



## A review of poisonous plants in Saudi Arabia

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### Abstract

A diverse range of flora characterizes the Kingdom of Saudi Arabia, including both edible and medicinal plants, as well as various species of trees, herbs, and shrubs. The wide expanse of the KSA's various geographic regions and climates is what makes it unique. Wild plants have great economic importance and are useful to living organisms in many ways, such as food and medicine. In addition, various bioactive compounds are also present in these wild plants, which are known to exert various biological and pharmacological properties. In the Saudi Arabian kingdom, there are several such wild plants that are present and that are traditionally used against insects, infectious diseases, and chronic disorders. However, many of these have compounds that are toxic to various organisms, including humans and animals. The medicinal. The utility of these plants is therefore compromised if used incorrectly and in large quantities, as they will have a toxic effect. And due to the widespread use of these plants by the local population, information about their toxicity must be known to reduce the incidence of accidental poisoning. The value of this paper lies in educating people about the dangers of poisonous plants and highlighting them for use in the pharmaceutical industry. In addition, this review presents a set of studies that provided data for toxic floral diversity in Saudi Arabia.

**Keywords:** Saudi Arabia, wild plants, poisonous plants, toxicity, pharmaceutics

### Introduction

Poisonous plants cause numerous, and sometimes catastrophic, losses to the diversity of secondary compounds they produce that can harm human and animal health and cause poisoning and death (Panter *et al.*, 2019) [21]. Poisonous plants are plants that are toxic in whole or in part under all or some conditions, and the harmful effect of which varies. Their contact with an organism will exert harmful effects or cause death immediately or by the cumulative action of the toxic property, due to the presence of a known or unknown chemical effect (Angus, 2008) [9]. Because of these toxic plants, there is no difference between poisonous and non-poisonous plants. Typically, these plants have higher levels of toxic alkaloids, making the taste bitter or unpleasant, but some poisonous plants can have a sweet or agreeable taste, and their delicious fruits are visually appealing (Douglas, 2008) [11]. The toxic nature of the whole plant or any part of the plant may be due to the production of toxic substances such as alkaloids, glucosides, amines, toxalbumin, kerotoxin, resins, saponins, tannins, etc., many of which are harmful to human and animal life. (Ketewa *et al.*, 2008) [15]. These diverse toxic floras have been reported throughout the different regions of Saudi Arabia. However, several of the animals and microorganisms are tolerant to lower quantities of poisonous plants or their products. However, high dose intake or consumption of the plants in larger quantities causes several degenerative effects on various animals, including cattle and poultry. These toxic potentials are also utilized in an alternative way to control the population of various pests (Johnson, 2009) [14]. The purpose of this paper is to refer to studies that dealt with the effects of toxic flora in Saudi Arabia and the concept of plant toxins in order to comprehend the mechanisms of toxic compound formation that are manufactured and stored in the plant, the mechanisms of poisoning by plant toxins, the

toxic effects of plant toxins, and the prevention of poisonous plants.

### Plant toxins

Phytotoxins are naturally occurring plant chemicals or secondary metabolites formed in plants as protection against various threats such as infection by bacteria, fungi, insects, and animals. Phytotoxins can be found in fruits and vegetables commonly consumed by humans (Nriagu, 2019) [20]. Toxins are peptides, but they are also low molecular weight compounds, such as alkaloids, terpenoids, saponins, or other secondary metabolites. A lot of humans, especially villagers or their cattle, are continuously exposed to deleterious compounds in nature. Non-proteinogenic amino acids biosynthesize many phytotoxins via biosynthetic pathways inferred from the isotope tracer analysis results. Humans have used these secondary cultures for thousands of years as drugs and as agents for animal killing and murder (Vickery, 2010) [26]. The toxicity of chemical compounds produced by a plant as any toxic chemical compound is determined by several factors, including how much of the substance a person is exposed to, how they are exposed, and how long (Kumarappan *et al.*, 2011). These plants contain numerous toxic compounds such as alkaloids, tannins, and anthocyanins (Alsop and Karlik, 2016) [7], Rasool *et al.* (2022) [22, 27] reported a total of 38 species of flowering plants belonging to 23 families and 38 genera considered poisonous, for example, but not limited to, the family Asteraceae, Solanaceae, Fabaceae, Euphorbiaceae, and Convolvulaceae. The quantity of toxins that are contained in a toxic plant depends on various factors; this includes the plant itself, the environmental conditions, and the nutrient availability. Geographical location, time of year, and plant growth conditions may also affect the levels of these toxic compounds in a plant (Alsop and Karlik, 2016) [7].

