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FORENSIC SUITABILITY OF SERATEC® ZEBRASHIELD FOR FIELD PRESERVATION OF CANNABIS SATIVA TISSUES: GENETIC AND TOXICOLOGICAL PERFORMANCE AFTER 30 DAYS

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INTRODUCTION

Cannabis sativa is one of the most frequently encountered plant species in forensic investigations, where reliable genetic and chemical analyses are often required for varietal identification, source attribution, and legal classification. However, the preservation of cannabis tissues remains a significant challenge, particularly when samples are collected in field conditions and cannot be processed immediately. Environmental factors such as temperature fluctuations, humidity, microbial activity, and prolonged storage may result in DNA degradation and cannabinoid alteration, potentially affecting the reliability and reproducibility of forensic examinations. Therefore, effective preservation strategies are needed to maintain sample integrity from collection to laboratory analysis and to support robust forensic workflows.

OBJECTIVES: The main purpose of this study was to evaluate the suitability of the SERATEC® ZebraShield device for preserving *Cannabis sativa* leaf and floral tissues stored for 30 days at room temperature. Specifically, we assessed its ability to maintain DNA integrity, support reliable STR genotyping, and preserve cannabinoid stability (%THC), comparing the obtained results with those from fresh plant material.

MATERIALS & METHODS

Sample collection. *Cannabis sativa* leaf and floral tissues were obtained from two independent forensic seizures (N=30). Subsamples were collected for analysis at T_0 and after 30 days of storage at room temperature (T_1) using the SERATEC® ZebraShield preservation device (**Fig.1**).

DNA extraction, quantification, amplification and CE. Cannabis DNA was extracted from all T_0 and T_1 samples. DNA concentrations were evaluated before STR amplification. Amplicons were analyzed by capillary electrophoresis (CE), and genotyping results obtained from preserved samples were compared (**Fig.2**).

THC extraction and analysis. Forensic analyses aimed to determined %THC in plant samples were based on solid–liquid extraction with cyclohexane, followed by qualitative GC–MS and quantitative GC–FID analyses. Variation in %THC between T_0 and T_1 was used to assess the suitability of SERATEC® ZebraShield vial as storage device for fresh Cannabis sativa samples (**Fig. 3**).

RESULTS & DISCUSSION

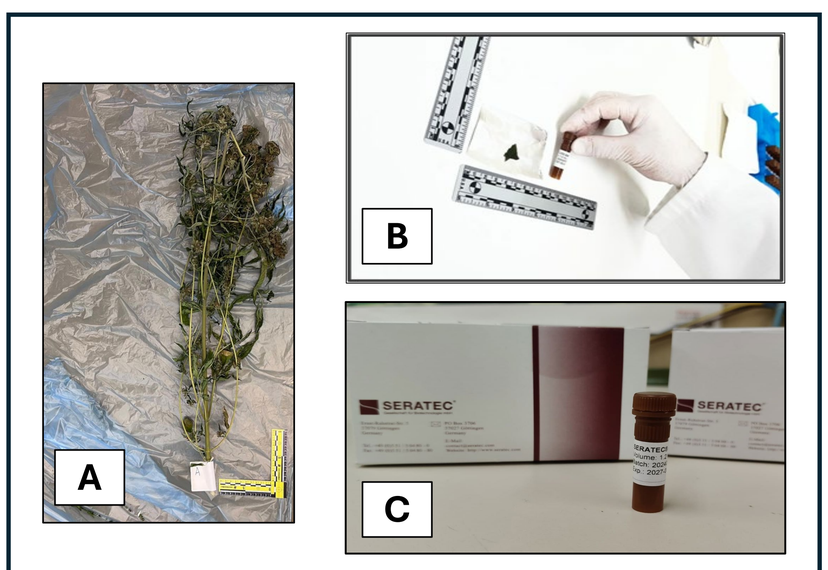


Figure 1. (**A**) One of the seized plants from which samples were collected. (**B**) Plant fragment was used for one month storage at room temperature. (**C**) SERATEC® ZebraShield's vial for the plant material storage.

