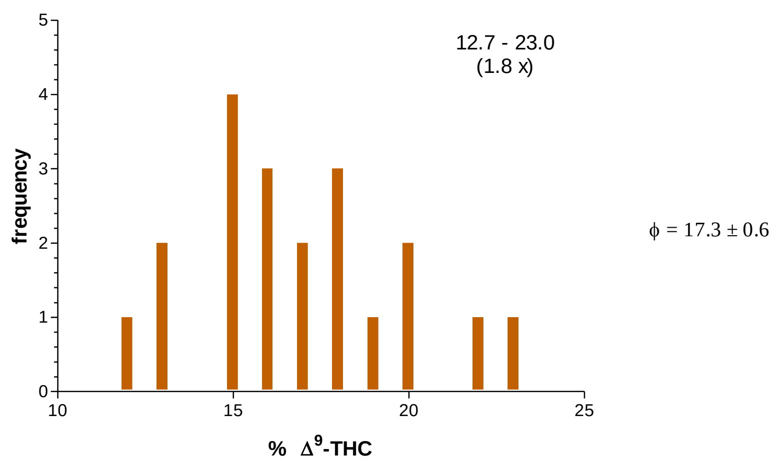

Distribution of Δ9-THC in single plant (strain C).
1 - 5, samples from the bottom to the top of the plant
(plant No. 4).
% Δ9-THC
sample
ϕ = 20.6 ± 0.8
18.5 - 23.0
(1.24 x)


Distribution of Δ9-THC in single cannabis plants of the same strain (strain C). Five samples from the bottom to the top of the each plant (from the left to the right).
% Δ9-THC
sample
ϕ = 17.3 ± 0.6
12.7 - 23.0
(1.8 x)

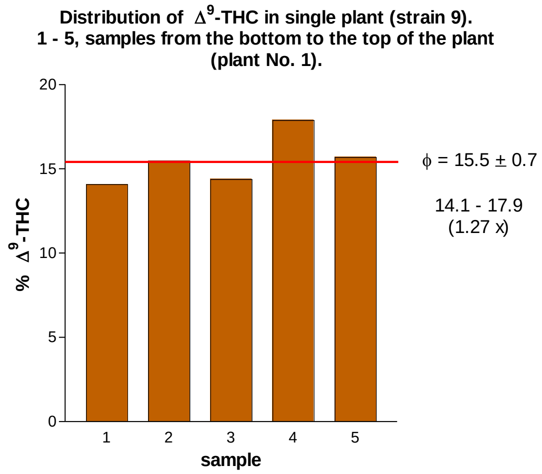
Distribution of Δ^9-THC in single cannabis plants of the same strain (strain C). Five samples from the bottom to the top of the each plant (from the left to the right).

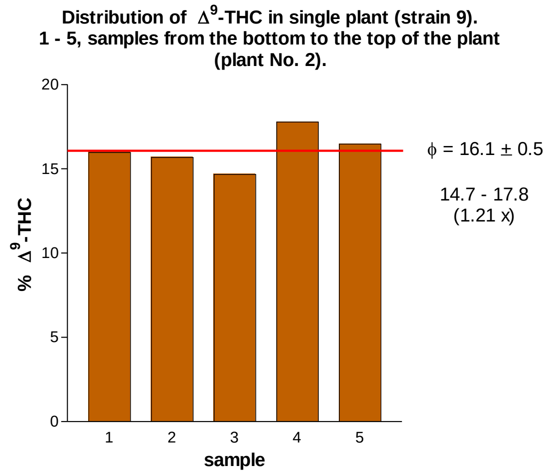


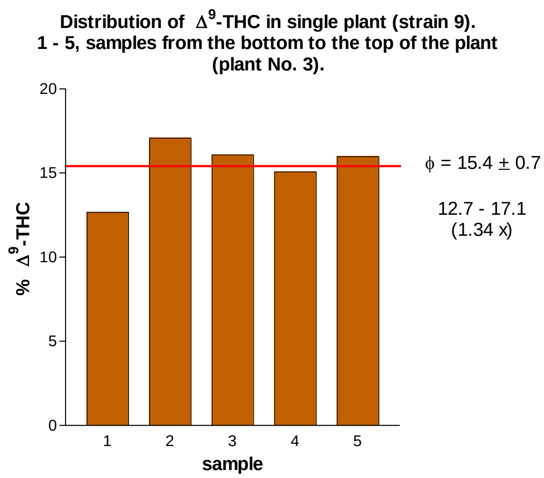
THC histogram. Frequency of different plants of the strain C versus Δ^9-THC concentration (%).

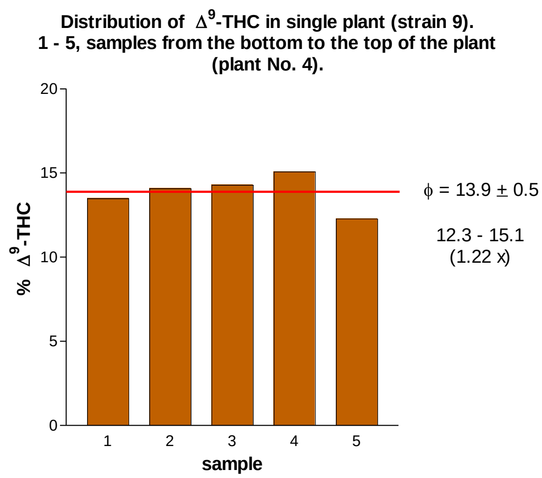


Used strain: **Strain 9**:

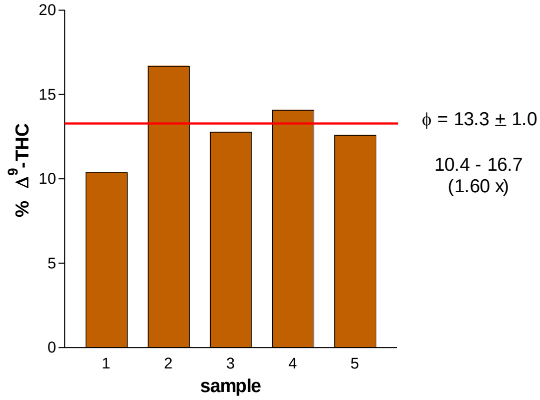




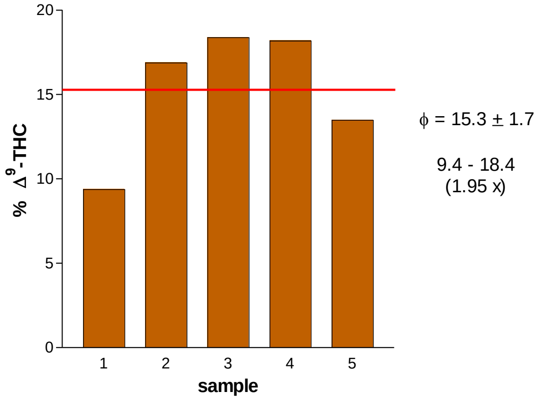




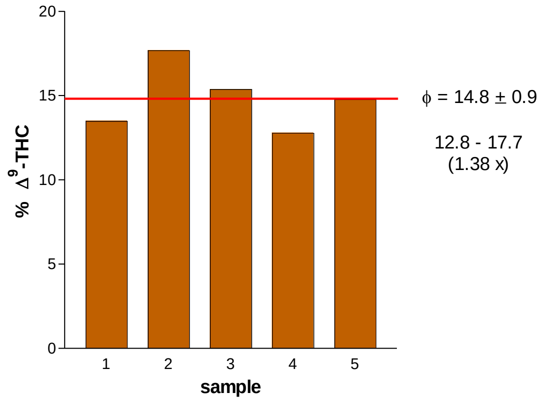
Distribution of Δ^9-THC in single plant (strain 9).
1 - 5, samples from the bottom to the top of the plant
(plant No. 5).



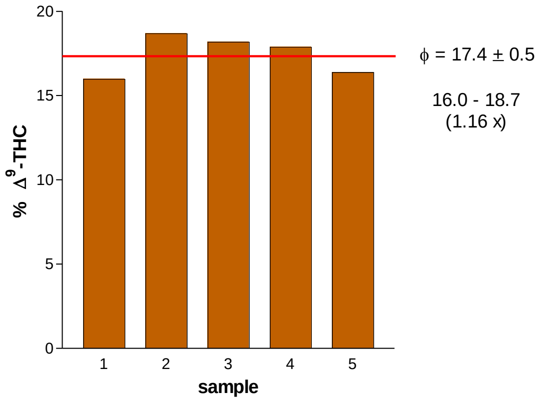
Distribution of Δ^9-THC in single plant (strain 9).
1 - 5, samples from the bottom to the top of the plant
(plant No. 6).

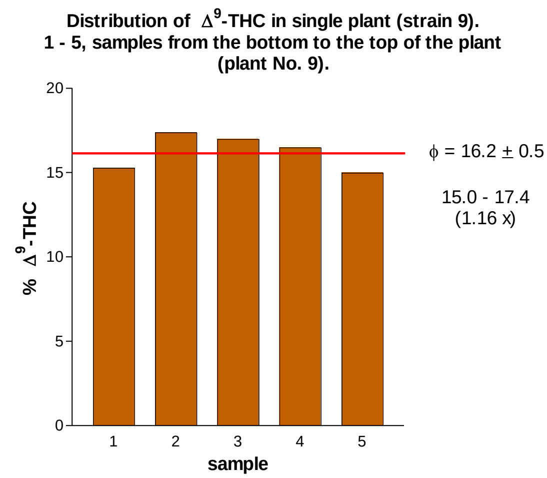


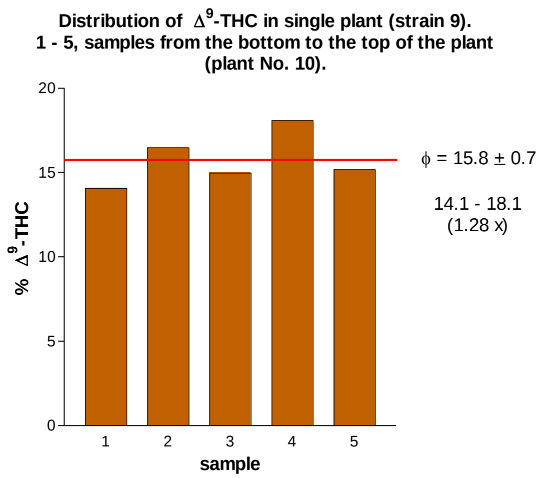
Distribution of Δ^9-THC in single plant (strain 9).
1 - 5, samples from the bottom to the top of the plant
(plant No. 7).