### Toxins Found in Plants and their effect

Plants contain a variety of toxic compounds, and the classes are diverse. However, soluble alkaloids, terpenoids, and phenols are the most common. Phytotoxins are described according to the organ system in the human body that they affect, such as neurotoxins and cardiac toxins. They are also classified according to their structural and chemical properties, divided into alkaloids, glycosides, tannins, proteins, oxalates, enzyme inhibitors, antivitamin, phytoestrogens, and volatile ether layers (Sekhar *et al.*, 2012) [23]. It involves plant poisoning if it has been eaten. Also, contact with some plants may cause allergic reactions and skin irritation that can lead to a rash. Such as hay fever, which is caused by the dropping of pollen grains during the breeding season of the plant, as well as contact dermatitis, which results from direct contact with some types of plants. Strategies vary in the action of plant toxins after infection of the organism. Some of them work by disrupting the membrane, inhibiting signal transduction processes, inhibiting the exchange of ions and nutrients, inhibiting metabolism, or thwarting hormonal control of physiological processes (Mithöfer and Boland, 2012) [18].

### Studies of inventory and identification of plants in the Kingdom of Saudi Arabia

In southwestern Saudi Arabia, sixty-one species used in folk medicine belonging to 33 families of angiosperms are reported to have toxic components (Abulafatih, 1987) [2]. The majority of species are wild, and a few are cultivated. It was found in his study that some plant species have a poisonous side, such as *Nerium oleander L.* (Apocynaceae), *Euphorbia schimperiana*, *Jatropha sp.*, and *Ricinus communis L.* (Euphorbiaceae), and *Datura stramonium L.* (Solanaceae). The study by Doaigey (1991) [10] indicated the types of crystals in 16 poisonous plants that grow naturally in many regions of Saudi Arabia *Chenopodium album*, *Datura stramonium*, *Nerium oleander*, *Ricinus communis*, *Rumex nervosus*, *Withania somnifera*, *Anabasis articulata*, *Pergularia tomentosa*, *Convolvulus arvensis*, *Ammi majus*, *Anagallis arvensis*, *Calotropis procera*, *Citrullus colocynthis*, *Euphorbia peplis*. The scientist concluded at the end of their study that there is no relationship between the type and composition of crystals in the toxic properties of plants.

In a study on the toxicity of *Euphorbia helioscopia* (Euphorbiaceae) newly collected from the area surrounding the College of Veterinary Medicine and Livestock at King Faisal University in the Al-Ahsa region on fifty-two rats of both sexes to estimate the LD50, most of the rats that were given a high dose died after a latent period (3 hours), some animals in the other groups died within 24 hours) and the study concluded that the plant is moderately toxic and should not be added to animal feed (Al-Sultan, 2006) [8]. Furthermore, Sharawy and Alshammari (2009) [25] conducted a survey to inventory poisonous plants and animals in the western part of the Hail region, specifically in Jabal Aja. The data of 65 poisonous plant species are classified into 30 different families, which include one fungus, one thallophyte, five monocotyledon genera, and several other families. The study included the names of plant species and their families as well as the poisonous parts.

Akbar and Al-Yahya (2011) [3] examined one hundred and fifty local plants from different regions of Saudi Arabia for the detection of plant intrinsic compounds and their efficacy against microbes. It was found that the majority of plants contain alkaloids, flavonoids, tannins, sterols, and triterpenes. Finally, five plants, *Atractylis carduus*, *Calotropis procera*, *Cleome chrysantha*, *Cocculus pendulus*, and *Conyza incana*, were found to be highly toxic to animals and to have a role in causing major joint neuromuscular disability. Some of them also had a role in significantly lowering blood pressure, and thirteen plants showed a stimulating effect on the heart. Poisonous plants have been identified that grow in the Qassim region the Qassim region and have an impact on human and animal health, identify the chemicals they contain and the effects of eating them or even contacting them by humans or animals. 42 species belonging to 39 genera and 23 families have been recorded, which represents about 10% of the total plants in the region. The family Poaceae recorded the largest proportion of the number of poisonous individuals, followed by members of the families Chenopodiaceae and Boraginaceae (El Ghazali and Mousa, 2013) [12].

