

## Ph.D. Thesis Summary

# *In vivo* and *in vitro* Study of the Protective Effect of a Phenolic Extract of *Morus alba* Against Glyphosate Toxicity

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Since ancient times, man has always been concerned about increasing the quantity and quality of his crops, preventing them from being damaged by insects, fungi, undesirable plant species, etc. However, it was not until after the Second World War those pesticides began to be used on a large scale as a basic tool to control pests that destroy or reduce crops.

But here a major problem arose, which is the confirmed involvement of pesticides in the phenomenon of oxidative stress, which research continues to demonstrate day by day its great share of responsibility in the induction of dozens of major pathologies and disorders.

To face this situation, it was essential to resort to natural antioxidants.

Today, consumers are more and more interested in increasing the consumption of fruits and vegetables in their diet, due to the presence of bioactive compounds, which are linked to the benefits for human health, such as reducing the risk of suffering from various diseases.

Mulberry trees have a pleasant and sweet taste, in addition, some varieties have attractive colors at ripening, they are popular and appreciated on the world market. The fruits of mulberry trees contain a wide range of bioactive compounds and their use in natural medicine is ancestral. In Asian countries, healing properties are attributed to the leaves, fruits and root bark. This is why, in recent years, its consumption has increased.

The main objective of this thesis is the physico-chemical, then physiological characterization of the leaves of white mulberry tree Tunisian cultivated in northern Tunisia. To achieve this general objective, the following specific objectives are proposed: Identification of bioactive compounds in the leaves by colorimetric assay methods (Ciocalteu Folin test) and by chromatographic analysis using HPLC-DAD chromatography and LC-MS technique. Antioxidant properties were measured and demonstrated by the



reduction methods is that of free radical scavenging using DPPH- and ABTS-. The *in vivo* and *in vitro* evaluation of antioxidant and anti-inflammatory effects in animal and cell models treated with Glyphosate (herbicide).

#### **KEYWORDS**

White mulberry, polyphenols, antioxidant activity, neuroprotective activity, glyphosate, chlorogenic acid, oxidative stress, BV2, PC12, apoptosis, necrosis, neurotoxicity

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#### **KEY CONTRIBUTIONS**

This study reinforces the scientific knowledge on phytotherapy in particular with the bioactive substances of the white mulberry of the Mediterranean zone and their beneficial effects in particular on the detoxifying organs like the liver against the xenobiotics like the pesticides, which can be of an important utility for the pharmaceutical industry based on the natural resources. This work will therefore help researchers to better elucidate the risks of the arbitrary use of glyphosate-based products on the one hand and on the other hand to better valorize medicinal plants and their powerful protective molecules.

#### **FUTURE DIRECTIONS**

Further studies will be needed to make this work usable for the development of a phytomedicine. This study could eventually be completed by a bio-guidance of our extracts. This will involve fractionating the extracts on cultured cells, purifying the most active fractions and determining the chemical structure of the compound responsible for the neuroprotective effect in each case of neurotoxicity. Also, possible synergistic/antagonistic effects between the various phenolic compounds should not be overlooked in future work, in order to deepen our knowledge of the behavior of all the chemical compositions of the extracts studied.

To further elucidate the mechanisms of action and signaling pathways involved in neuroprotection and with a view to developing new therapeutic approaches aimed at reducing the oxidative stress responsible for the neuronal death observed in glutamate excitotoxicity-related neurodegenerative disease. We hypothesized that protein expression is correlated with gene expression. Therefore, in order to confirm our hypotheses, we need to evaluate *in vitro* gene expression and protein activity (antioxidant enzymes).

**DECLARATION LETTER**

**Subject:** Declaration of Intent to Publish Thesis Summary in Science Digest

Dear Editor,

I, El Hafedh El Mouhab, hereby declare on behalf of all the authors involved in the research, that we have reached a unanimous agreement to publish the summary of our thesis, titled "*In vivo and in vitro* Study of the Protective Effect of a Phenolic Extract of *Morus alba* Against Glyphosate Toxicity", in Science Digest.

This research was conducted at the Laboratory of Neurophysiology, Cellular Physiopathology and Biomolecule Valorization, Department of Biology, Faculty of Sciences of Tunis, University of Tunis El Manar, Tunisia under the supervision of Prof. Mohamed Amri, during the academic year 2021. The study represents the culmination of El Hafedh El Mouhab's Ph.D., research project and we are excited to share the key findings with the global scientific community through the esteemed platform of Science Digest.

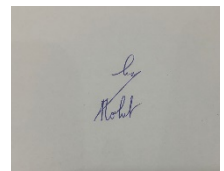
This declaration confirms that all co-authors have been made aware of and have consented to the publication of the thesis summary in Science Digest. Furthermore, we affirm the accuracy and completeness of the information provided in the submission.

Thank you for considering our work for publication.

Sincerely,

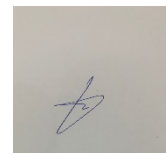
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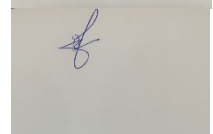
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