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iHERITAGE JORDAN

EXPLORING THE MEDICINAL PROPERTIES OF WILD PLANTS IN PETRA: INSIGHTS FROM THE ANCIENT CAPITAL OF THE NABATEANS

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VR/AR proposed projects for Petra

The Jordanian Society for Research, Entrepreneurship and Creativity





A Rose - Red City Half As Old As Time (By John William Burgon 1845)

It seems no work of Man's creative hand,
by labour wrought as wavering fancy planned,

But from the rock as if by magic grown,
eternal, silent, beautiful, alone!

Not virgin-white like that old Doric shrine,
where erst Athena held her rites divine;

Not saintly-grey, like many a minster fane,
that crowns the hill and consecrates the plain;

But rose-red as if the blush of dawn
, that first beheld them were not yet withdrawn;

The hues of youth upon a brow of woe,
which Man deemed old two thousand years ago,
match me such marvel save in Eastern clime,
a rose-red city half as old as time.

EXPLORING THE MEDICINAL PROPERTIES OF WILD PLANTS IN PETRA: INSIGHTS FROM THE ANCIENT CAPITAL OF THE NABATEANS

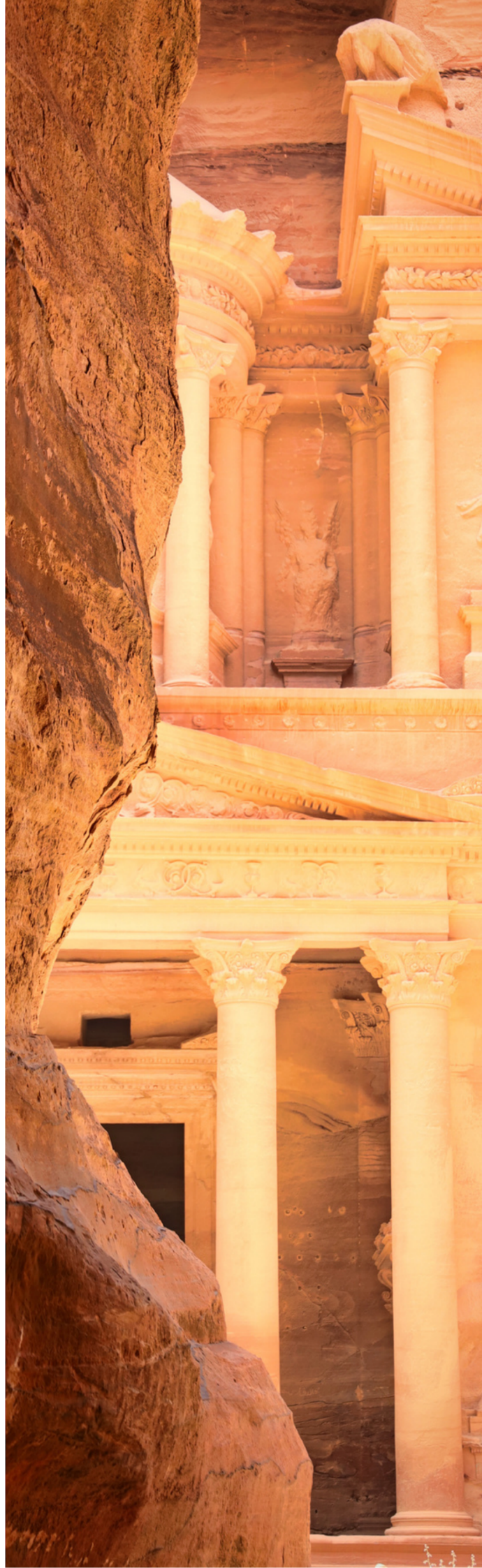
BACKGROUND OF PETRA AND TRADITIONAL MEDICINE

Petra, a breathtaking archaeological site located approximately 250 km south of the Jordanian capital Amman, boasts a unique geographical position, nestled within the Mediterranean phytogeographical region. Petra is a semi-arid Mediterranean bioclimatic zone with cooler temperatures. The area extends into the Irano-Turanian and tropical regions in the west near Wadi Araba, offering a diverse array of flora and fauna for visitors to discover.

