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Characterization of the Contamination of Marijuana with Paraquat

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Since 1975 the Mexican Government has operated a marijuana eradication program employing paraquat (1,1'-dimethyl-4,4'-bipyridinium dichloride) as the principal herbicide. During the latter part of 1977 and 1978, concern was voiced that paraquat-contaminated marijuana was entering the U.S.A. and might present a health hazard to those who smoked it. As a result, the Research Institute of Pharmaceutical Sciences, University of Mississippi, under contract by the National Institute on Drug Abuse (NIDA), analyzed samples of marijuana for paraquat. These samples represented large seizures of Mexican Cannabis which had been confiscated in the southwest region of the United States by the U.S. Department of Justice, Drug Enforcement Administration (DEA). Twenty of 115 samples (17%) seized from October 20, 1976, to March 1978, were found to contain paraquat at levels ranging from 2.0 to 2264 ppm with an average of 331 ppm (TURNER et al. 1979). Experiments are being conducted by the Research Triangle Institute to determine the chemical constituents of the smoke from paraquat-contaminated marijuana and the amount of paraquat that might reach the lung at various concentration levels of the contaminated marijuana. These experiments are also under contract by NIDA.

Evidence (ZAVALA & RHODES 1978, KIMBROUGH & GAINES 1970) that paraquat which reaches the lung parenchyma has a deleterious effect on the lungs has been reported. The Center for Disease Control (CDC) conducted a study to obtain information regarding the prevalence of contamination and the distribution of concentration levels of paraquat in marijuana. To meet this objective, CDC arranged to receive marijuana samples on a cooperative basis with the seven regional DEA laboratories and 14 local or state enforcement laboratories in major urban areas.

METHODS

One gram samples of marijuana were analyzed by reversed-phase paired-ion high performance liquid chromatography (NEEDHAM et al. 1979) to a detection limit of 5 ppm for paraquat with demonstrated linearity to 800 ppm.

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Control samples were field-sprayed marijuana supplied by the Research Institute of Pharmaceutical Sciences, University of Mississippi. The standards were paraquat-free marijuana to which paraquat in the aqueous solution had been added. When sample weight permitted, analyses were repeated for confirmation.

RESULTS

In this study, 1,006 marijuana samples from 910 seizures were analyzed for paraquat. These samples had been confiscated from 1975 to January 1979, with a major percentage (62.6%) confiscated in the last calendar quarter of 1978. A total of 168,424 kg of marijuana was confiscated.

The data are presented according to the U.S. Census Division from which the sample was confiscated. Figure 1 shows the 10 divisions, the number of confiscated samples received from each division, and the number of positives.

Table 1 presents these data according to both the number of seizures and the weight of material confiscated. Nationally, it was found that:

1. 33 of the 910 seizures, or 3.6%, were found to be contaminated with paraquat.

2. 1,059 of the 168,424 kg confiscated, or 0.63%, of the total by weight, were contaminated.

On a regional basis, the highest rates of contamination were found in Division VI and, to a lesser extent, in Division IX. For example, in Division VI, 23 of the 180 seizures (12.8%) were contaminated; furthermore, 1,044 of the 46,786 kg (2.2%) of the marijuana confiscated in this division were contaminated. These 1,044 kg represented about 99% of the total contaminated marijuana seized nationally. Therefore, it seems that paraquat-contaminated marijuana is most likely to be found in the Southwest.

Paraquat contamination in the 33 seizures found to contain paraquat ranged from 10-461 ppm, with a mean concentration of 111 ppm and a median concentration of 52 ppm. Of the confiscated marijuana represented here, 70% of the total seizures and 98.5% of the total weight occurred in Division VI. Twenty-three of the 33 contaminated samples (69.7%), contained less than 100 ppm of paraquat, and only 2 of 33 (6.1%), were contaminated at greater than 400 ppm.