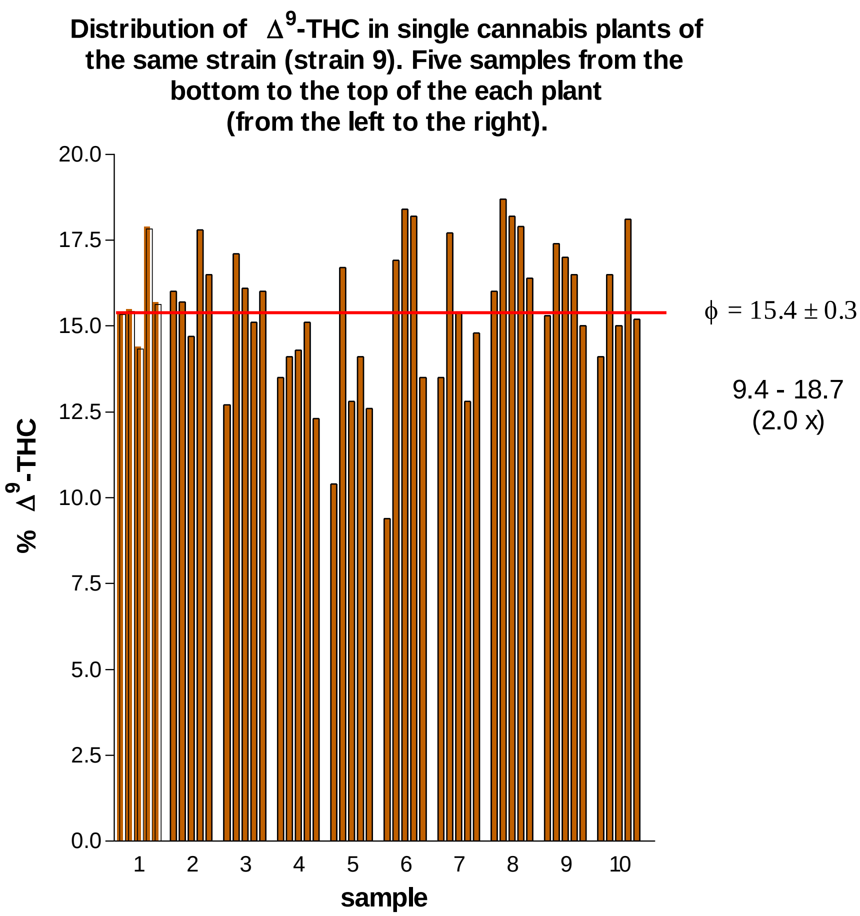


Distribution of Δ^9-THC in single plant (strain 9).
1 - 5, samples from the bottom to the top of the plant
(plant No. 8).

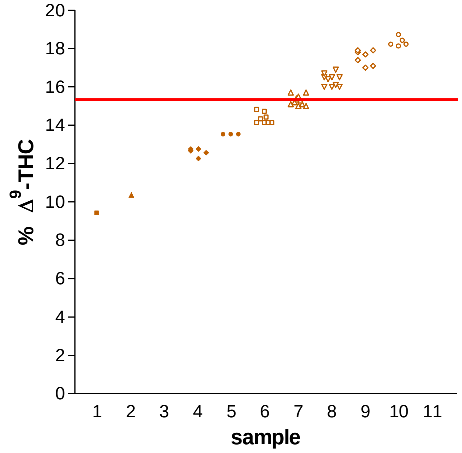



Distribution of Δ9-THC in single plant (strain 9).
1 - 5, samples from the bottom to the top of the plant
(plant No. 9).
20
15
10
5
0
% Δ9-THC
ϕ = 16.2 ± 0.5
15.0 - 17.4
(1.16 x)
1
2
3
4
5
sample


Distribution of Δ9-THC in single plant (strain 9).
1 - 5, samples from the bottom to the top of the plant
(plant No. 10).
20
15
10
5
0
% Δ9-THC
ϕ = 15.8 ± 0.7
14.1 - 18.1
(1.28 x)
1
2
3
4
5
sample


Distribution of Δ9-THC in single cannabis plants of
the same strain (strain 9). Five samples from the
bottom to the top of the each plant
(from the left to the right).
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
% Δ9-THC
ϕ = 15.4 ± 0.3
9.4 - 18.7
(2.0 x)
1
2
3
4
5
6
7
8
9
10
sample

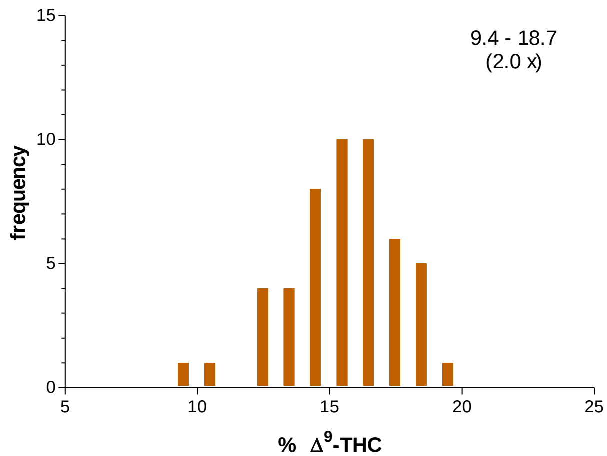
Distribution of Δ⁹-THC in single cannabis plants of the same strain (strain 9). Five samples from the bottom to the top of the each plant (from the left to the right).



ϕ = 15.4 ± 0.3

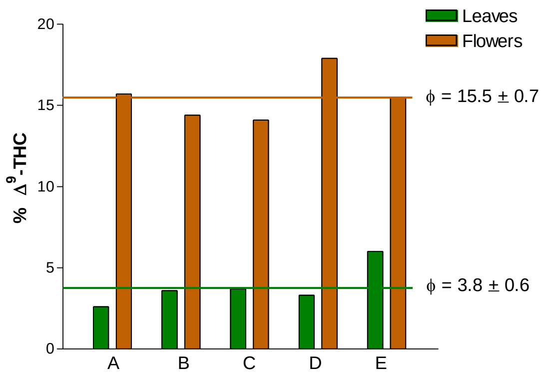
9.4 - 18.7
(2.0 x)

THC histogram. Frequency of different plants of the strain 9 versus Δ⁹-THC concentration (%).

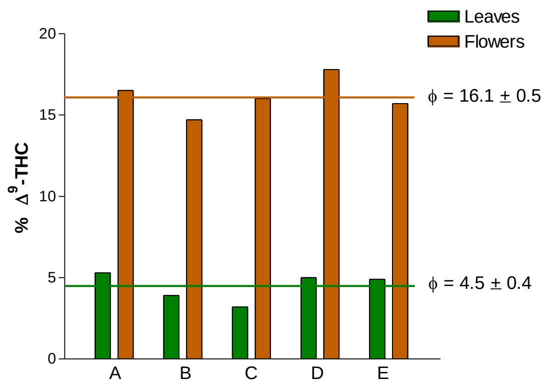


ϕ = 15.4 ± 0.3

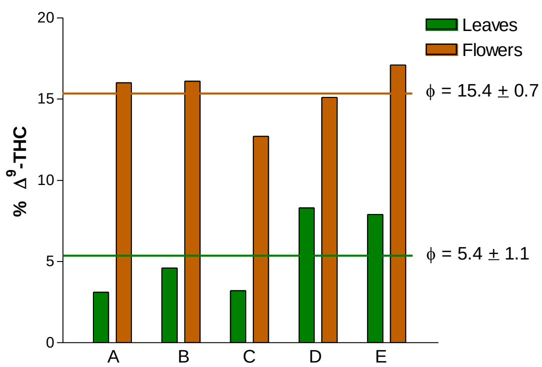
Distribution of Δ⁹-THC in single plant (strain 9, plant 1). A - E, samples from the top to the bottom of the plant.



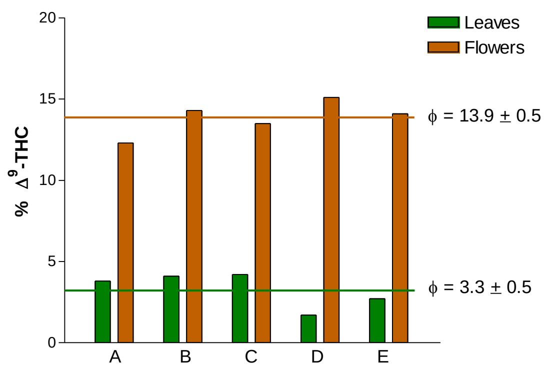
Distribution of Δ⁹-THC in single plant (strain 9, plant 2). A - E, samples from the top to the bottom of the plant.



