

Gone with the hurricane. Impact of tropical weather in body fluid identification and DNA profiling

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Introduction

Body Fluid Identification (BFID) is of paramount importance in criminal investigations to characterize potential biological evidence. This step normally precedes DNA profiling. Current BFID methods include chemical, enzymatic and serological assays. In comparison, the latter is more specific as they are based on antigen-antibody reactions where an antibody binds to a protein unique or almost unique for the body fluid. At present there are serological rapid tests for the detection of human blood, semen, saliva and menstrual blood. Despite of the widespread use of these tests, there are no studies assessing the impact of environmental conditions on BFID and the subsequent DNA analysis. On the other hand, it is well-known that mitochondrial DNA (mtDNA) helps to identify tough DNA substrates, like skeletal remains and hairs. However, only a few studies addressed detection and analysis of mtDNA from body fluids subjected to harsh environmental conditions.

Objectives

The present work assessed the effect of tropical weather conditions on body fluid identification and posterior nuclear DNA (nDNA) and mtDNA profiling over time, demonstrating the key role of mtDNA on overcoming the issues of identification.

Materials and Methods

This experimental design and procedure were carried out using SERATEC® immunochromatographic tests for the detection of human blood, semen and saliva, for both laboratory and crime scene application. DNA quantification was carried out with Promega PowerQuant. STR profiling was performed with Promega Fusion 6C. BigDye Direct (Thermo) was used for mtDNA sequencing, according to a previously published protocol. (Figure 1)

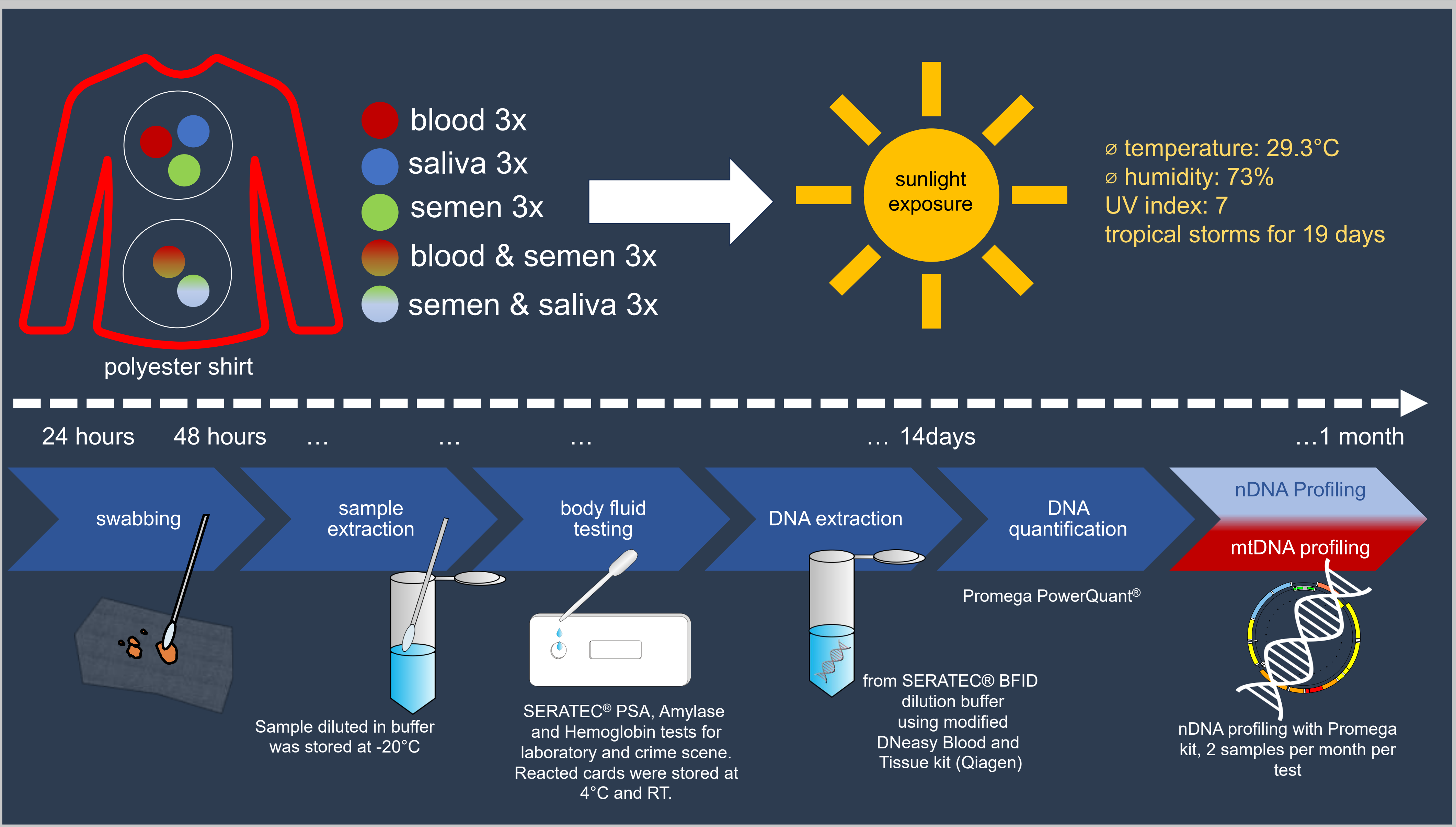


Figure 1. Experimental procedure. All samples were collected by swabbing and examined as per above workflow after 24h, 48h, 14 days and 1 month, respectively. Statistical analyses were carried out using SPSS (IBM) and applying parametric tests.

