

Forsythia's Pharmacological Evaluation and Genetic Toxicology

Abstract

An indigenous fragrant and therapeutic herb is *Origanum elongatum* L. The previous research on *O. elongatum*'s taxonomy, botanical description, geographic distribution, bioactive chemicals, toxicity, and biological effects is summarised in this article. Chemical tests revealed that *O. elongatum* contains a variety of chemical substances, particularly volatile substances. Studies on the pharmacology of *O. elongatum*'s volatile components and extracts revealed that they have a variety of medicinal benefits, including antibacterial, antifungal, antiviral, antioxidant, vasodilator, corrosion inhibitor, and hepatoprotective activities. Additionally, toxicological studies showed that this species is safe. The primary chemicals in *O. elongatum*, which show a variety of pharmacological activities with a wide range of mechanistic insights, may be linked to the pharmacological actions of the plant.

Keywords: polyacetylenes • pharmacology • toxicology • pharmacokinetics • antioxidant

Introduction

This review discusses current developments in our knowledge of decavanadate toxicity and pharmacological uses. According to toxicological *in vivo* research, V10 causes different changes in oxidative stress indices than those seen with vanadate (V1). The depolarization of mitochondria (IC₅₀ = 40 nM) and oxygen consumption (99 nM) in *in vitro* tests with mitochondria showed a particularly robust V10 effect in compared to V1. It is hypothesised that a crucial step in decavanadate-induced necrotic cardiomyocyte death involves mitochondrial membrane depolarization [1]. In addition, only decavanadate species, not V1, had strong inhibitory effects on myosin ATPase activity that was activated by actin (IC₅₀ = 0.75 M), while these inhibitory effects were less pronounced for Ca²⁺-ATPase activity (15 M) and actin polymerization (17 M). It is likely that V10 interacts at specific places with these proteins that protect against hydrolysis, but on the other hand, it may drive V10 reduction to oxidovanadium because interactions with the calcium pump and actin decavanadate lead to its stability (IV). All things considered, it is indicated that in addition to V10 and V1 species, vanadium (IV) species may potentially be involved in the pharmacological uses of V10 species and compounds whose mechanism of action is yet unclear [2].

Moroccan endemic *Origanum elongatum* (Bonnet) Emberger ET Maire is a fragrant and therapeutic plant. It is a perennial herb from the *Origanum* genus and a member of the Lamiaceae family. It is only found in Morocco's northeast (NE), which stretches from the Middle Atlas to the Rif Mountains, ranges and is primarily at high altitude on the mountains (the mountain of Tazekka and the mountain of Bouyablane). *O. elongatum* was found to contain many kinds of bioactive components, including terpenoids, flavonoids, oxygenated compounds, hydrocarbon compounds, and phenolic compounds, according to phytochemical studies. These species' primary volatiles are carvacrol, thymol, linalool, and limonene. Chemical study revealed that depending on the plant part and the collection place, the chemical makeup varies among numerous published studies [3].

Pharmacological studies revealed that *O. elongatum* extracts and essential oils (EOs) had a range of biological actions, including hepatoprotective, antioxidant, antibacterial, antifungal, antiparasitic, and antiviral properties. These biological effects are undoubtedly

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a result of *O. elongatum*'s chemical makeup, particularly its principal constituents carvacrol, linalool, and thymol. Indeed, studies in the literature found that these substances had a variety of pharmacological effects. Additionally, the toxicological studies revealed that *O. elongatum* caused a modest alteration in behaviour along with transient drowsiness and lack of appetite without altering pathophysiological or neurological activity, and the LD50 was higher than 3000 mg/kg [4].

The goal of this review is to examine all prior research on *O. elongatum* L. in terms of taxonomy, botanical description, geographic distribution, ethno botanical prospecting, toxicology, and all studies on the biological activities of the various parts of this plant. We will also provide a summary of all phytochemicals that have been isolated and identified from the extracts or EOs of this plant. The goal of this research is to establish a solid scientific foundation for future investigations and the creation of *O. elongatum*-based pharmaceuticals [5].

Materials and Methods

Origanum elongatum's botanical description, taxonomy, decomposition, photochemistry, and biological characteristics were all the subject of the information gathering. To gather papers regarding *O. elongatum*, a number of databases were examined, including Google Scholar, Web of Science, Scopus, Science Direct, Springer Link, Wiley Online, SciFinder, and PubMed. The data were gathered for all years. In this evaluation, the articles were gathered, arranged in tables, examined, and highlighted for each field. *O. elongatum*'s chemical constituents were taken from the PubChem database, and their chemical structures were shown using the Chem Draw Pro 8.0 programmer [6].