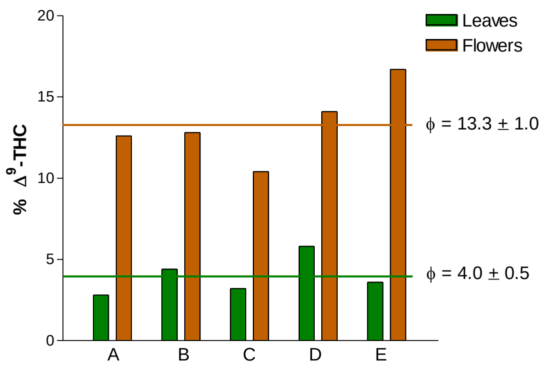
Distribution of Δ⁹-THC in single plant (strain 9, plant 3). A - E, samples from the top to the bottom of the plant.



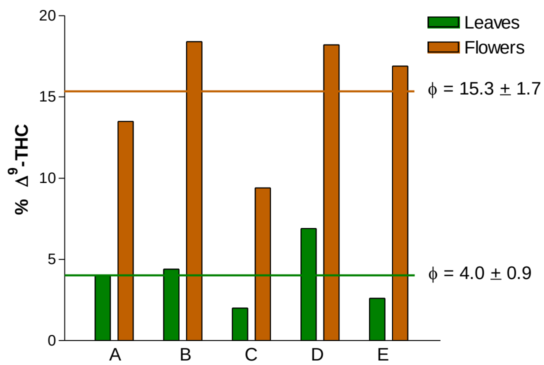
Distribution of Δ⁹-THC in single plant (strain 9, plant 4). A - E, samples from the top to the bottom of the plant.



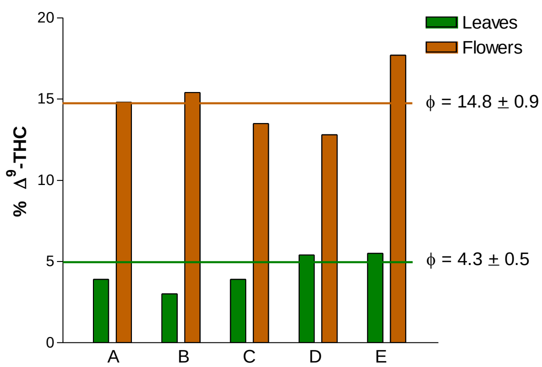
Distribution of Δ^9-THC in single plant (strain 9, plant 5).
A - E, samples from the top to the bottom of the plant.



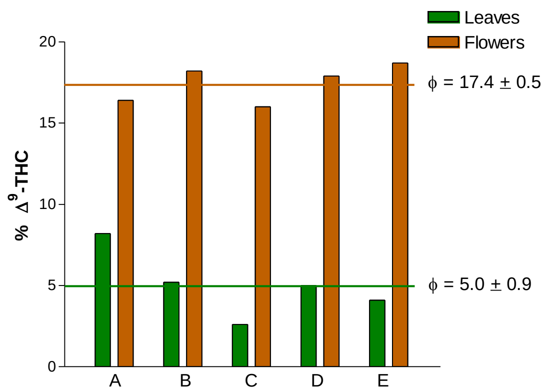
Distribution of Δ^9-THC in single plant (strain 9, plant 6).
A - E, samples from the top to the bottom of the plant.



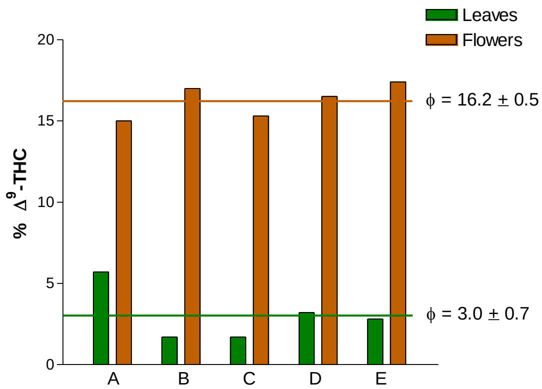
Distribution of Δ^9-THC in single plant (strain 9, plant 7).
A - E, samples from the top to the bottom of the plant.



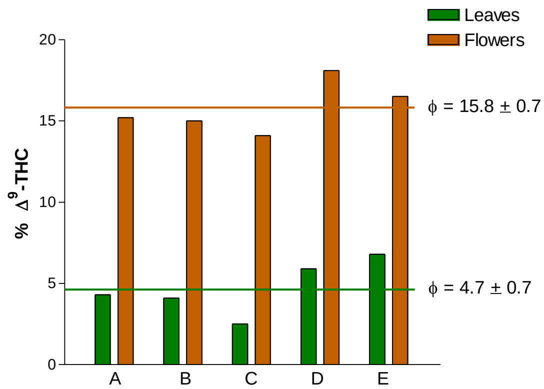
Distribution of Δ^9-THC in single plant (strain 9, plant 8).
A - E, samples from the top to the bottom of the plant.



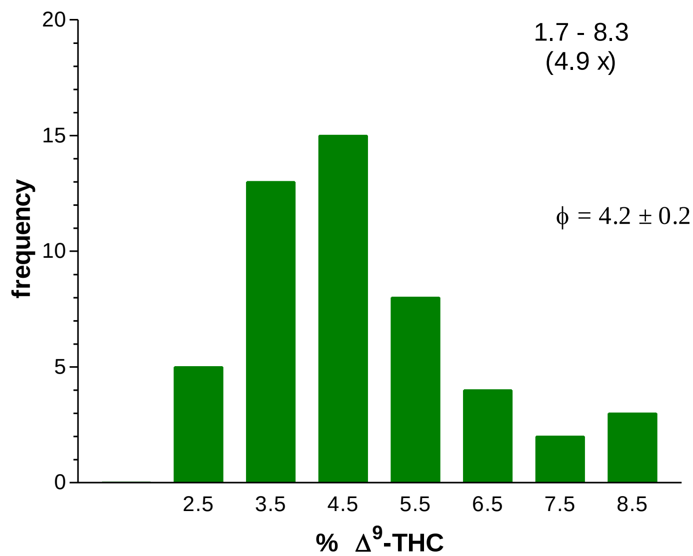
Distribution of Δ^9-THC in single plant (strain 9, plant 9).
A - E, samples from the top to the bottom of the plant.



Distribution of Δ^9-THC in single plant (strain 9, plant 10).
A - E, samples from the top to the bottom of the plant.



THC histogram for small leaves surrounding the female flowering tops. Frequency of different plants of the strain 9 versus Δ^9-THC concentration (%).



As small leaves surrounding the female flowering tops can be "contaminated" by the resin from the female flowering tops, the results of analyses of these leaves are not probably the results of just only leaves, but of leaves + more or less amount

of stuck resin on this small leaves. Because of that it does not give us real “picture” about these small leaves and differences are so big (up to 4.9 x).

Strain 9 of cannabis used in Israel for treatment – comparison of different flowering tops together with leaves surrounding these flowering tops

Female flowering tops were analyzed as were supplied, e.g. also with small leaves. This is the difference from previous analyses, as the amount of leaves can influence the content of Δ^9-THC in the flowering top.

A – sample from the top of the plant; B – sample from the middle of the plant

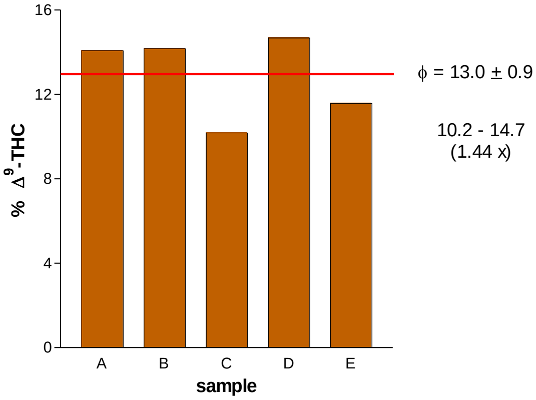
C – sample from the bottom of the plant; D – sample from the top of the plant (closer to the main stem)

E – sample from the middle of the plant (closer to the main stem)

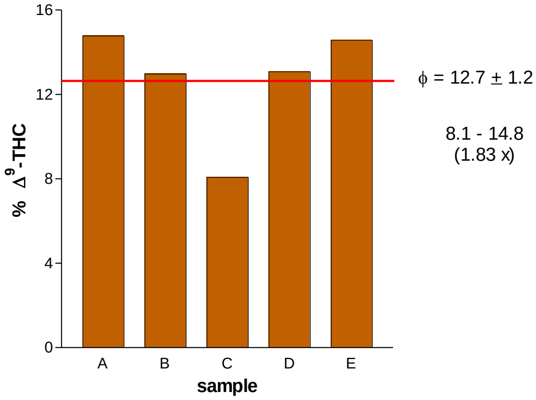
Table 2. Content of Δ^9-tetrahydrocannabinol in %.

variety **9**	A	B	C	D	E
20	14.1	14.2	10.2	14.7	11.6
21	14.8	13.0	8.1	13.1	14.6
22	15.5	14.8	9.3	13.3	12.0

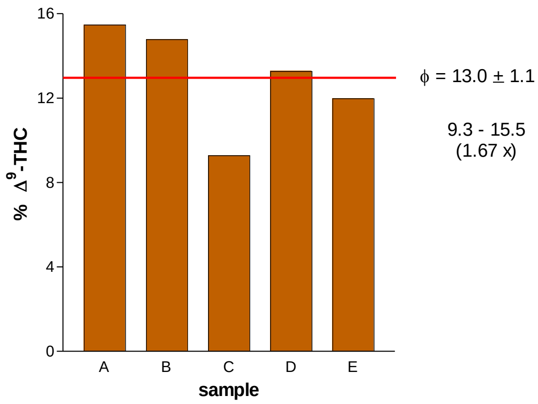
Distribution of Δ9-THC in single plant (strain 9). A - E, samples from the single plant (plant No. 20).



