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On the Legality of Cannabis: The Responsibility of the Expert Witness

The possibility that the genus *Cannabis* comprises more than one species has been a matter for considerable controversy over a long period of time. The literature on the botany of *Cannabis* is complicated and confusing because of numerous specific and varietal names, most of which have never been properly published or described according to the rules of botanical nomenclature. Thus, the genus has been considered to be monotypic and most taxonomists have, in the past, agreed that *Cannabis sativa* Linnaeus included all variants. A recent publication by Schultes et al [*1*] listed some of the specific epithets which have so far been proposed in the literature:

Cannabis americana Houghton et Hamilton in *Am. Journal Pharm.* 80 (1908) 17, *nomen nudum*

Cannabis erratica Sievers *ex Pallas Neue Nord. Beytr.* 7 (1796) 174, *nomen nudum*

Cannabis foetens Gilibert *Exercit. Phytol.* 2 (1792) 450, *nomen illegitimum*

Cannabis generalis E. H. L. Krause in *Strum. Fl. Deutchland,* Ed. 2, 4 (1905) 199

Cannabis gigantea Crevost in *Bull. Econ. Indochine,* n.s., 20 (1917) 613

Cannabis indica Larmarck *Encycl.* 1 (1783) 695

X Cannabis intersita Sojak in *Novit. Bot. Del. Sem. Hort. Bot. Univ.* Carol Prage (1690) 20

Cannabis lupulus Scopoli *Pl. Carniol.* Ed. 2, 2 (1772) 263

Cannabis macrosperma Stokes *Bot. Mat. Med.* 4 (1812) 539

Cannabis pedemontana Camp, *J. N.Y. Bot. Gard.* 36 (1936) 114, *nomen nudum in synon*

Cannabis ruderalis Janischewsky, *Uchenyl Zap. Gas. Saratov. Univ.* 2, pt. 2 (1924) 14

Cannabis sativa Linnaeus, *Sp. Pl.* (1753) 1027[1]

A study of these indicates that three were originally described by Linnaeus, Lamarck, and Janischewsky and were separately named *Cannabis sativa, Cannabis indica,* and *Cannabis ruderalis,* respectively. These three species have been taxonomically classified, properly described, and type specimens recorded and critically compared. Schultes et al [*1*] summarized the distinguishing characters of these three species. The following quotation from this article describes these differences and proposes a taxonomic key to identify them.

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While we recognize our present incomplete knowledge of characters, we offer the following key to distinguish the several species discussed above:

1) Plants usually tall (up to 5 to 18 feet), laxly branched, Akenes smooth, usually lacking marbled pattern on outer coat, firmly attached to stalk and without definite articulation.

C. sativa

1a) Plants usually small (4 feet or less), not laxly branched, Akenes usually strongly marbled on outer coat with a definite abscission layer, dropping off at maturity.

2) Plants very densely branched, more or less conical, usually 4 feet tall or less. Abscission layer a simple articulation at base of Akene.

C. indica

2a) Plants not branched or very sparsely so, usually 1 to 2 feet at maturity. Abscission layer forms a fleshy caruncle-like growth at base of Akene.

C. ruderalis

Stearn [2] recently stated that the "distinctions which have been made between the taxa known as *C. sativa, C. indica* and *C. ruderalis* relate to characteristics of the fruit." He points out that when Linnaeus classified *C. sativa* in 1753 and gave India as the country of origin, the actual botanical data and description were based on plants grown in Northern Europe in 1737. To study the plant, botanists are faced with complexities regarding the variability of present-day cultivated versus truly wild *Cannabis* (noting that there can be no wild hemp except in areas where it is native). According to Schultes et al [1] a complete clarification of the botany of *Cannabis* will require field studies, where the plant is native or has not been subjected to cultivation.

In 1972, Small [3] reported the study of meiosis and pollen fertility in hybrids representing combinations of 38 different populations of *Cannabis.* He found that these populations shared the same chromosome end-arrangement, and there was no reduction in pollen fertility of first generation hybrids. This indicated that sterility barriers were not developed. The results of the interfertility studies by Small do not preclude the possibility that sterility barriers may exist, however [4]. It is known that "acceptable" species exist in certain genera where few or no sterility barriers are present [4]. Recognition of species mainly or totally on the presence of sterility barriers is a point of view accepted by some taxonomists. To other taxonomists, definable morphological differences are necessary.

Quimby [5], through taxonomic research on *Cannabis* since 1968, contends that there is only one species in this genus. Reviewing the literature of *Cannabis* encompassing approximately 21 reported species, he maintains that the only species that has been consistently reviewed and accepted by the botanical community is *C. sativa* L. He also maintains that cross-pollination between types occurs.

Takhtajan [6] has expressed his opinion regarding the genus *Cannabis* in Russia. His view of the classification differs from Janischewsky in that he believes "*C. indica* and *C. ruderalis* do not deserve the rank of species."