The surrounding mountains of Petra, rising to 1500m, encircle the site from the east, creating a stunning natural amphitheater. Water sources, primarily rainfall, snow, and the springs of Wadi Musa, nourish the land. Rainfall ranges from around 400 mm in the north to 50 mm in Wadi Araba in the west. The soft, fertile soil of the Ash-Sharah Mountains, which is clayish with light yellow to grey color, was cultivated in ancient times for fruit trees and cereals (Oran, 2005).

With virtual and augmented reality technology, visitors can immerse themselves in Petra's natural beauty and explore its fascinating history. By utilizing these innovative tools. Visitors can discover the region's unique plant life and medicinal properties, gaining a deeper understanding of the local culture and heritage.

Consequently, herbal medicine has long been a primary source of healthcare in developing countries, providing affordable treatment for many people. In Jordan, traditional medicine based on medicinal plants is widely recommended and plays a crucial role in healthcare, particularly for those living in remote areas. It is estimated that over 80% of the population still rely on herbal medicine, which has been used for centuries and is deeply ingrained in Jordanian culture (Hamdan and Afifi, 2004; El-Dahiyat et al., 2020).





The ancient Hippocratic-Galenic method of traditional medicine, further developed by Muslim medical scientists during the Middle Ages, is still widely practiced in Jordan today. While modern medicine is also available, herbal medicine remains highly popular due to its cultural significance and effectiveness in treating various ailments (Lev and Amar, 2002).

With the development of virtual and augmented reality technology, one can venture into the realm of traditional herbal medicine in Jordan with a fresh and immersive perspective. Individuals can learn about the history and uses of medicinal plants and experience their healing properties in a highly engaging and interactive way. This technology can potentially bring traditional medicine's benefits to a broader audience while preserving and promoting Jordanian culture and heritage.

Jordan's diverse geography and climate have contributed to a rich flora, with approximately 20% of its total flora representing medicinal plants. With about 485 species from 99 families, Jordan boasts a relatively large number of medicinal plants despite its limited geographic area (Alzweiri et al., 2011). Local herbalists have identified and recommended these plants for their health benefits.

Medicinal plants have been widely used in traditional herbal medicine worldwide, with many showing promising results in treating various diseases. Researchers have discovered potent drugs from medicinal plants with antimalarial, antineoplastic, antirheumatic, anticoagulant, hypoglycaemic, and antimicrobial properties (Abuhamdah et al., 2013). Jordanian plant extracts have also shown significant activity compared to other plant species, highlighting their potential as a source of novel therapeutics (Talib and Mahasneh, 2010).

It is important to preserve the remnants of Jordan's rich and ancient medical culture by collecting information on medicinal herbs and their folk uses from aboriginal Jordanian Bedouins, such as those in the Petra region. Gathering data from practitioners who utilize medicinal plants and are regarded as professionals is also crucial for Jordanian researchers. The use of VR and AR technology can aid in documenting and preserving this valuable knowledge for future generations.

Several ethnopharmacological studies have been conducted in various regions of Jordan to evaluate the effectiveness of plants used in treating specific ailments. To assess their efficacy, the studies characterized each plant's reported use value (UV) and informant consensus factor. UV helps identify the most frequently indicated plants for treating a particular ailment. The informant consensus factor (ICF) was utilized to measure the consistency of information about a plant's use in treating a category of ailments (Lafi et al., 2022).

In the modern era, we have advanced technology like virtual reality (VR) and augmented reality (AR) that can help us explore, link, and potentiate the values offered by traditional healthcare systems. We can collect and document Petra's folkloric use of medicinal plants and herbs by integrating VR and AR into our research. We can also identify the medicinal plants by their scientific names and the common preparation method. With the help of VR and AR, we can create an interactive experience that allows people to virtually explore the location where these plants can be found and learn about their relative importance in traditional medicine. This technology can bring a new dimension to the study of medicinal plants and enhance our understanding of their cultural and medicinal significance.

***Achillea fragrantissima* (Forssk.) Schultz Bip. (قيصوم عطري)**

It is commonly known as lavender cotton; the genus *Achillea* belongs to the Asteraceae family, also known as yarrow. It is one of the most popular and important natural remedies belonging to the oldest medicinal plant. It is a tiny, intensely aromatic white-wooly shrub growing from 30 cm to 60 cm in height (Patocka and Navratilova, 2019). Recorded in deserts and semideserts like Shobak and Petra. The herb is commonly used in folk and traditional Arabic medicine, widely prescribed, and known for its numerous pharmacological effects. Extracts are rich in pharmacologically active compounds such as sesquiterpenoids, flavonoids, alkaloids, tannins, bitters, and lignans (Wesam et al., 2020). The popular herb is found in over 40% of herbalist shops and is well-known among customers. The herb is considered safe for use without adverse effects. The aerial parts of the plant are frequently used in the Badia region to treat gastrointestinal and respiratory issues, with a high UV of 0.85 (Lafi et al., 2022).