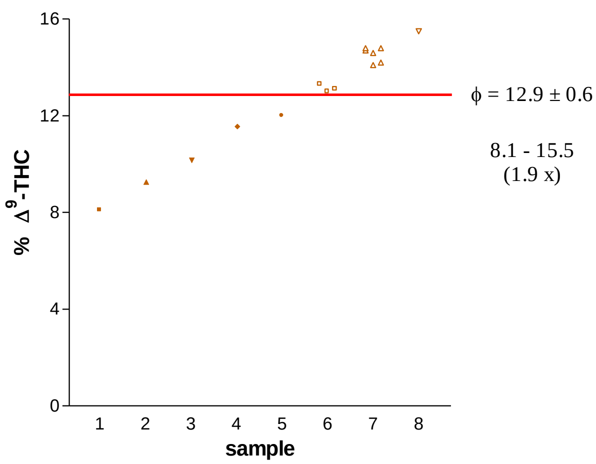
Distribution of Δ9-THC in single plant (strain 9). A - E, samples from the single plant (plant No. 21).



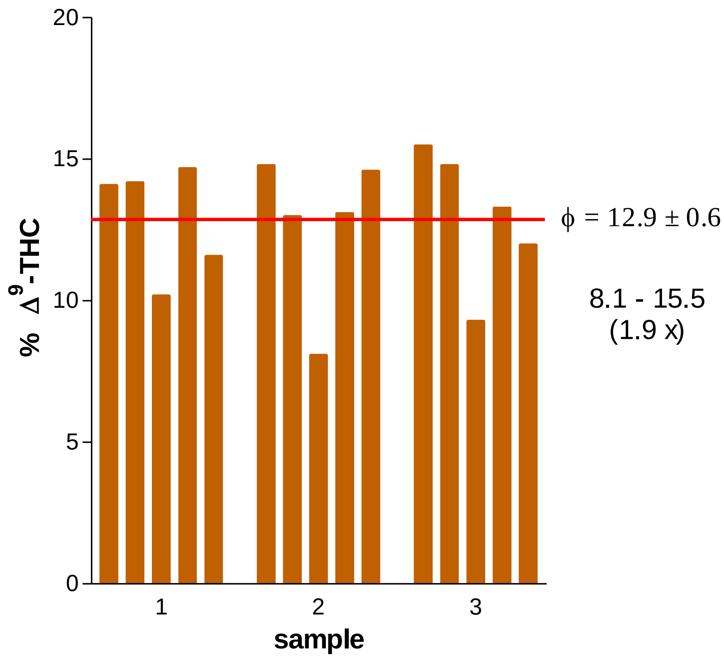
Distribution of Δ9-THC in single plant (strain 9). A - E, samples from the single plant (plant No. 22).



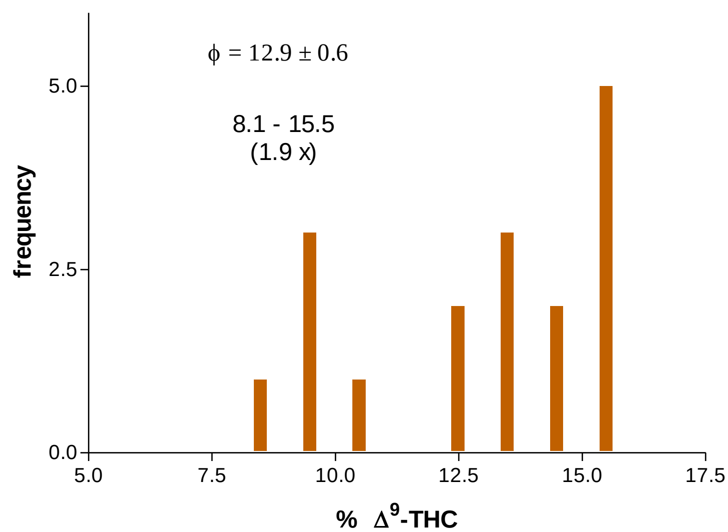
Distribution of Δ9-THC in single cannabis plants of the same strain (strain 9). Five samples from the bottom to the top of the each plant (from the left to the right).



Distribution of Δ^9-THC in single cannabis plants of the same strain (strain 9). Five samples from the bottom to the top of the each plant (from the left to the right).



THC histogram. Frequency of different plants of the strain 9 versus Δ^9-THC concentration (%).



Results

From the above result it is justified concern that patient even when using the same strain and the same amount of medicinal cannabis can smoke different amounts of the active compound for treatment (up to double dose) what can influence his/her treatment.

B. Fermentation of medicinal cannabis

As for some patients smoking of cannabis is unpleasant, the technique of fermentation is employed similarly as for tobacco or tea to make the smoke smoother. If the fermentation is stopped early, the marihuana has a sweeter taste because of the sugars which the ferment produced.

I studied this process in comparison with the changes of THC content. The results are in the following table. As one can see from this table, decrease of THC content is not such dramatic and it is worth for patients which do not like the smoke of dried marihuana.

Cannabis strain	CBD (%)	Δ^9-THC (%)	CBN (%)
Pandora's Box	t	12.1	t
Pandora's Box after 1 day fermentation	t	11.9	0.3
Pandora's Box after 2 days fermentation	t	11.8	0.5
Pandora's Box after 3 days fermentation	t	11.4	0.4
Pandora's Box after 4 days fermentation	t	10.2	0.6
Pandora's Box after 5 days fermentation	t	8.1	0.5

Critical Mass	t	15.9	0.4
Critical Mass after 1 day fermentation	t	13.2	0.6
Critical Mass after 2 days fermentation	t	12.0	1.0
Critical Mass after 3 days fermentation	t	10.8	1.2
Critical Mass after 4 days fermentation	t	10.1	1.3
Critical Mass after 5 days fermentation	t	10.0	1.3

C. Inhaled Medicinal marihuana and the immunocompromised patient

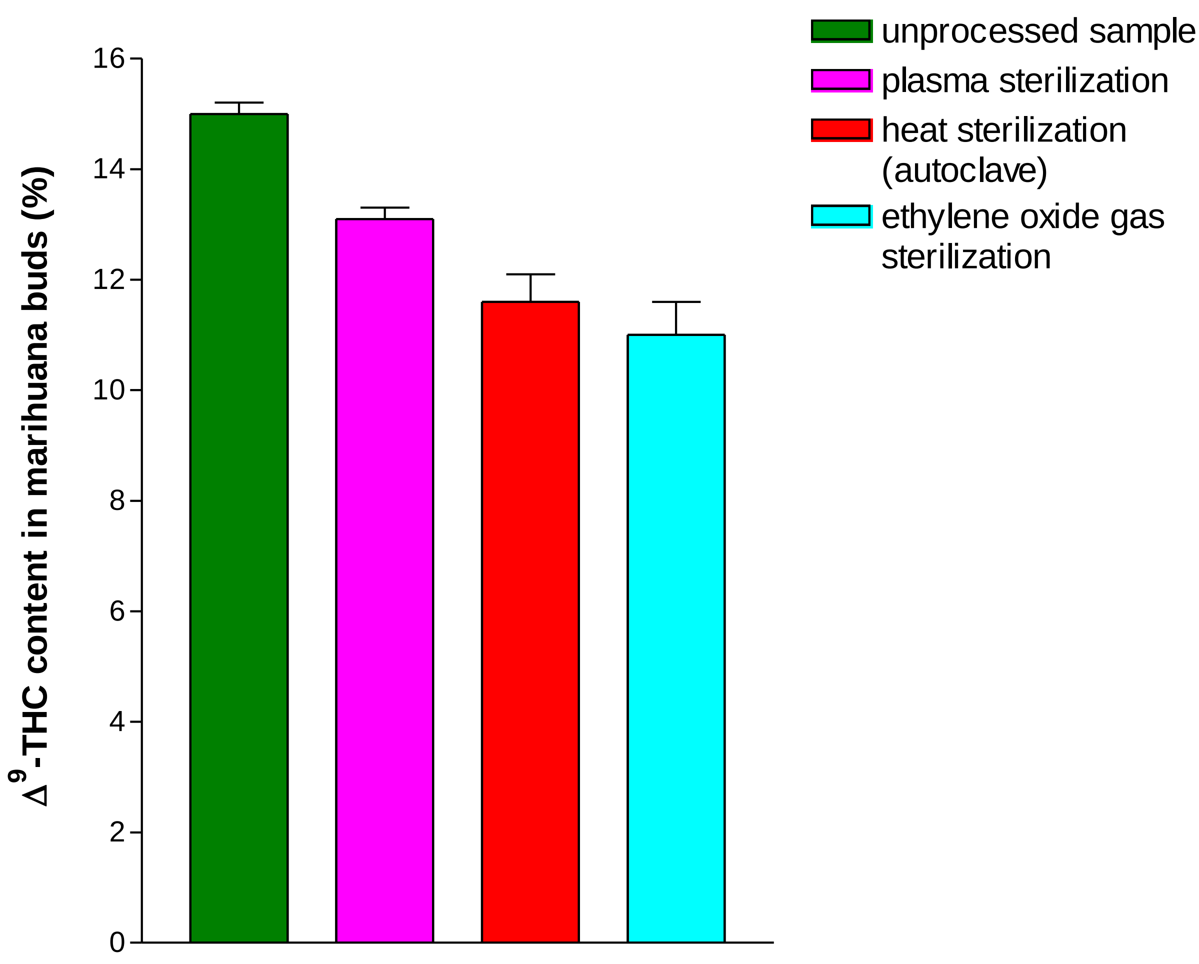
Medicinal marihuana is a valuable medication in certain specified medical conditions, mostly for immunocompromised patients. If the patient cannot tolerate the cookies or the sublingual oily drops, the remaining methods are smoking or evaporation. Evaporation produces cannabinoid molecules with minimal tar and other smoking by products. However, as every herb, various microorganisms are carried on its leaves and its flowers. Those could put the patient under the risk of opportunistic lung infections, mainly by inhaled molds.

We measured the loss of cannabinoid molecular activity under various methods of sterilization.

