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CONTENTS

Experimental cultivation of cannabis plants in the Mediterranean area

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ABSTRACT

In research carried out in 1982, which included the cultivation of cannabis plants with low, medium and high levels of Δ^9-tetrahydrocannabinol (THC), the authors have determined the parameters for individualization and classification of cannabis plants according to their intoxicant potential. This can help to provide courts of law with valid supportive expertise on cannabis trafficking cases. The parameters are the percentages of THC in cannabinoids and in the dried substance of a plant, as well as the percentage of cannabinoids in the dried substance. On the basis of these parameters, the authors have found that a cannabis plant in which the percentage of THC exceeds 50 per cent of the total amount of cannabinoids of the extractable resin and 0.3 per cent of the total amount of dried substance, and in which the amounts of resin and cannabinoids are substantial, has a considerable intoxicant potential and is liable to be used for illicit production of cannabis for abuse. On the contrary, a plant with a THC level below 50 per cent of the cannabinoids and 0.3 per cent of the dried substance, in addition to a low level of total cannabinoids, has low intoxicant potential and can be used in industry for the production of oil and rope. On the basis of these parameters it is also possible to predict the intoxicant potential of a young cannabis plant harvested at a relatively early stage of its development.

Introduction

Cannabis and its preparations are widely available drugs on the illicit market. In order to implement legislation relating to cannabis control, courts of law must take into account scientific expertise based on clear distinctions between cannabis plants with high intoxicant potential and plants with low or limited potential [1].

For this purpose, the authors have adopted the classification of cannabis plants proposed by Small and Cronquist [2]. According to these

authors, cannabis plants are divided into two groups. The first group comprises plants of limited intoxicant potential containing less than 0.3 per cent of Δ^9-tetrahydrocannabinol (THC) in the dried upper parts of the plant and younger leaves. The THC content of these plants is usually less than 50 per cent of the total cannabinoids of resin. Mature female plants generally contain more than twice as much resin as mature male plants. Such plants usually grow in the areas north of latitude 30° N and are adapted to relatively short periods of vegetative growth [2].

The second group comprises plants of considerable intoxicant potential. These plants contain more than 0.3 per cent of THC in the dried material from the upper parts of the plant and younger leaves. Cannabinoids of resin contain more than 50 per cent of THC. Mature female plants generally contain less than twice as much resin as mature male plants. Such plants usually grow in the areas south of latitude 30° N and are adapted to a relatively long period of vegetative growth [2].

The "Canapa indiana", in the Italian law of 1975 (Law No. 685), could correspond to the second group of the taxonomic scheme described above [2]. The establishment of parameters, based on scientific evidence, for individualization and classification of cannabis plants according to their intoxicant potentials can help provide courts of law with important supportive expertise in cannabis trafficking cases. Bearing this in mind, the authors undertook research at the beginning of 1982 to determine the validity of the classification by Small and Cronquist [2] and to determine parameters that can be practically used for the appropriate classification of cannabis plants into those from which drugs of abuse with considerable intoxicant potential can be produced and those having very low intoxicant potential and capable of being used for the production of oil and rope.

Materials and methods

For this research, the authors used confiscated cannabis seeds that were illegally imported from the Middle East and East Asia. The following three groups of seeds were chosen according to the level of THC content of cannabis plants from which such seeds have been obtained: A – low level; B – medium level; and C – high level of THC content.

At the beginning of March 1982, the seeds were placed into Petri capsules and kept on filter paper soaked in water at the constant temperature of 20° C for 24 to 48 hours. Thirty of the seeds that germinated were transferred to seed beds where they remained for an average period of seven days. Once the plants reached a height of 5 – 10 cm, they were planted in the ground to grow in an area of land half shaded and of normal consistency at distances of 50 cm from one another. The ground was watered twice a week until the end of May and then three times a week [3].

At the end of May, once the plants had reached a height of 50 cm, some leaves from the third whorl were taken for analysis. This procedure was repeated at the end of each month until the beginning of September, when the plants matured. The leaves taken for analysis were dried in sunny and well-aired areas until a constant weight was reached, which took an average period of seven days. The dried leaves were broken up into minute fragments and the resin was extracted by petroleum ether, applying the method used by Mari [4].