Tea preparations are used as an analgesic, antipyretic for headaches and fatigue, or as a treatment for respiratory tract problems, eye infections, smallpox, dysmenorrhea, and hemorrhoids (Patocka and Navratilova, 2019).

Recommended for wound healing, inflammations, and skin manifestations (Wesam et al., 2020). Bedouins use them to treat stomach ailments, prepare antidiabetic drinks, and treat bronchitis. Also known to stop bleeding and treat pneumonia, rheumatism, allergic rhinitis, and menstrual disorders. The volatile oil has antimicrobial activity and was used to manage several diseases and as a carminative depurative (Younes et al., 2015; Wesam et al., 2020).

***Salvia palaestina* Ben. (ميرمية، القصعين الفلسطيني) (Lamiaceae)**

One of the 20 *Salvia* species found in Jordan, this plant is associated with local traditional medicine and is both medicinal and ornamental (Oran, 2015a). It grows wild in fields and roadsides in several areas, including Amman, Salt, Jarash, Irbid, and Al-Tafilah, as well as in Petra, Karak, Mafraq, and Dana, according to the Royal Botanic Garden Edinburgh (2019). *Salvia* species have a long history of use in traditional medicine for treating over 60 different ailments, including but not limited to aches, epilepsy, colds, bronchitis, tuberculosis, hemorrhages, and menstrual disorders (Al-Jaber et al., 2012b).



Achillea fragrantissima (Forsskal) Schultz Bip. (Oran, 2015a)



Salvia palaestina Benth. (Oran, 2015a)



Its hot and cold-water extract is a traditional herbal remedy for its spasmolytic, antidiarrheal, antibacterial, and anti-inflammatory effects. In addition, it is commonly used for the common cold, cough, and influenza (Al-Jaber a et al., 2012a).

Salvia leaves are used to prepare anti-inflammatory and analgesic infusions for rheumatic pain and stomachache and are recommended as antitussive and for hyperlipidemia and hypertension. In addition to mouth gargles and wound healing ointments (Shehadeh et al., 2014)

***Paronychia argentea* (Caryophyllacea)** **(رجل الحمامة، حشيشة الراعي)**

Herbaceous hairy plant, perennial, with branching stems widely distributed and growing locally in Jordan under local conditions. It is known as Whitlow Wort (Alhourani et al., 2020). Found in fallow fields, field borders, and waste places throughout Jordan (Hamdan and Afifi, 2004) and Wadi Musa/ Petra and Tafila region (AlRawashdeh and AlRawashdeh, 2016). The flowering time is from January to April (Hamdan and Afifi, 2004).

The primary medicinal use is to resolve Urinary system disorders (Ali-Shtayeh et al., 2000). It has been used for many human diseases as diabetes traditional medicine (Veeraraghavan et al., 2020). A prevalent treatment, hot beverage for the aerial parts (decoction), is widely used by locals to treat Kidney stones, ulcers, and ailments and is usually recommended before meal. (Hamdan and Afifi, 2004).

It was traditionally used as a diuretic for urinary tract infections, gastric analgesics, bladder prostate, and abdominal stomach (Abuhamdah et al., 2013). *P. argentea* was found to be the most commonly used plant for managing diabetes, with a UV of 0.33. The plant also scored high ICF values of 0.72 and 0.73 for treating kidney problems, inflammations, and pain of various origins, respectively (Lafi et al., 2022).

Their crude extracts showed important alpha-amylase inhibitory activity (Alpha-glucosidase is one of the essential enzymes responsible for the breakdown of carbohydrates), and its inhibition may effectively control abnormal blood glucose levels. (Hamdan and Afifi, 2004).