The term "species" is a unit of classification for both plants and animals. It is categorized by a population of similar specimens alike in their structural and functional characteristics, which breed only with each other (sometimes with fertile offspring), have a common ancestry, and, in nature, maintain structural characters through countless generations. From a practical standpoint, two types of data may be utilized for the purpose of defining species: (1) internal separation, which is of a genetic-physiologic nature expressed through incompatibility and intersterility, and through weakness of the hybrid offspring and (2) external separation, which considers criteria of flower, fruit, seed, anatomical and vegetative characters, resulting from environmental and ecological geographic factors.

Anderson [7] has examined the anatomy of *C. sativa* and *C. indica* from type loca-

tions and found very substantial differences between the wood characteristics of these plants. These findings substantiate Lamarck's description of *C. indica* in 1783 and Linnaeus' description of *C. sativa* in 1753. The anatomy of the wood is widely recognized as the most conservative character of plants which cannot be an intraspecific response to environmental factors.

The fact remains that this genus has not yet been proven unequivocally to be monotypic or polytypic. However, the photographs and text in the reference article [*1*], along with Anderson's findings [*7*], clearly describe distinct characteristics by which one variant may be distinguished from the other, lending convincing evidence to the polytypic proposal.

Most state food and drug laws are derived from the Federal law and, therefore, in addition to scientific information, we should consider the Federal law as a basis for legal interpretation. Under Title 21, U.S. Code, Section 802, *Cannabis sativa* is defined as being "marihuana." Under Title 21, U.S. Code, Section 209, Federal law defines *Cannabis indica* as a poison.

The Acts of Parliament in England and Scotland, specifically the Pharmacy and Poisons Act, 1933, and the Dangerous Drug Act, 1951, specify only the genus, *Cannabis,* as the controlled substance.

On the Federal level, however, several court rulings defining "marihuana" have occurred, stating that *Cannabis sativa* L. refers to all forms of *Cannabis* plant material, on the basis of legislative intent. Cases cited include:

(1) *United States v. Gaines,* 489 F 2d 690 (5th Cir., 1974)
(2) *United States v. Honeyman, et al.,* Crim. No. 71-1035-RHS, N.D. Cal, Sept. 13, 1972)
(3) *United States v. Honneus,* 16 Cr. L. 2338 (First Cir., Dec. 24, 1974)
(4) *United States v. Lewallen,* 16 Cr. L. 2404 (U.S.D.C. W. Wisc., Jan. 19, 1974)
(5) *United States v. Moore,* 330 F. Supp. 684 (E.D. Pa., 1970), *Affd.* 446 F. 2d 448 (3rd Cir., 1971), *Cert. Dis.* 406 U.S. 909 (1972)
(6) *United States v. Rothberg,* 351 F. Supp. 1115 (E.D. N.Y., 1972) Affd. 480 F. 2d 534 (2d Cir., 1973)
(7) *United States v. Walton,* 43 L.W. 2333 (D.C. Cir., Jan. 28, 1975)

Some states have redefined "marihuana" to include all species and variants. In other jurisdictions, however, the courts are still faced with the semantic problems, and depend largely on the testimony of the expert witness from the laboratory.

Schultes et al [*1*] have little hesitation, with the evidence available at this point, in accepting the polytypic concept on the basic question of whether *Cannabis* is monotypic or polytypic. The acceptance or rejection of a polytypic composition of the genus *Cannabis,* however, is not sufficient to rely on in a court of law. The scientist must testify to current scientific knowledge and to his results, and is incapable of differentiating botanical species among most forensic samples of plant material presented to him. As "marihuana" is a common name and has no scientific validity, the popular concept of this plant is based on chemotaxonomy, not on taxonomy. Whether there exist one or twelve species, they all contain isomers of tetrahydrocannabinol or other cannabinoids [*8–10*]. When one smokes an extracellular layer or a broad, short leaf rather than a long, narrow leaf, or a tall plant versus a short plant, the pharmacological effect will be similar due to the presence of the active component, tetrahydrocannabinol.

As the result of a technical controversy, the legal scientist is often in a quandary regarding legal testimony in answering the question, "Is this plant material marihuana?" In fact, the question demands an answer from a field in which he is possibly unqualified to give an opinion, and requires a botanical taxonomist rather than an expert in forensic chemistry or toxicology.

Forensic procedures commonly in use for identification of marihuana rely on both morphological and chemical characteristics and, properly used, can identify the cannabinoids, specific components of *Cannabis,* or can identify the plant from physical characteristics.

Microscopic Examination

The botanical examination is carried out by obtaining a random sample of plant material and observing it with a low-power microscope. The examination concentrates on the leafy material, observing the type and nature of hairs on the leaves, and the akenes or seed, observing their cellular structure.

The upper surface of the leaves carries short hairs, swollen at the base, often containing calcium carbonate crystals or cystolithic hair whose shape resembles a bear claw. This surface also carries the glandulose hairs which appear when the plant is about to flower, especially on the tops of female plants. These hairs have a shiny appearance and a sticky touch due to exuding resin. On the under side of the leaves are long, slender, fibrous hairs (called silicotic hairs) which do not have cystoliths.