Under sterilization process amount of Δ^9-THC decreased between 12.6 and 26.6 % (see table and graph bellow)

sample	content of Δ^9-THC	decrease of Δ^9-THC in %
unprocessed	15.0 ± 0.2	
after plasma sterilization	13.1 ± 0.2	- 12.6
after heat sterilization	11.6 ± 0.5	- 22.6
after ethylene oxide gas sterilization	11.0 ± 0.6	- 26.6

Influence of sterilization on Δ^9-THC content in medicinal marihuana buds.



Conclusions

To sterilize a sample of medicinal marihuana it is the best to use plasma sterilization, which is the mildest one, as during our experiment the amount of Δ^9-THC decreased only by 12.6 %.

D. Efficiency of mechanical cannabinoids purification from the plant.

At present time became popular between cannabis abusers to purify cannabis resin from the flowering tops. The resulted material has higher amount of THC than the starting one. To check the efficiency of this process, this methods used by abusers were applied in research effort.

Courtesy of the company Chevrat Sijach were obtained cannabis samples for research purposes used in this study.

1. Sieved plant material

Cannabis female flowering tops were analyzed as usually for the main cannabinoid compounds and after that worked up.

Regular analysis revealed in the flowering tops of the strain Yellow C traces of CBD, 23.2% THC, and 0.2% CBN. Subsequently this sample was sieved through the sieve of different mesh with the following result.

Cannabis strain	CBD (%)	Δ^9-THC (%)	CBN (%)
Yellow C - 73 mesh	t	42.8	0.3
Yellow C - 120 mesh	t	27.7	0.2
Yellow C - 160 mesh	-	12.3	0.1

Conclusion

Just simple sieving can give material with almost twice higher amount of THC than in the flowering tops.

2. Bubble hash

Bubble hash is refined hashish that bubbles when smoked. It include a sieving system that uses ice, water and multiple levels of screening in order to remove the resin gland heads from the cannabis plant material, and to further remove any impurities from the hashish leaving a very pure resin. The use of only water and multiple levels of sieving to isolate the concentrated material is ideal for health-conscious consumers and/or medical patients for whom which chemical processing is un-desirable or possibly a health risk.

In the following experiments analyses of the flowering tops are followed by table with bubble hash analyses.

Regular analysis revealed in the flowering tops of the strain Carl 6.1% CBD, 5.4% THC, and traces of CBN.

Cannabis strain	**CBD (%)**	**Δ^9-THC (%)**	**CBN (%)**
Carl – bubble hash	17.9	16.4	0.27
Carl – flowering tops after bubble hash	t	t	-

Regular analysis revealed in the flowering tops of the strain Yellow C traces of CBD, 23.2% THC, and 0.2% CBN.

Cannabis variety	**CBD (%)**	**Δ^9-THC (%)**	**CBN (%)**
Yellow C	0.1	94.3	0.5
Yellow C – the rest after bubble hash preparation	-	3.1	-

Regular analysis revealed in the flowering tops of the strain 8 no CBD, 17.7% THC, and traces of CBN.

Cannabis strain	**CBD (%)**	**Δ^9-THC (%)**	**CBN (%)**
Bubble hash – from flowering tops - plant 8	-	88.2	t

Conclusion

Work-up of the cannabis flowers to prepare bubble hash “isolated” present cannabinoids almost quantitatively and the concentration of THC increased approximately 3 – 4 times.

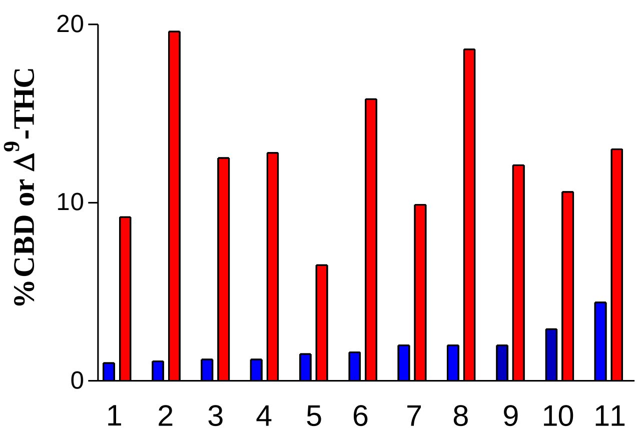
The danger of the above studied methods proved, that by this way abusers of cannabis can very simply increase activity of cannabis and also the volume of illegal samples for illicit traffic can allow them to smuggle such material more easily. At the same time it can be the way to make medical cannabis for patients more pure.

E. Strains of medicinal cannabis, cultivated in Israel with CBD content more than 1%.

It was found by analyses that the spectrum of medicinal cannabis in Israel cover all necessary ratios of CBD and THC as follows:

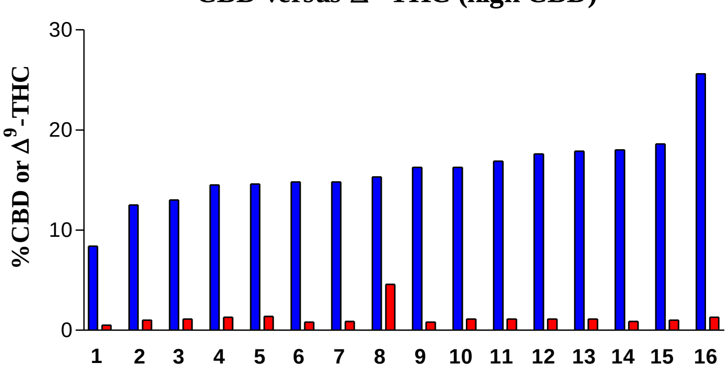
1. <u>Strains with low CBD and high Δ^9-THC</u>

CBD versus Δ^9-THC(high Δ^9-THC)

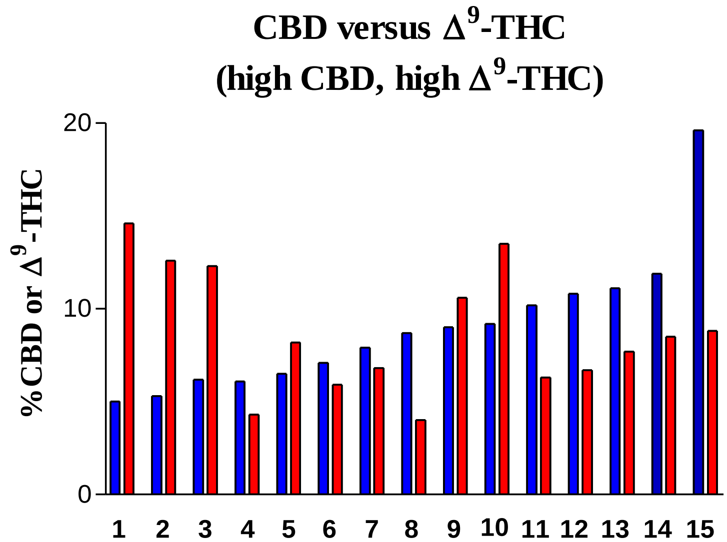


2. <u>Strains with high CBD and low Δ^9-THC</u>

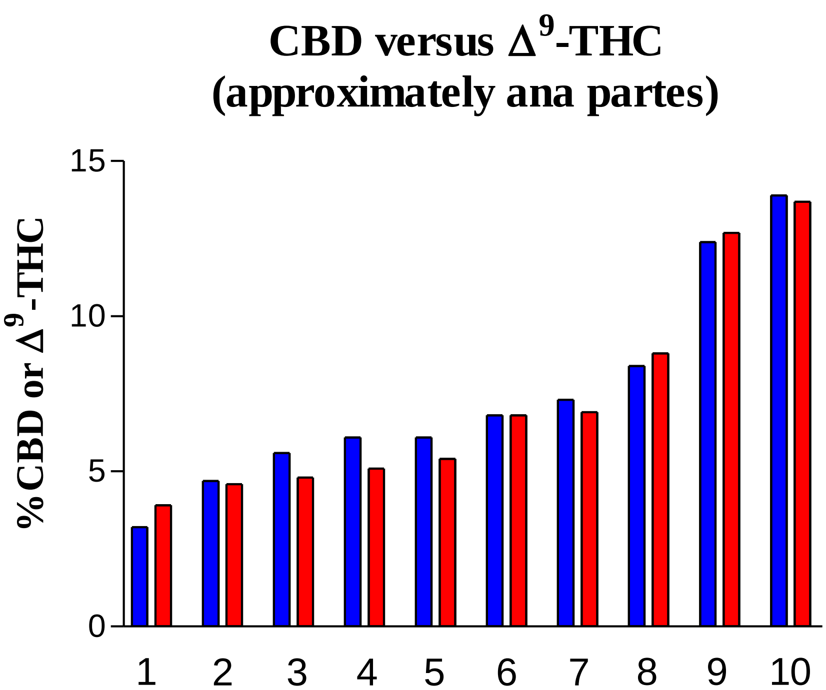
CBD versus Δ^9-THC (high CBD)



3. Strains with high CBD and high Δ9-THC



4. Strains with approximately the same content of CBD and Δ9-THC (difference in content is less than 1 %) – natural "Sativex"



F. Different cannabis strains used by farmers in Israel

In Israel there are about eight companies which grow medicinal cannabis for therapeutic use. Unfortunately each of these companies uses cannabis strains and products of cannabis according to their decision or availability. Because of that not every patient has the same possibility to obtain certain cannabis product for his/her illness. From analyses of medicinal cannabis and products from medicinal cannabis which I did during the last years the result was that there is too much strains (even when we today understand that for different illnesses different cannabis strains are supposed to be used, there is necessity for limited amount of different strains).

I understand that companies in Israel, which grow cannabis, compete between them, but with health of our patients we cannot compete and because of that should be selected several different strains, which will be available for all patients and these will be the most efficient different strains for different illnesses.