***Pistacia atlantica* (Anacardiaceae)** **Atlantic Pistachio (بطم اطلسي)**

Wild pistachio (Mahjoub et al., 2018) is a deciduous tree up to 20 m in height. Flowers are very short; leaves are ovate or oblong; small fruits are ovoid or ovoid-globular to rounded shapes. The flowering time is February to April. It finds habitats mostly in semi-steppe areas and



Pistacia atlantica
(Amara et al., 2020)

Steppes, solitary, or forming scattered stands (Hamdan and Afifi, 2004). Recorded in Aman, Wadi Butum, Azraq, Irbid, Dana, and Shobak (Royal Botanic Garden Edinburgh 2019). Widely used and recommended in the alternative medicine system for treating diabetes mellitus (Hashemnia et al., 2015).

In Jordan, fruits are used for numerous problems related to stomachache, and the resin is used as a general remedy (Lev and Amar, 2002). Middle Eastern and Mediterranean areas used the plant for renal diseases, coughs, and wounds. Active for scabies, lip fissures, and hair loss (Mahjoub et al., 2018), and known for its antimicrobial, antioxidant, antitumor, and antihyperlipidemic activities (Yousfi et al., 2005).

The resin and fruit of *P.atlantica* are helpful for upper and lower gastrointestinal disorders, hepatic weakness, hepatitis, and ascites. In addition, it is used for treating headaches, stroke, tetanus, seizure, and tremor and as nerve tonics (Mahjoub et al., 2018).

The fruit has analgesic properties and has been used for back pain, bone fractures, and musculoskeletal disorders; the resin could strengthen the gum tissue.

The extracted oil contains Terpenoids, Phenolic Compounds, Fatty Acids, Sterols, Tocopherols, and tocotrienols that have antioxidant properties (Bahman et al., 2015)

Aqueous leaf extract from *P.atlantica* has hypoglycemic effects due to the inhibitory effect on α -amylase and α -glucosidase and was also used in treating ulcerative colitis (Mahjoub et al., 2018).

***Teucrium polium* L. Lamiaceae (Labiatae) (قدحة، جعدة)**

A common wild plant is known as Cat thyme or wild germander and is locally known as Jaa'deh (Qur'an, 2009). The Royal Society for the Conservation of Nature (RSCN) records it as a medicinal plant. The plant has been documented in various regions of Jordan, including Irbid, Ajoun, Jarash, Balqa, Mafraq, Amman, Madaba, Karak, Tafila, Petra, Ma'an, Rum, and Aqaba (Royal Botanic Garden Edinburgh, 2019).

It is an edible plant known for various biological activities; it is commonly used in folk medicine to treat multiple conditions, such as headaches and abdominal colic. Its aerial part infusion can also treat kidney stones (Al-Qudah et al., 2011). The infused aerial part showed anti-inflammatory and astringent effects (Qur'an, 2009; Oran, 2014).

For many years, *Teucrium* species have been utilized in folk medicine, with most still in use today. Specifically, *T.polium* has traditionally been employed for treating various ailments, including gastrointestinal disorders, inflammations, diabetes, and rheumatism (Al-Rawashdeh, 2015). *Teucrium* is a pubescent aromatic herb that



Teucrium polium (Al Sheikh et al., 2012)

grows wild in different locations throughout Jordan, including the rocky mountains and marginal areas. It flowers between April and August and has oval leaves with 1 cm long margins, with stems that end in corymbose or paniculate inflorescences (Al-Qudah et al., 2011). Chemical analysis of *T.polium* revealed various components, including Germacrene D, bicyclo germacrene, β -pinene, and carvacrol. It also contains limonene, β -bourbonene, β -caryophyllene, and β -elements as major compounds (Al-Rawashdeh, 2015).

This species is one of 10 species of this genus in Jordan flora; the extract is rich in flavonoids and has been used in folk medicine for almost two decades to treat various anti-inflammatory, anti-hyperglycemic, antispasmodic, anti-anti-inflammatory, and antimicrobial properties (Al-Shalabi et al., 2020).

***Arum hygrophilum* Boiss.** **(Araceae) (لوف او رقيطة)**

Widely known as Green Arum, its Arabic name is Lufe (This species is an endangered Jordanian plant (Taifour and El-Oqlah, 2015). It is recorded in the Mediterranean region and Jordan. It grows naturally in rocky places, forestry, mountains, upper Jordan Valley, and Petra (Royal Botanic Garden Edinburgh, 2014; Jaber et al., 2020). Despite its toxicity, the plant is rich in flavonoids such as vitexin, luteolin, isoorientin, and rosmarinic acid (Afifi et al., 2017). It is utilized as food and traditional medicine to manage many diseases (Azab, 2017).