The akenes, like the leaves, are very much a part of the plant. The distinctions between species, taxonomically and historically, primarily have been made on the pistillate specimen—more precisely, the fruit [*2*]. Care must be taken when examining the akenes in manicured plant material for presence or absence of an abscission layer. The drying process and the age of the plant at harvest may affect this characteristic. It is uncertain at this point as to the degree of misinterpretation of species as the result of these factors.

If all criteria are met, a complete microscopic examination is presently conclusive for providing the characteristics for the identification of *Cannabis,* and presents a possibility for the identification of the characteristics of *Cannabis sativa* (seed only).

Evolution of CO_2 from Cystoliths

If a mineral acid (for example, HCl) is added to a microscopic preparation of a suspected sample of marihuana and the calcium carbonate crystal in the basal portion of the hair decomposes with effervescence (giving off carbon dioxide), this is supportive, but not conclusive, evidence for the presence of *Cannabis* [*11*].

Duquenois Test

The Duquenois color test is chemically based primarily on the presence of the 1,3-dihydroxybenzene (resorcinol) partial structure of the cannabinoids [*12*]. A large number of naturally occurring compounds contains this basic structure; however, a majority of these contains other structural features which retard the Duquenois reagent. Thus, if the criteria for a positive Duquenois test are adhered to, and botanical evidence is also available, the Duquenois color test will lend supportive evidence of the presence of cannabinoids, but not tetrahydrocannabinol (THC) specifically.

Thin-Layer Chromatography

Shellow [*13*] states that "chromatography was never intended as a technique to identify anything and chromatographic separation cannot provide even a tentative basis for identifying an unknown substance." The first publication on thin-layer chromatography (TLC) came out during the successful period of Tswett chromatography, when efforts were being made to achieve microchromatography [*14*]. Zechmeister and Cholnoky [*15*] pointed out in 1938 that "the chief problem is not the development of a suitable apparatus, but the precise identification of the absorbed substances."

The development of TLC since 1938 has been monumental [*14*]. To date, science can use this technique for positive qualitative identification when coupled with other diagnostic parameters. In the case of the cannabinoids, a highly selective color reaction with Diazo Blue B can be utilized for the latter purpose. TLC is even used in clinical diagnosis, and in numerous forensic chemical identification procedures for the detection and identification of unknown substances. Three spots will usually appear representing cannabidiol, cannabinol, and tetrahydrocannabinol in order from point of origin. The color intensity will vary, depending on the quality of the marihuana extracted. Thus, following specific criteria, one can usually positively recognize the presence of tetrahydrocannabinol, cannabinol, and cannabidiol. If the TLC results show any deviation or discrepancies, further identification by gas chromatography or gas chromatography/mass spectrometry may be conducted.

From a morphological and chemical standpoint, one can therefore determine that the material in question contains tetrahydrocannabinol and cannabinol and has other chemical and physical characteristics that set it apart from other plant genera. Therefore, it belongs to the accepted concept of "marihuana." By legal definition in some jurisdictions, however, "marihuana" is *Cannabis sativa* L. and we cannot truthfully acknowledge the presence of this species with the exclusion of all others, especially if the material has been manicured or otherwise adulterated so that botanical characteristics are not evident. Until "marihuana" is redefined legally, we are dealing with a substance which cannot be differentiated analytically under the present legal handicap in jurisdictions bound to a specific definition of "marihuana" as *Cannabis sativa* L.

A logical and unbiased scientific approach should be taken in the identification of manicured plant material. If the plant material is analyzed and is determined to contain the same characteristics that previously described "marihuana," it should be reported that the plant material belongs to the genus *Cannabis.* The legal interpretation should be left to the courts. "Marihuana" would be, and has been in some states, more properly defined by including all possible species or variants of plants of the genus *Cannabis.*

Summary

The controversy concerning the taxonomic status of the genus *Cannabis* has now advanced to a stage where the forensic scientist has limitations to his testimony in identification of "marihuana" plant material in jurisdictions where the law defines "marihuana" as *Cannabis sativa* L. Whether the genus *Cannabis* is monotypic or polytypic is as yet uncertain, but recent taxonomic reviews weigh heavily toward the existence of three or more species within the genus. The taxonomists or forensic scientists cannot, therefore, positively state for fact that *C. sativa* is the only species existing within the genus *Cannabis.* The popular concept of "marihuana" is actually based on the chemical characteristics of the plant *Cannabis,* rather than on the taxonomic classification. This is evident in its inclusion as a drug or hallucinogenic substance under Federal and local statutes. It is therefore proposed that "marihuana" be redefined legally to include all members belonging to the genus, in jurisdictions where legal definition warrants such an act, or that these jurisdictions follow the format set forth by Federal rulings.

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