Results

Immunochromatographic Tests: It was possible to detect blood and semen on polyester clothes up to one month under tropical weather conditions. Saliva, however, was detectable after up to 14 days, but not 30 days after deposition.

STR profiles and mtDNA sequencing: It was possible to obtain full STR profiles from blood up to 14 days, and partial profiles from the other body fluids. Good quality mtDNA was obtained from all samples, allowing to assign haplogroups (Figure 2).

Discussion and Future Considerations

In conclusion, this study demonstrated for the first time the possibility of BFID and DNA profiling after exposure to tropical weather conditions over time. The success depends on the type of body fluid, as well as the length of exposure. Furthermore, it was possible to successfully integrate BFID, nDNA/mtDNA retrieval and analysis in a straightforward workflow by extracting the DNA from samples diluted in BFID tests' buffer.

Future work will be focused on BFID from stains exposed to other extreme environmental conditions as well as the optimization of DNA extraction from those samples.

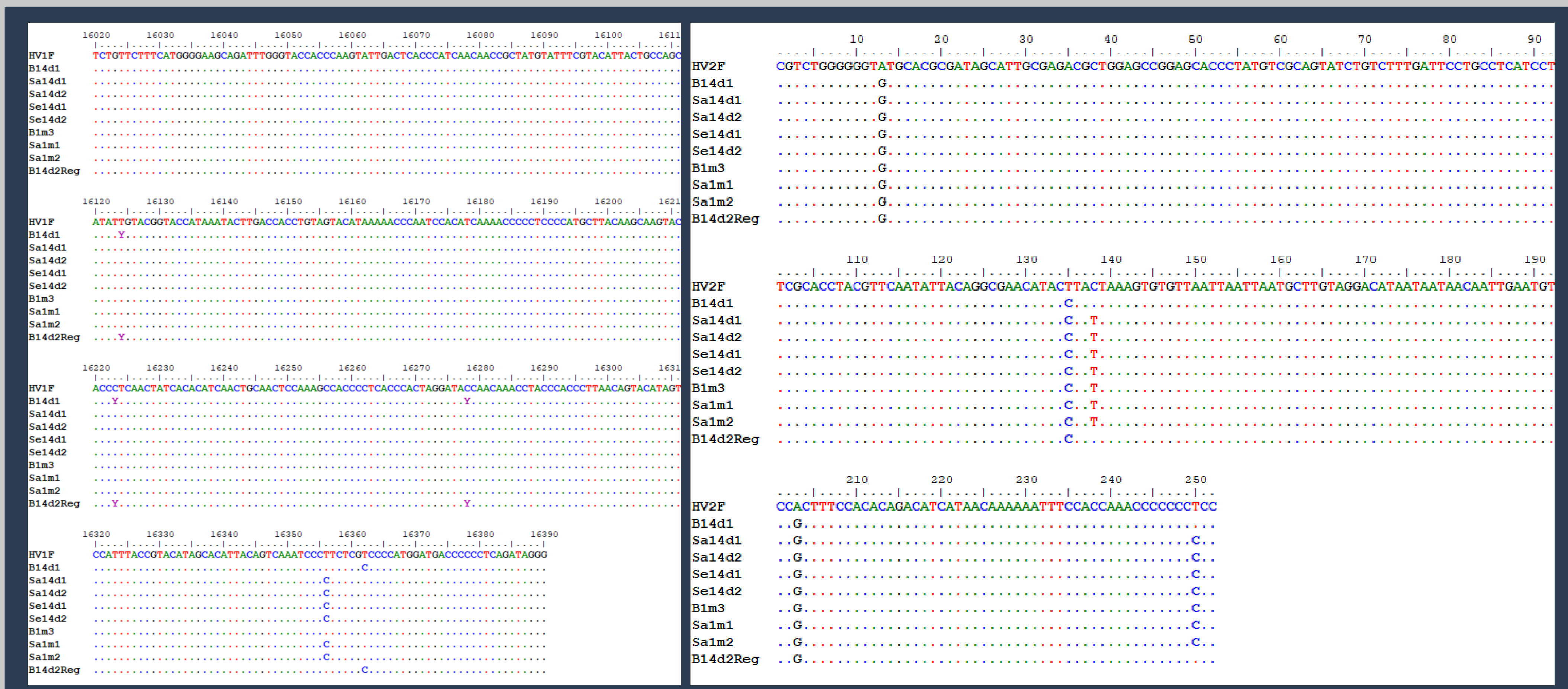


Figure 2. . mtDNA sequencing. It was possible to obtain a good quality mtDNA profile and assign haplogroups in all samples.