Jordanians utilize the plant as spices cooked like leafy crops (Al-Lozi et al., 2008). This natural remedy can be cooked or extracted with different solvents and utilized in complementary and folk medicine for the circulatory system. It is also used as a natural anticancer agent for colon cancer, weight loss, hypoglycemic and antibacterial agents, and as a remedy against poisons (Jaber et al., 2020).

***Arum palasetinum* Boiss.** **(Araceae) (لوف فلسطيني).**

A wild edible plant species restricted to the Mediterranean part of Jordan. It is commonly known as Palestine Arum, with its Arabic name as Lufe. Its fruits are consumed for food or medicinal purposes (Husein et al., 2014; Taifour and El-Oqlah, 2015).



Arum hygrophilum Boiss.
(Al-Daghistani et al., 2021)



Arum palasetinum Boiss. (Oran, 2015b)

Polyphenols and alkaloids are considered the main secondary metabolites of this plant, in addition to flavone c-glycosides, flavonols, flavones, and proanthocyanidins. Studies showed that the extracts possess anticancer activity in breast carcinoma cell lines and antioxidant activity (Husein et al., 2014). Another study revealed the inhibition potential of plant extract against gastrointestinal enzymes involved in carbohydrate and lipid digestion and absorption. This may support its possible uses as a herbal remedy and a strategy to prevent and control hyperglycemia (Afifi et al., 2017). Furthermore, the plant is the most commonly used complementary or alternative therapy among cancer patients in Palestine (Ali-Shtayeh et al., 2011).

***Carthamus tenuis* (Asteraceae) (قرطم)**

A common weed with edible leaves and young stems, its wildflower is also a source of allelochemicals (Qasem, 2015). *Carthamus tenuis* has been recorded in various regions in Jordan, including Ajloun, Irbid, Mujib, Petra, Karak, Debeen, Salt, Dana, Madaba, Amman, Zarqa, and Jarash (Royal Botanic Garden Edinburgh, 2014).

The plant is a widely spread medicinal plant with aerial parts containing many compounds with different cellular activities. Most of these compounds traditionally used as treatments showed an immunosuppressive role as well as antifungal, antibacterial, inflammation, abortion, infertility, skin diseases, and hemorrhoid (Shawagfeh, 2020).

The plant is rich in antioxidants and polyphenols such as quercetin, catecholamine, and capaic acid; all have an anticancer effect. Each of these compounds can be potentially effective against different cancer cell lines (El-Hela et al., 2013).



Carthamus tenuis (Boiss & Blanche) Bornm. (Shawagfeh, 2020)



Peganum harmala (Pratama et al., 2021)

***Peganum harmala* L.** **(Zygophyllaceae) (حرمّل)**

Peganum harmala is a frequently used plant and herb in Badia, with a usage value (UV) of 0.4 for treating gastrointestinal, dermatological, and general pain conditions. In the Mujib area, the seeds and leaves of this plant are utilized to increase sexual activity, with a UV of 0.37 (Lafi et al., 2022). Harmaline, an active ingredient in *P.harmala*, is a central nervous system stimulant and a reversible inhibitor of monoamine oxidase A (MAO-A), a category of antidepressants. The plant extract showed analgesic, anti-inflammatory, and antibacterial activity against drug-resistant bacteria. The root is applied to kill lice and insects. It is also used as an antihelmintic and abortifacient, and in large quantities, it can reduce spermatogenesis and male fertility in rats. It has antioxidant and antimutagenic properties (Abuhamdah et al., 2013).

***Artemisia herba-alba* Asso.** **Asteraceae (Compositae)** **(شّيح أبيض)**

It is commonly known as 'white wormwood,' and its Arabic name is 'Sheeh.' It is a native plant of Jordan, a medicinal and aromatic perennial dwarf shrub that grows wild in dry zones of the Mediterranean region (Qnais et al., 2016).