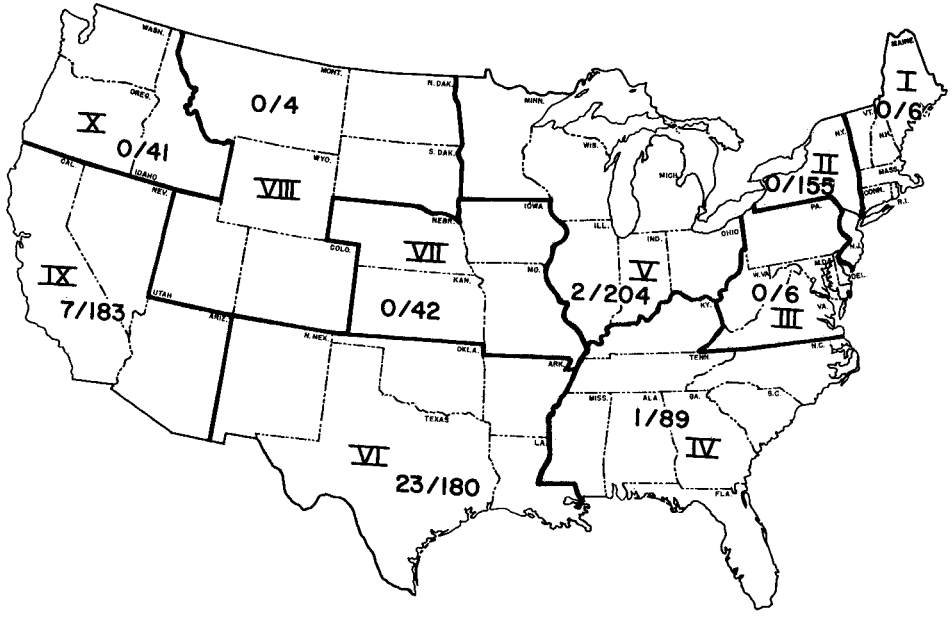

Figure 1. Seizures of marijuana in which paraquat-contaminated marijuana was found vs. all seizures, by U.S. Census Division, 1975-1978.

TABLE 1

Contaminated Seizures by Count and by Weight for Each Division

DIVISION	SEIZURES	CONTAMINATED SEIZURES	% CONTAMINATED SEIZURES BY COUNT	WEIGHT OF SEIZURES (kg)	WEIGHT OF CONTAMINATED SEIZURES (kg)	% CONTAMINATED SEIZURES BY WGT.
I	6	0	--	0.68	--	--
II	155	0	--	23184	--	--
III	6	0	--	61	--	--
IV	89	1	1.1	96804	1.7	0
V	204	2	1.0	320	0.3	0.1
VI	180	23	12.8	46786	1044	2.2
VII	42	0	--	458	--	--
VIII	4	0	--	0.61	--	--
IX	183	7	3.8	810	13.3	1.6
X	41	0	--	0.10	--	--
TOTAL	910	33	3.6	168424	1057	0.63

Of the 910 seizures, only 95 involved marijuana of known origin, with 88 involving Mexican marijuana. Data related to the Mexican marijuana are given below:

Total Weight of Seized Marijuana - 25,715 kg
Mean Weight of Seized Marijuana - 292.2 kg
Median Weight of Seized Marijuana - 1.0 kg

Number of Contaminated Seizures - 11
Percent of Total Seizures that were Contaminated - 12.5%

Weight of Contaminated Marijuana - 489.8 kg
Percent by Weight of Contaminated Marijuana - 1.9%
Mean Weight of Contaminated Seizures - 44.5 kg
Median Weight of Contaminated Seizures - 1.0 kg

Range of Paraquat-Contaminated Marijuana - 10 to 222 ppm
Mean Concentration of Paraquat-Contaminated Marijuana - 88.4 ppm
Median Concentration of Paraquat-Concentrated Marijuana - 66.3 ppm

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