From the analyses of the samples, which were supplied by legal growers in Israel, resulted that in present time I analyzed 73 well known strains (part of them is used around the world for recreational use) and another 189 strains which are under different names, numbers or letters (there is possibility that part of these are used by growers to prevent identification of their strains). This gives us altogether 262 different strains.

Below are the strains used by different farmers.

73 well known strains:

Afghan Kush - Cann Pharmaceutical

Agent Orange - IMC Chaklaut

Ak-47 (Ak-47 Marijuana Strain) - Cann Pharmaceutical, PharmoCann

Bazooka - CannDoc

BCTP (BC Bud Depot - The Purps) - CannDoc

Blueberry - PharmoCann

Buddha's sister - PharmoCann

Burmese - CannDoc

Cannatonic (MK Ultra x G-13 Haze) – IMC Chaklaut

Cannatonic 1 (MK Ultra x G-13 Haze) - IMC Chaklaut

Cannatonic 2 - IMC Chaklaut

Cannatonic x Thai - Chevrat Sijach

Cherry Berry - CannDoc

Cinderella - PharmoCann

Costa Rica - Tikun Olam

Critical - Royal Queen - PharmoCann

Critical Mass - IMC Chaklaut

Critical - Royal Queen Seeds - PharmoCann

Dairy Queen - IMC Chaklaut

Diesel Barcelona - CannDoc, Teva Adir

Double Gum Buds - Chevrat Sijach

Early durban x Double gum - Chevrat Sijach

Fabiana - CannDoc, Teva Adir

Free Leonard x Northen light (FL NL) - CannDoc, PharmoCann

Free Leonard - CannDoc, Kibutz Elifaz, Abarbanel

G13 x Haze (G13 Marijuana Strain + Haze Marijuana Strain) - Chevrat Sijach

Green Perkel - CannDoc

God Bud - CannDoc

Hawaii - CannDoc, Teva Adir

Him 136 - CannDoc

Himalaya - CannDoc, PharmoCann

Himalaya Gold - PharmoCann

Jack Herrer (JH) - CannDoc, Kibutz Elifaz

Jack’s Cleaner - IMC Chaklaut

Kandy Kush - IMC Chaklaut

Kandy Kush x Skunk - IMC Chaklaut

Kush - IMC Chaklaut

Lemon - Cann Pharmaceutical

M-13 - Shaefa LeChajim

Magma – CannDoc

Maomao x Sage - CannDoc

Maomao x Choco - CannDoc

Mark-V - Cann Pharmaceutica, CannDoc

Master Kush - Chevrat Sijach

Maui Waui – Teva Adir

Northen Light (NL) - CannDoc

Pandora's Box - IMC Chaklaut

Power plant - Chevrat Sijach

Purple - Chevrat Sijach

Purple Budha – Teva Adir

Purple Kush - Cann Pharmaceutical, PharmoCann

Purps – PharmoCann

Red Horse – Teva Adir

Royal Medica – Teva Adir

Sage - CannDoc

Shark – CannDoc

Skunk – Teva Adir

Sour Tsunami - CannDoc

Sour Diesel - PharmoCann

Sour Diesel x AK-47 - Chevrat Sijach

Special Queen - PharmoCann

Sputnik - IMC Chaklaut

Star Jack - CannDoc, Teva Adir

Super Silver Haze - Tikun Olam

Super skunk - Chevrat Sijach

Swazi Safari – PharmoCann

Sweet and Saur Widdow - CannDoc

Thai - CannDoc

Thai x Free Leonard - CannDoc

Tora Bora - PharmoCann

White Russian - Cann Pharmaceutica, CannDoc, Abarbanel

White Widow - CannDoc

Zardde-2 (Sour Diesel + AK47) – Chevrat Sijach

189 strains (may be cultivars of these farms ?):

Abarbanel (5):

Choco

HIM 136

LC 286 G

L.S.K

TP 112

Ministery of Health (1):

Agro Mazor

CannDoc (32):

BCTP#2

BCTP#6 (BC Bud Depot - The Purps)

Choco

Green Toffy

FL-2

FL-3

FL NL#1

FL NL #2

FL NL #3

FLC 16/6

FLC 20/1

FLC 20/3

FLNL #2

FLNL #3

JH#3

JH#4

JH#5

JH#6

JH#8

LC#2

LC-NZ

NL6

NL10

Sage 2

Toffy 1

Toffy 2

TP 112

TP #6 19/12

WR-1

WR-2

WR-4

WR-5

Cann Pharmaceutica (5):

#7

#8

AM

LC-NZ

PK

Chevrat Sijach (34):

9 e

9 ee

186

187

(5/8) white G

AC-1

Arad#2

AT-1

Blue

BSK-1

Brown

Cannabol Placebo

Delbik#5

GPB-10

Madaf

Maya

Orange

Papy

Pink A

Red 7

Red 9

White 5

White 6

WTR-1

Yellow C

Zalman

Zan A

Zan C

Zan 6

Zan 6A

Zan 7

Zan 7B

Zan 8

Zan 9

IMC Chaklaut (28):

AF

AFF

AFG

AFL-3

AFL-6

Dina

Ela

Hadas

Jael

Lital

Lilach

PaZ

הדס

ליטל

יעל

אלה

לילך

הראל

ניצן

אלה

דינה

ניצן

ירדן

שולה

1

2

3

4

Kibutz Elifaz (2):

LC

TP

PharmoCann (6):

C3

C6

C15

Chum

Jarok

VZT

Shaefa LeChajim (21):

Adom

Cahov

DQ-IMC

Jarok

Lilach

Lavan

Sagol

Turkiz

U.Z.A.F.

Varod

אמטיסט

I אודם

II אודם

III אודם

I ענבר

II ענבר

צהוב

לבן

וורוד

אדום

ירוק

Tikun Olam (57):

1 ב"ה

2 ב"ה

3 ב"ה

4 ב"ה

A (חורץ)

B (סגול)

B0101

B0102

B0103

B0201

B0202

B0203

B0301

B0302

B0303

B0601

B102 (HELENA)

B202 (AVIDEKEL)

B301 (MIDNIGHT)

B601 (ALASKA)

Barcelona-702 (BO 702)

Barcelona-703 (BO 703)

C (סאטיבה s)

Carl

CBD9

Costa Rica

Chorec (חורץ)

D (ארז)

DO3

Dorit 0 (B12 OR)

Dorit 1

Dorit 2 (GOG&MAGOG)

Dorit 3 (LITTLE DEVIL)

Dorit 4 (JASMIN)

Eran

EREZ

Erez A (ארז)

Erez B (ארז)

Jarden

Kol HaTor

Nican

S-05

Sagol

Sativa

Shula

Vered

X

X-5

X-7

X-8

X-10

ערן אלמוג

אור

אל-נא

אלנה

מור

רפאל

Conclusion

In my aim to do the best research and to have good result it is necessary to say, that some of these companies were not ready to reveal abbreviations of their cannabis strains or how they prepared cannabis products. As it is medicine it is

important to know how this medicament was prepared and what was exactly used for the preparation. I suggest centralize it, what means to find the best procedures which will be obliged to use all companies dealing with medicinal cannabis.

There is necessary to study illnesses and their treatment with different strains of cannabis and choose certain amount of different strains, which will be used in Israel for treatment. There must be also general decision which cannabis preparations will be allowed and known way how to prepare them.

There is no place for growers to have secret strains and secret recipes for cannabis products preparation. It must be centrally organized and must be known all details concerning cannabis preparation as this is medicine for patients and not "secret pill". Any official strain of cannabis for treatment must be available for any patient in any place in Israel.

Discussion

Formerly the plant samples were high - Δ^9-THC ones, but today are cultivated also CBD-rich strains. The importance of CBD in the medical cannabis was already proved by scientific research. Medicinal cannabis was recently almost exclusively used by smoking.

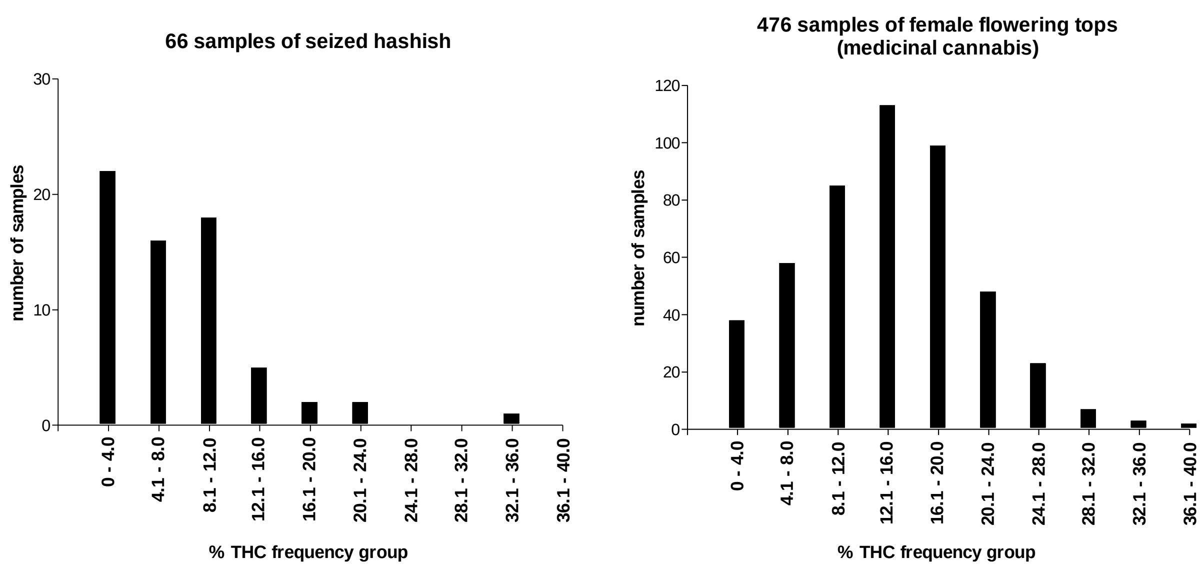
The main cannabinoids are in the plant predominately in the form of their precursors – cannabinoid acids. During smoking process these acids decarboxylate to the appropriate neutral cannabinoids and because of that it was not necessary to process these samples by any way.