Cannabinoids are quantified by gas chromatography using the following equipment and experimental procedures: gas chromatograph Perkin-Elmer model F30, connected with a Hitachi recorder model 56; glass columns (2 m × 6.35 mm ID) packed with 2.5 per cent XE-60 on Chromosorb W 80 – 100 mesh; zone temperature injection and detection, 250° C; column oven, 220° C; carrier-nitrogen with a flow of 65 ml/min; and a flame ionization detector.

Results and discussion

Tables 1, 2 and 3 summarize the results obtained in this research. A comparison of the data, based on the relative percentage of cannabinoids, shows that the cannabis plant conserves its individuality until the beginning of its flowering stage.

Table 1

Content of THC in the total amount of cannabinoids in a cannabis plant, 1982

	Percentage in month of cutting			
Plant code	*May*	*June*	*July*	*August*
		Group A		
A1	37.7	40.9	38.5	31.7
A2	69.8	69.0	68.1	59.7
A3	19.6	33.3	30.0	15.6
A4	69.6	77.5	57.3	52.4
A5	49.6	69.9	58.5	47.1
A6	50.9	64.4	54.6	48.1
A7	51.4	62.7	60.7	52.9
A8	33.4	36.5	37.1	29.2
		Group B		
B1	27.2	28.7	27.1	24.5
B2	36.1	31.8	39.8	29.1
B3	50.5	54.9	66.2	47.9
B4	53.7	64.0	54.4	55.6
B5	51.6	50.2	58.7	44.6
B6	60.3	54.9	62.8	52.0

Table 1 (continued)

Plant code	Percentage in month of cutting			
	May	*June*	*July*	*August*
B7	8.9	9.0	11.0	8.8
B8	43.9	50.2	51.5	44.4
B9	23.6	34.9	28.2	22.1
B10	24.1	29.4	30.0	24.2
B11	50.8	52.1	58.8	45.0
B12	23.0	28.1	33.1	32.5
	Group C			
C1	57.2	59.4	57.2	41.4
C2	61.8	66.6	63.9	59.3
C3	64.4	77.0	73.5	53.8
C4	63.0	60.1	61.1	60.7
C5	23.8	31.2	28.3	22.3
C6	29.4	26.5	23.2	24.3
C7	63.4	77.0	61.7	64.6
C8	61.6	70.6	71.8	62.4
C9	61.8	71.0	70.0	63.1
C10	10.3	12.0	13.1	10.0

Table 2

Content of THC in the total amount of dried substance in a cannabis plant, 1982

Plant code	Percentage in month of cutting			
	May	*June*	*July*	*August*
	Group A			
A1	0.5	0.6	0.5	0.4
A2	1.1	1.1	0.8	0.7
A3	0.2	0.3	0.3	0.2
A4	1.1	0.9	0.6	0.6
A5	0.6	1.0	0.8	0.5
A6	0.8	0.8	0.5	0.4
A7	1.1	1.1	0.7	0.6
A8	0.6	0.6	0.4	0.3
	Group B			
B1	0.3	0.4	0.3	0.3
B2	0.3	0.3	0.4	0.3
B3	0.4	0.4	0.5	0.3
B4	0.6	0.6	0.5	0.6
B5	0.6	0.7	0.6	0.5
B6	0.8	0.5	0.7	0.7
B7	0.1	0.1	0.1	0.1
B8	0.6	0.7	0.7	0.6

***Table 2** (continued)*

	Percentage in month of cutting			
Plant code	*May*	*June*	*July*	*August*
B9	0.3	0.4	0.3	0.3
B10	0.4	0.5	0.4	0.4
B11	0.5	0.6	0.9	0.6
B12	0.3	0.6	0.7	0.7
		Group C		
C1	0.9	1.1	1.1	0.8
C2	1.4	1.7	1.4	1.4
C3	1.4	1.4	1.5	1.2
C4	1.1	1.0	1.1	1.0
C5	0.3	0.5	0.5	0.4
C6	0.5	0.5	0.5	0.4
C7	0.9	1.2	1.0	1.0
C8	1.2	1.5	1.6	1.4
C9	0.9	1.2	1.0	0.8
C10	0.1	0.2	0.2	0.1

Table 3

Content of cannabinoids in the total amount of dried substance in a cannabis plant, 1982