Discussion

A native to Morocco, *Origanum elongatum* (Bonnet) Emberger et Maire is a species. It is a woody perennial with up to 90 cm long stems. It has tall, light- or dark-brown (purplish) stems with hirsute (hairs about 1.5 mm long) bases and frequently glaucous leaves. First-order branches can be found in the upper third to half of the stems and can be up to 15 pairs long and 4 cm wide. Second-order and third-order branches are less frequently

found. Spikes make up every branch, either totally or mostly. Up to 30 pairs of leaves per stem, oblong or oval, whole margins, obtuse tops, 10 mm long, 8 mm wide, somewhat leathery, light green or purplish, frequently glaucous, glabrescent (pilose to glabrous; hairs c. 1.2 mm long), and up to 1600 sessile glands per cm² are the characteristics of the leaves [7]. The 40 mm long, approximately 3 mm diameter spikes are rather flimsy and loose. There are 10 pairs of lanceolate, top-acute, 3 mm long, 1 mm broad, glabrous or pilosellous, green, and frequently glaucous bracts per spike. The subsessile flower. Calyces are 3.5 mm long, glabrous or pilosellous on the outside, and have 1 mm long teeth. Corollas are 6 mm long, pink, and outer pilosellous. The upper lip is divided into two, roughly 0.3 mm long lobes, while the lower lip is divided into three, roughly 3/5 of inch long lobes. Staminal filaments can be between 2 and 3.5 millimetres long. Styles can be as long as 8 mm [8].

The word *origanum*, which means "ornament of the mountains," is derived from two Greek words, "oros," which means mountain, and "ganos," which means brightness. The word "Oregano" first appeared in French in the 13th century, originating from Mexican "*Lippia* sp." and European "*Origanum* sp." Around the world, the term "Oregano" is frequently used to describe a spicy scent and flavour. The Lamiaceae family and Nepetoideae subfamily are both home to the genus *Origanum*. Dr. JH letsvaart substantially altered the taxonomic point of view in 1980. letsvaart split the genus into three divisions, ten sections, 38 species (one with six subspecies and another with three variations), and 17 hybrids in this work. Based on the morphological characteristics of the plant, this classification was made (length of the stem, number of branches, and shape of the leaves) [9].

Five species of *Origanum* are found in the Moroccan flora, of which two (*O. compactum* and *O. vulgare* subsp. *virens*) are thought to represent Ibero-Moroccan species and three (*O. elongatum*, *O. grosii*, and *O. fontqueri*) are indigenous to the country. These three Moroccan steno-endemics are susceptible to taxonomic misunderstanding because of their striking morphological similarity. *O. grosii* and *O. fontqueri* are regarded as synonyms of *O. elongatum* in several databases. The hybrid *Origanum fontqueri*

is not included in the letswart classification, despite the fact that *O. grosii* and *O. elongatum* have different morphological characteristics that distinguish them as two distinct *Origanum* species. *O. elongatum* has longer stems, ears, and leaves than *O. grosii*, but *O. grosii* has a longer and wider bract. However, *O. elongatum* and *O. grosii* differ morphologically from *O. compactum* (section *Prolaticorolla letsw*) and *O. vulgare* subsp. *virens* in a clear and noticeable way (section *Origanum L*) [10].

Conclusion

Decavanadate would cause oxidative stress in organisms more frequently than one may anticipate. Ion pumps, mitochondria, and particular biochemical procedures may interact with decavanadate to cause stress. The depolarization of the mitochondrial membrane is thought to be the mechanism through which decavanadate induces necrotic cell death. The concurrent actions of decavanadate on ion pumps and mitochondria result in alterations in ROS production, an increase in intracellular calcium, and a suppression of the activities of antioxidant enzymes including SOD and catalase. Decavanadate's molecular targets include several important proteins involved in muscle contraction and its control.

The putative back-door mechanism of V10 myosin ATPase inhibition induced by actin as well as the suppression of actin polymerization by decavanadate, although the latter process needs further clarification, are particularly intriguing. Since their cytotoxicity was higher than their rate of tumour cell growth inhibition, several decavanadate compounds appear to be unsuitable for anticancer action. Decavanadate, however, has been successfully used in antibacterial activity and has been reported as having many other pharmacological applications, such as an antidiabetic drug in addition to activities against viruses. All things considered, it is suggested that knowledge of the pharmacology and toxicology of decavanadate may be helpful, at least in part, to clarify the biological functions of various polyoxometalates in order to make them accessible and secure for clinical usage.

Morocco has an abundance of plant resources, including a unique variety of

medicinal plants that are employed in the diagnosis, treatment, and prevention of a number of diseases. This study confirms and supports the widespread use of these plants as antibacterial, antifungal, antiviral, antioxidant, vasodilator, corrosion inhibitor, and hepatoprotective agents to treat various diseases by demonstrating that the Moroccan *O. elongatum L.* species possesses active principles that exhibit notable therapeutic effects. The current study provides pertinent information that is sufficient justification for *O. elongatum L.* clinical trials. Further research should be done, especially to establish the safety of the medication, even though preliminary studies have verified its therapeutic effect.

Conflicts of Interest

None

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None

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