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DNA Fingerprinting: The New Trend in Fighting the Adulteration of Commercialized and Cultivated Medicinal Plants

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Herbal medicine refers to the long historical use of medicinal plants, which is well established and widely known to be safe and effective [1]. Moreover, and nowadays, approximately 70% of "synthetic" medicines are derived from medical plants [2]. But, with no doubt, the adulteration and/or substitution of medicinal plants remain the main problem treating the drug industry worldwide [2]. Adulteration is defined as an intentional substitution or addition of another plant species or foreign substance, in order to increase the weight, potency of the product, and/or to decrease its cost [3].

In general, adulteration is considered as an intentional practice. However, unintentional adulterations also exist in herbal raw material trade, most probably due to the confusion in vernacular names between indigenous systems of medicine and local dialects, the lack of knowledge about the authentic plant, the non-availability of the authentic plant, the similarity in morphology and or aroma, the careless in collecting and some other unknown reasons [2,3].

For many decades, many methods were elaborated for the differentiation of the spurious and authentic plants. Most of these methods were based on plant morphological observations, microscopy and chemical markers. The limitations of these methods generated a need for newer and supportive techniques [4-6].

Based on the concept of the DNA fingerprinting applied in the determination of the ancestry of plants, animals and other microorganisms, the genotypic characterization of medicinal plants became a strong method that genetically detects adulterations or substitutions by searching for specific genes [1,3,6].

In a recent study, samples of *Rheum ribes* L. (Lebanese Rhubarb) roots commonly used and sold in the Lebanese market were collected in order to determine their chemical composition, compare them to a genuine one, and to check if they're falsified or not. The chemical composition was identified and compared with different samples bought from various herbalist shops scattered across the Lebanese regions. Interestingly, some morphological and microscopic differences were observed between few of the samples. Yet, the authors mentioned that these methods weren't reproducible because no clear conclusion could be drawn. For further confirmation, DNA analysis was used to show that three out of thirteen analyzed samples were not *Rheum ribes* [7].

In another example, Macroscopic and microscopic description of samples claimed as *Viola odorata* L. from several herbalist shops in Lebanon, have shown that these samples refer to *Cercis siliquastrum* L. After many tests of specificity of the designed primers for each plant, the PCR analysis reveals that 20% of the collected samples contained the DNA of both *Viola and Cercis,* and 80% showed negative results with the primers of Viola and positive results with the primers specific to *Cercis.* These results clearly describe a good example of a fraudulent adulteration of Viola with *Cercis* [1].

DNA fingerprinting of medicinal plants using PCR techniques has become an invaluable tool to detect adulteration. DNA sequencing also start increasing in this specific domain, either in combination with, or as a replacement for traditional DNA fingerprinting techniques. A major example is the use of short, standardized regions of the genome as taxon barcodes for biological identification of plants [8-10].

Because of the increase in the rate of dependence on herbal medicine, and the gap in supply and demands, the falsifications will continue to grow, and the hazardous effects of such actions will directly affect human health. The cultivation of authentic medical crops remains the best way to fight falsification, and the ideal way to detect adulteration actions is by developing new techniques that are very specific and relatively fast and low cost. Till today, DNA fingerprinting remains the most reliable technique in the modern pharmacological research worldwide.

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