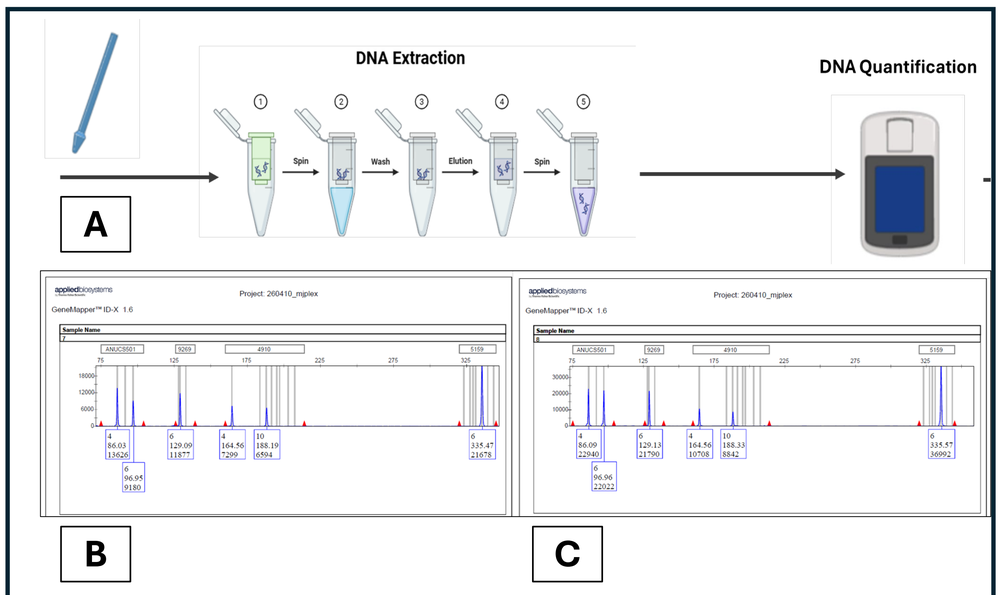
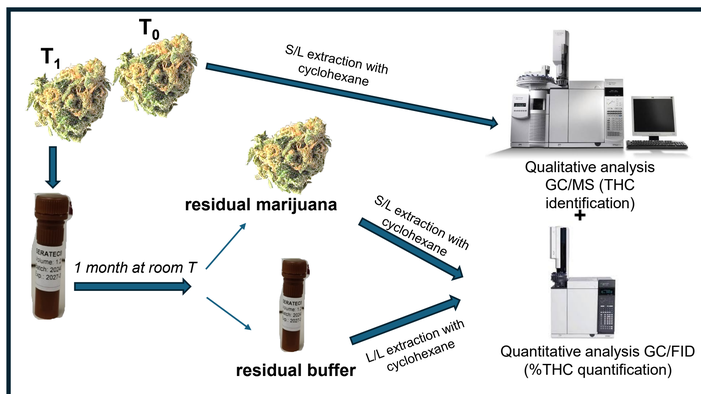


Figure 2. (**A**) Working flow from plant tissue extraction to CE analyses. (**B**) Part of the electropherogram of a plant tissue for which DNA was extracted immediately after sampling (T_0). (**C**) Part of the electropherogram of a plant tissue collected, stored in a SERATEC® ZebraShield's vial and DNA exracted after 30 days (T_1).



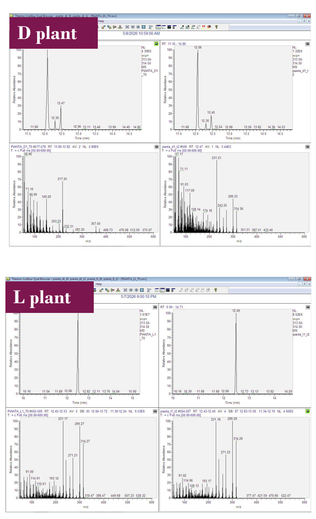


Figure 3. Sampling strategy for forensic toxicological analyses. Samples from two cannabis seized plants (D and L) with different %THC were tested. After seizing, D plant was named "legal", because its low %THC (≈ 0,3%). Instead, L plant do to its high %THC was named "illegal" (≈ 5.5%).

Δ%THC after 1 month incubation at room temperature

Sample	Aliquot (mg)	[THC] (ng/µL)	% THC	$\%THC_{Medio}$	ΔTHC%
D1-T_0	41,1	10,137	0,25%	0,31%	
D2-T_0	36,2	13,553	0,37%		
D1-$T_{1\text{-marijuana}}$	41,0	3,560	0,32%	0,29%	-6,6%
D1-$T_{1\text{-buffer}}$		9,607			
D2-$T_{1\text{-marijuana}}$	43,6	3,500	0,26%		
D2-$T_{1\text{-buffer}}$		7,996			
L1-T_0	44,8	67,244	6,00%	5,48%	
L2-T_0	36,1	44,795	4,96%		
L1-$T_{1\text{-marijuana}}$	37,8	10,092	3,90%	3,99%	-27,3%
L1-$T_{1\text{-buffer}}$		69,110			
L2-$T_{1\text{-marijuana}}$	41,5	16,324	4,07%		
L2-$T_{1\text{-buffer}}$		76,310			

CONCLUSIONS

Seratec® ZebraShield buffer resulted negative to THC, thus ensuring specificity. Comparable STR genotypes were obtained from fresh and preserved Cannabis sativa samples, indicating effective DNA preservation after 30 days of storage. After one month incubation at room Temperature, residual marijuana tested positive to THC and ZebraShield buffer partially solubilize the active principle. Variation in %THC for tested plants between T_0 and T_1 highlighted a degree of variation, that could derive from the need to further improve THC extraction from buffer. In conclusion, THC remained detectable following one month storage of fresh Cannabis sativa samples at room temperature, supporting the suitability of the SERATEC® ZebraShield device for both genetic and toxicological forensic analyses.

ACKNOWLEDGMENTS

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