All Δ^9-THC-rich samples have usually extremely high content of Δ^9-THC, so these samples are more efficient than regular hashish or marijuana.

It was proved that not only plant of the same strain, but also flowering tops from the same plant are not of the same quality, what means that patient does not use all the time the same amount of active compounds.

It looks that in spectrum of different cannabis strains, cultivated in Israel are almost all necessary ratios of the main cannabinoids, CBD and THC. The only missing strains are these with low CBD and low THC content (e.g. below 1 % of each) and such strains have also important medicinal value.

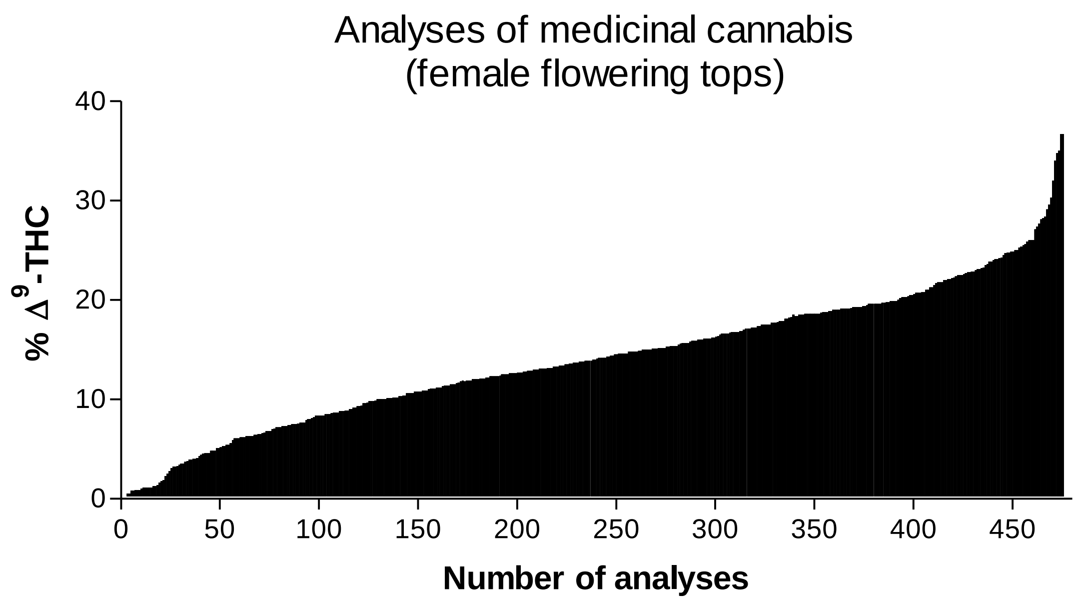
If we compare high THC samples (content between 12.1 and 20.0 % THC) of seized hashish and medicinal cannabis (female flowering tops) studied in this grant it is evident that at hashish samples are only 10.6 % of such samples contrary medical cannabis where such samples are 44.5 % (see Graph 1 and 2 below).



Graph 1 and 2. Frequency of Δ^9-THC concentrations at seized hashish samples and medical flowering tops ones.

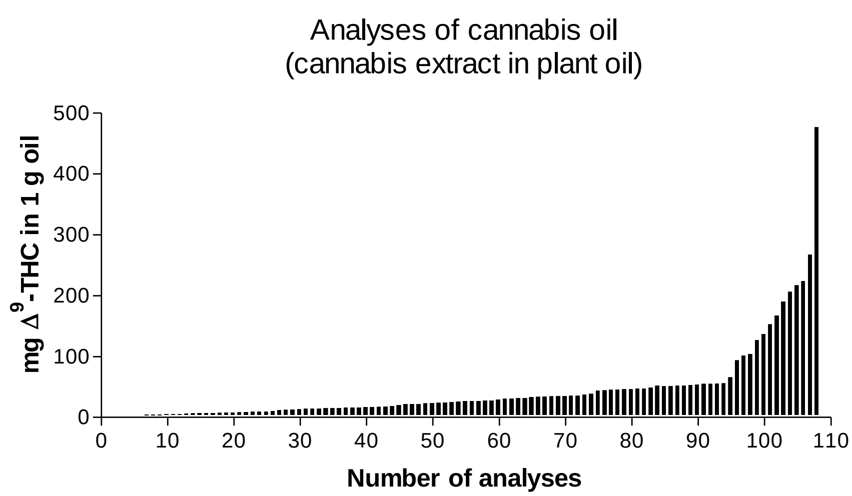
G. Results of analyses of different cannabis products for treatment from all growers

476 samples:



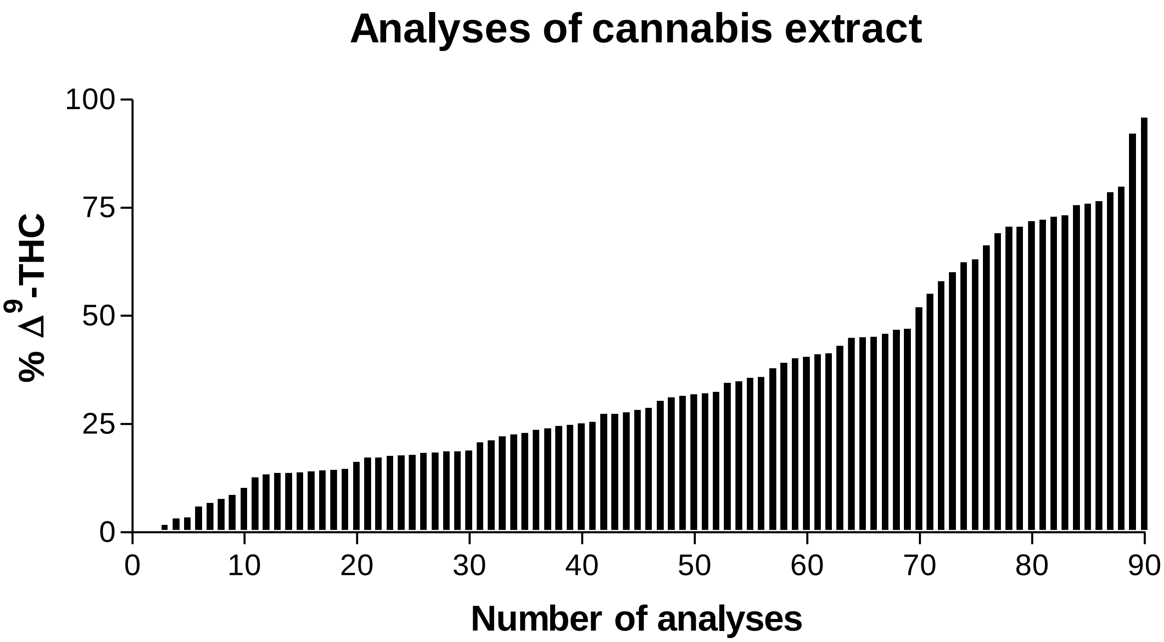
traces up to 36.7 %
ϕ = 14.10 ± 6.88 (0.32)
ϕ = mean ± SD (SEM)

108 samples:



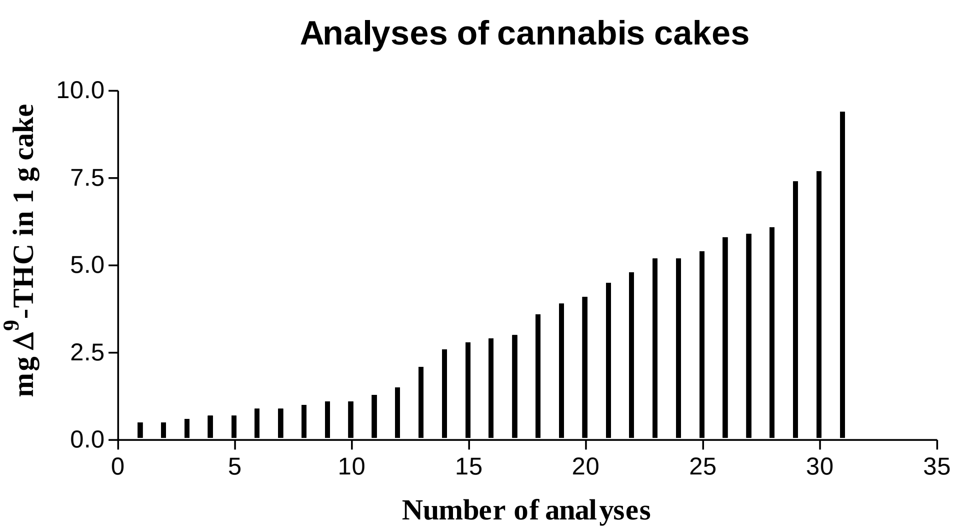
0.2 up to 476.4 mg/g oil
ϕ = 44.63 ± 65.63 (6.32)
ϕ = mean ± SD (SEM)

90 samples:



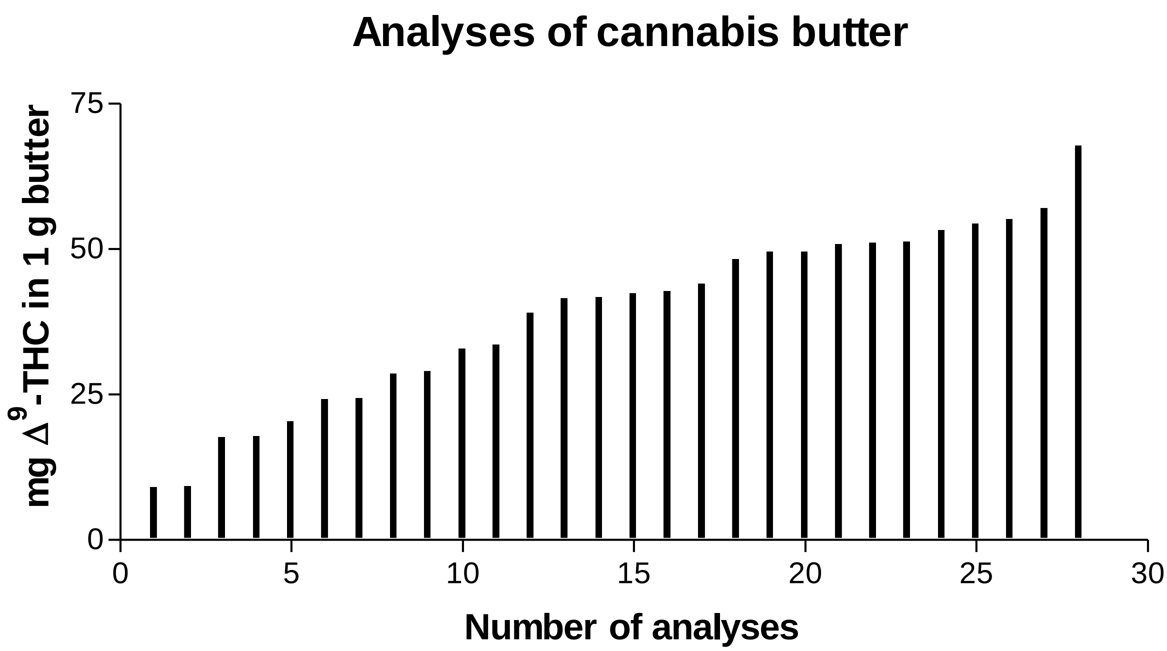
0.2 % up to 95.8 %
ϕ = 34.94 ± 23.43 (2.47)
ϕ = mean ± SD (SEM)

31 samples:



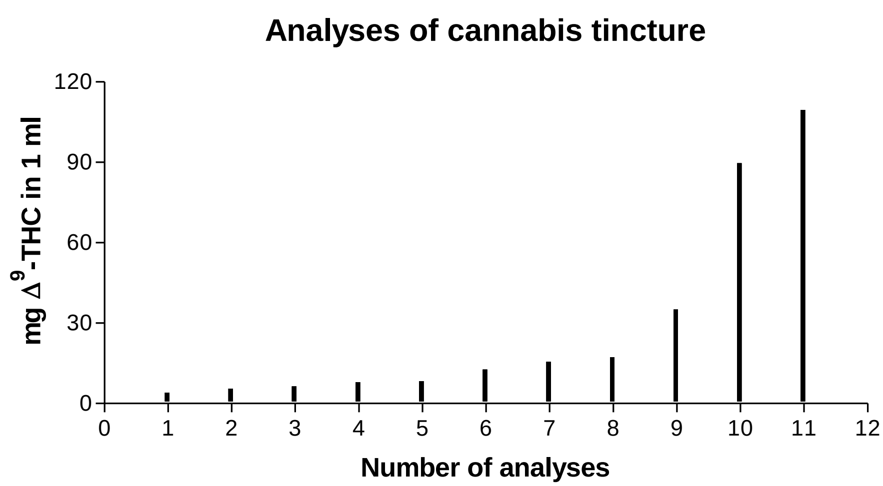
0.5 mg up to 9.4 mg/g
ϕ = 3.33 ± 2.47 (0.44)
ϕ = mean ± SD (SEM)

28 samples:



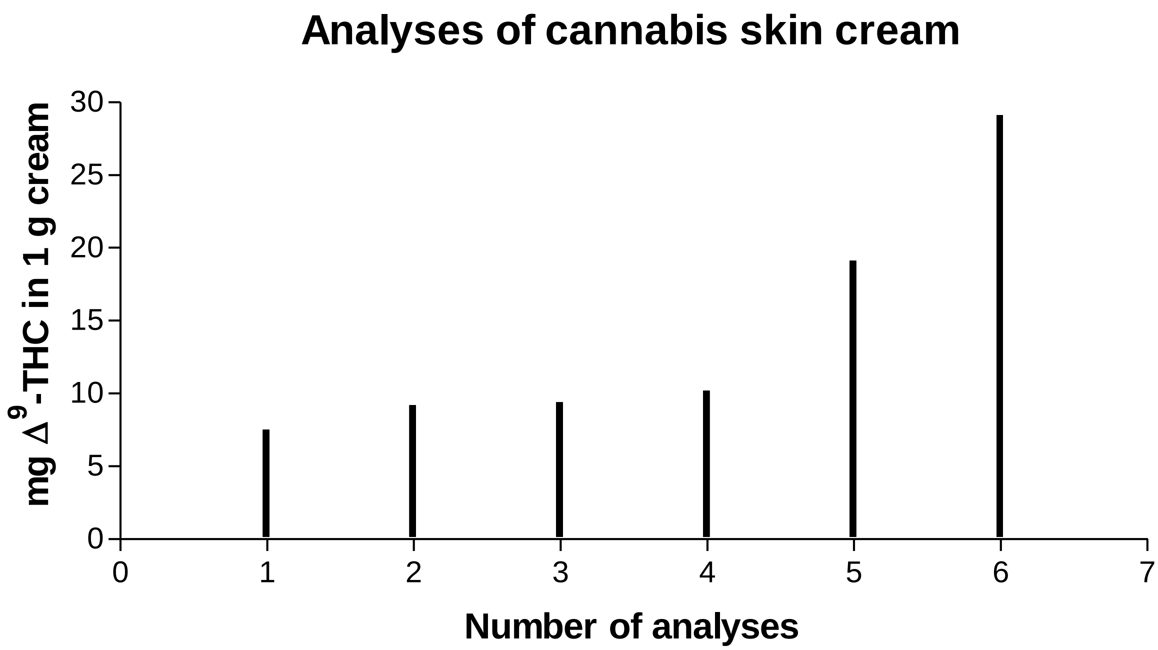
9.1 up to 67.8 mg/g butter
$\phi = 38.82 \pm 15.40$ (2.91)
ϕ = mean ± SD (SEM)

11 samples:



4.1 up to 109.6 mg/ml
$\phi = 28.34 \pm 36.55$ (11.02)
ϕ = mean ± SD (SEM)

<u>6 samples</u>:



7.5 up to 29.1 mg/g cream
$\phi = 14.08 \pm 8.42$ (3.44)
ϕ = mean ± SD (SEM)

The other food products, supplied for analysis were:

1. Juice from fresh cannabis – 33.8 (plant material after juice squeezing had 3.2 % Δ^9-THC) and 70.4 μg Δ^9-THC /ml
2. Caramel candy with cannabis - 2.0 and 6.2 mg Δ^9-THC/g
3. Chocolate with cannabis – 1.1 and 4.1 mg Δ^9-THC/g
4. Cream for filling waffles and cakes - 1.1 and 4.1 mg Δ^9-THC/g
5. Sugar with cannabis – 7.1 mg Δ^9-THC/g
6. Honey with cannabis – 0.4, 0.8 and 10.4 mg Δ^9-THC/g
7. Dry fruits with cannabis – 1.3 mg Δ^9-THC/g
8. Syrup with cannabis – 0.07 mg Δ^9-THC/g
9. Suppository with cannabis – 0.3 mg Δ^9-THC/g

Analyses of legal alcoholic beverages which appeared in the recent years on Israel market:

sample	**CBD (μg/L)**	**Δ^9-THC (μg/L)**	**CBN (μg/L)**
Cannabis vodka (Česká republika)	277.13	208.76	111.70
pivo Boxer Hacienda (Švýcarsko)	1229.0	83,45	333,8
pivo Boxer Hacienda (Švýcarsko)	1100.0	86.13	360.0
pivo Boxer Hacienda (Švýcarsko)	1300.0	74.53	350.0
pivo Spirit of Hemp (Rakousko)	75.6	261.6	94.4

Recommendation

From the above results it is justified concern that patient even when using the same strain and the same amount of medicinal cannabis can smoke different amounts of the active compound for treatment (up to double dose) what can influence his/her treatment. I suggest using different methods than by smoking (*per os*, *per rectum*, and creams for skin) – medicinal cannabis as extracts, cannabis in oil, cakes, creams, suppositories etc. or homogenize plant material and give to patient "average" reproducible sample of plant material (if they use it by smoking or by vaporization).

As in the plant material are cannabinoids predominantly in the form of appropriate cannabinoid acids, it is necessary to decarboxylate these acids, if the sample does not undergoes thermal decarboxylation process.

There is no place for growers to have secret strains and secret recipes for cannabis products preparation. It must be centrally organized and must be known all details concerning cannabis preparation as this is medicine for patients and not “secret pill”. Any official strain of cannabis for treatment must be available for any patient in any place in Israel. As it is medicine it is important to know how this medicament was prepared and what was exactly used for the preparation. I suggest centralize it, what means to find the best procedures which will be obliged to use all companies dealing with medicinal cannabis.

It is also necessary to cultivate cannabis with low amounts of CBD and/or THC (below 1 %), as at certain illnesses it is also suitable medicine for patients.

It is truth that during smoking medicinal cannabis the active compounds cross blood/brain barrier very fast and patient may feel the influence of this medical preparation almost instantly. On the other side it is necessary to use other ways of use, as smoking of any plant material is not healthy and harms the health of patient. As patient does not use medicinal cannabis in life-threatening situations, it is recommended to use different way of use than smoking. It is truth that by different way than smoking the effect occurs more slowly, but on the other side this effect has a longer duration what is for patient advantageous.

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Final note

This report gives a brief overview of a three-year study of seized hashish samples analyses and evaluation of medicinal cannabis samples.