Many poisonous plants were recorded in the Al-Adir Valley in the Hail region, such as *Anagallis arvensis*, *Calotropis procera*, *Cleom amblyocarpa*, *Conyza discordis*, *Datura stramonium*, *Fagonia cretica*, *Forsskalea tenacissima*, *Gymnarrhena micrantha*, *Hyoscyamus muticus*, *Leptadenia pyrotechnica*, *Solanium nigrum*, *Tribulus terrestris*, *Tribulus terrestris*, *Trichodesma africanum*, *Withania somnifera*, and *Zygophyllum simplex* (Alshammari *et al.*, 2015) [6]. *Hyoscyamus muticus L.* (Solanaceae) is an endangered desert plant that is found in the Arabian Peninsula and the deserts of the Middle East. Chemical analyses were made of the aerial parts of the cultivated plant grown in the arid region of Wadi Arar, Arar region, Saudi Arabia, during the summer season of 2016. The analysis revealed the presence of phenols, flavonoids, tannins, and sterols Eman *et al.* (2018) [13] and Sevon *et al.* (2001) [24] mentioned that the plant contains hallucinogenic and toxic properties. *Atropa belladonna* is another important plant that is used in folk medicine in various medicines and is a rich source of many alkaloids such as atropine, scopolamine, and others. Almubayedh *et al.* (2019) say that the plant or parts of the plant can make you sick if you eat them on purpose or by accident.

In the analysis of a collection of medicinal plants used in ethnomedicine in the Kingdom of Saudi Arabia, Aati *et al.* (2019) [1] reported 309 genera that contained 471 species out of a total of 2253 recognized species that belonged to 89 families. *Asteraceae*, *Fabaceae*, *Lamiaceae*, *Euphorbiaceae*, *Solanaceae*, *Apiaceae*, *Brassicaceae*, *Chenopodiaceae*, *Poaceae*, *Amaranthaceae*, *Boraginaceae*, *Apocynaceae*, *Convolvulaceae*, *Asclepiadaceae*, *Capparaceae*, *Polygonaceae*, and *Zygophyllaceae* Studies by Alrawili *et al.* (2020) [28] have consolidated the poisonous plants in the Osfan region northwest of Mecca, to raise awareness of their danger and their usefulness in the pharmaceutical industry. The study recorded 34 poisonous plants in the area, and their apparent description and toxicity were included as well as their exact location. Further, *Achillea fragrantissima* collected from multiple sites in the central region of Saudi Arabia contains about 24% trans-sapiny acetate. The compound is usually not found in such large quantities in the plant which were collected other

geographical locations. Hence, these plants should not be used for any kind of edible or medicinal purpose, without the advice of traditional practitioners only (Khan *et al.*, 2020) [16]. Later, Al Nasr (2020) [4] indicated a group of three plant species collected from Al Qassim region that have a toxic effect *Anti-Leishmanial*, which are *Teucrium oliverianum*, *Pergularia tomentosa* and *Cleome amblycarpa*. A recent study by Mseddi *et al.* (2021) [19] indicated that *Cleome africana*, *Euphorbia retusa*, and *Citrullus colocynthis* are poisonous plants that spread in the Selma Mountains, which is a naturally protected habitat in the Ha'il region in the north of Saudi Arabia.

### Conclusion

It is common for people to mistakenly believe that the use of herbs as a treatment for some diseases, to reduce or gain weight, or even to treat skin and hair is completely safe because they are natural products, and this is not true. Herbal medicines may produce negative effects such as allergies, rashes, asthma, headaches, nausea, vomiting, and diarrhea that can range from mild to severe and can lead to death, like other prescription medications. Nowadays, there is a great increase in the demand for herbal medicines. Plants are famous for possessing many chemical compounds with a lot of medicinal properties, and many powerful and effective medicines have been isolated from medicinal plants to treat terrible diseases. Hence, it becomes clear that studies of medicinal plants are of great importance for the benefit of humans in terms of manufacturing herbal medicines, so studies on plants must be intensified to reveal their suitability for safe use or not. In fact, both preclinical and clinical research is needed to figure out how effective and safe plant products are.

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