	Percentage in month of cutting			
Plant code	*May*	*June*	*July*	*August*
		Group A		
A1	1.4	1.6	1.2	1.2
A2	1.6	1.6	1.2	1.0
A3	1.2	1.0	1.1	1.3
A4	1.6	1.1	1.0	1.1
A5	1.2	1.5	1.3	1.0
A6	1.5	1.3	1.0	0.9
A7	2.2	1.7	1.2	1.2
A8	1.8	1.7	1.0	1.0
		Group B		
B1	1.0	1.3	1.0	1.2
B2	0.9	0.9	1.1	0.9
B3	0.9	0.7	0.8	0.7
B4	1.2	0.9	1.0	1.1
B5	1.1	1.3	1.0	1.2
B6	1.4	1.0	1.1	1.4
B7	1.3	1.5	1.3	1.1
B8	1.4	1.5	1.4	1.4
B9	1.1	1.2	1.2	1.3
B10	1.5	1.7	1.4	1.7
B11	1.0	1.2	1.6	1.4
B12	1.4	2.1	2.0	2.1

Table 3 (continued)

Plant code	Percentage in month of cutting			
	May	June	July	August
		Group C		
C1	1.6	1.8	2.0	1.9
C2	2.2	2.6	2.2	2.3
C3	1.7	1.8	2.1	2.2
C4	1.4	1.6	1.8	1.6
C5	1.7	1.6	1.7	1.7
C6	1.6	2.0	2.1	1.8
C7	1.5	1.6	1.6	1.6
C8	1.9	2.1	2.3	2.2
C9	1.4	1.7	1.5	1.2
C10	1.3	1.5	1.6	1.3

Given that the A, B and C groups of seeds (see tables 1, 2 and 3) are of different plants chosen for their low, medium and high levels of THC content, the authors have confirmed the finding by Small and Cronquist that "a given variant can conceivably migrate from any given group to any other with appropriate selection and alteration of genes controlling the critical diagnostic characteristic" [2]. It is thus possible to find closer affinities between populations of different varieties than between populations of a given variety [2]. This is clearly shown in tables 1, 2 and 3, which illustrate a considerable variation of the percentage of THC in cannabinoids and in the dry substance, as well as a considerable variation of the percentage of cannabinoids in the dried substance of different plants from groups A, B and C. It can be assumed that the mutants of groups A and B are members of group C. For example, plants C5, C6 and C10 (see table 2), which originated from the same plant C (selected for its high THC content), show lower THC contents in the month of August than plants A2, A4, A5 and A7, which originated from group A (selected for its low THC content). These findings provide evidence to support the view that analyses of confiscated plants should be carried out on all the specimens.

The genetic aspects and eventual inbreeding between mutant plants belonging to groups A, B and C (A2, B4, B6, C1, C2, C3, C4, C7, C8 and C9) need to be further studied.

In order to be able to evaluate correctly the intoxicant potential of a cannabis plant, it is necessary to determine the percentage of THC in cannabinoids of the extractable resin and the percentage of THC in the dried substance of a plant (see tables 1 and 2). It is also necessary to quantify cannabinoids in the dried substance of a plant (see table 3). Thus, the results of this research have confirmed the validity of the classification of cannabis plants proposed by Small and Cronquist [2]. If the plant produces little resin,

even though the percentage of THC in cannabinoids is high, the total amount of THC in the dried substance of a plant will be low.

On the other hand, even if a cannabis plant contains a large amount of resin, its intoxicant potential will be low if the percentage of THC in cannabinoids is low (below 50 per cent). For these reasons, a high-resin-producing plant with a high percentage of THC should be classified as a cannabis plant with a high intoxicant potential.

The analyses of a young plant during its development until the flowering stage can reveal the individuality of the plant and its intoxicant potential at the stage of its maturity. The data obtained show that in most cases the percentage of THC remains relatively constant in a plant throughout its development until its flowering, but the percentage of THC varies from one plant to another even though the plants have originated in the same stock of seeds obtained from one plant.

The results of this research clearly show that the THC content of a young cannabis plant, regardless of whether it is high or low, does not substantially change until the flowering stage of the plant. On the basis of the amount of THC and the amount of total cannabinoids in a young plant, even at a relatively early stage of its development, it is possible to predict its intoxicant potential at the stage of flowering. If the percentage of THC in a young plant is higher than 50 per cent of the total cannabinoids and more than 0.3 per cent of the total dried material, such a plant will most probably have high intoxicant potential at the stage of flowering. But if a young plant has a percentage of THC lower than 50 per cent of the total cannabinoids and lower than 0.3 per cent of the total dried material, such a plant will have low intoxicant potential at maturity. The predictive development of a young cannabis plant takes place owing to its genetic characteristics, which for such development appear to be more important than environmental conditions.

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