The plant grows in dry mountains and desert regions such as the Eastern Desert Shaubak, Ras an-Naqab, Karak, Tafila, Mafraq, and Zarka (Hudaib and Aburjai, 2011). This species has been used extensively in natural therapies and folk-traditional medicine for years. Its medicinal uses may be attributed to the high content of essential oils rich in sesquiterpene lactones and other secondary metabolites (Shibli et al., 2018). Locals commonly use *A.herba-alba* and related extracts in Jordanian traditional medicine as anthelmintic, antifatulence, spasmolytic, potential hypoglycemic effects, constipation, hypercholesterolemia, and jaundice (Khan et al., 2017). In addition, it is well-known in folk medicine for treating colds and cough diseases (Qnais et al., 2016). The Shrub essential oil exhibits antimicrobial and antispasmodic (Hudaib and Aburjai, 2011), anti-inflammatory, and antinociceptive effects in several models of inflammation and nociception. It contains β -Thujone, camphor, and caryophyllene acetate as major constituents (Qnais et al., 2016). In addition, the plant extracts contain several flavones, flavanones, dihydro flavonol, and a high content of phenolic components.



Artemisia herba-alba Asso. (Oran., 2015c)

According to the Jordan plant red list, this plant belongs to the least concerning endangered species (LC). However, taking action and serious concerns is necessary for plant multiplication to avoid falling into the endangered species list (Shibli et al., 2018).

Leaves and flowers are usually used in herbal preparations, and the methods of choice for preparing *A. herba alba* for medicinal uses are tisanes, infusion maceration, and decoction (Kha et al., 2017).

Arbutus andrachne **(Ericaceae) (القطلب العثكولي)**

Locally known as Kaikab belongs to the Ericaceae family; the plant is recorded in Irbid, Ajloun, Tal Al-Rumman, Dibeen, Jerash, Irbid, and Tafilah (Royal Botanic Garden Edinburgh, 2014). Fruits are part of the plant used for healing purposes, and in traditional medicine, the fruits are often prepared as a decoction.

Plant extract is commonly used as a laxative in traditional medicine; it has also been documented for its therapeutic properties in treating various medical conditions, such as urinary system problems. It is recommended as a blood tonic, pectoral, antitussive,

and anti-asthmatic agent.

The UV of 0.17 measured in *Arbutus andrachne* L. suggests that the plant may hold potential for traditional use for its laxative properties but may also hold significant therapeutic benefits in treating a range of medical conditions, such as urinary system issues, cancer, and respiratory diseases (Aburjai et al., 2007).

The bark of this plant is used as a source of wood, and its fruits are edible (Jaffal et al., 2022). The trees grow in rock crevices in Petra areas (Danin and Hedge 1998).

The plant is rich in polyphenols such as condensed tannins and catechin gallate. Many plant extracts showed good levels of antioxidant activity and are considered one of the best sources of free radical-scavenging compounds.

The fruit of the strawberry tree, also known as Kaikub, is used as an antitussive agent and asthma medication (Tawaha et al., 2007).

Potentially high value as a health-promoting food, rich in Antioxidants, known as antiseptics, and a remedy for urinary tract infections, hypertension, and diabetes, in addition to its uses as a diuretic and laxative (Abuhamdah et al., 2013)



Arbutus andrachne L. (Jaffal, et al., 2022).

***Ephedra Aphylla* (علندا)**

The Ephedraceae family includes various *Ephedra* species, which have medicinal properties. *Aphylla* species is distributed across different regions in Jordan, including Mafrq, Irbid, Amman, Jerash, Ajloun, Madaba, Balqa, Rum, Karak, Shaumari, Tafila, Ma'an, WadiAraba, and Petra. *Ephedra* is a genus of non-flowering seed plants that grow in arid regions of the tropics and subtropics (Al-Barri et al., 2021). The crude drug consists of the dried, young stems of the plant. Traditionally, locals in different regions of Jordan use all parts of the *Ephedra* plant or its branches to prepare a cold beverage that is well-known and recommended for its medicinal properties in the treatment of hay fever, colds, coughs, and bronchitis (Oran and Al-Eisawi, 2015). *Ephedra alte* C.A. Mey is the synonym. Extracts from different *Ephedra* species have traditionally been used as a tea to treat asthma. It contains ephedrine and pseudoephedrine alkaloids that have been widely used as bronchodilators and decongestants as nasal drops. In addition, the extract showed Anti-allergy antipyretic activities (Deabes et al., 2020). *Ephedra* extracts possess antibacterial, antifungal, and antioxidant activities. The plant is a natural source of alkaloid products, such as ephedrine, traditionally used to treat conditions like asthma, sinusitis, and rhinitis. Furthermore, isolated alkaloids from the plant are utilized as essential medicinal agents for their pain-relieving, antispasmodic, and bactericidal effects. Overall, *Ephedra* is an important source of natural compounds with antioxidant capacity (Al-Trad et al., 2018).

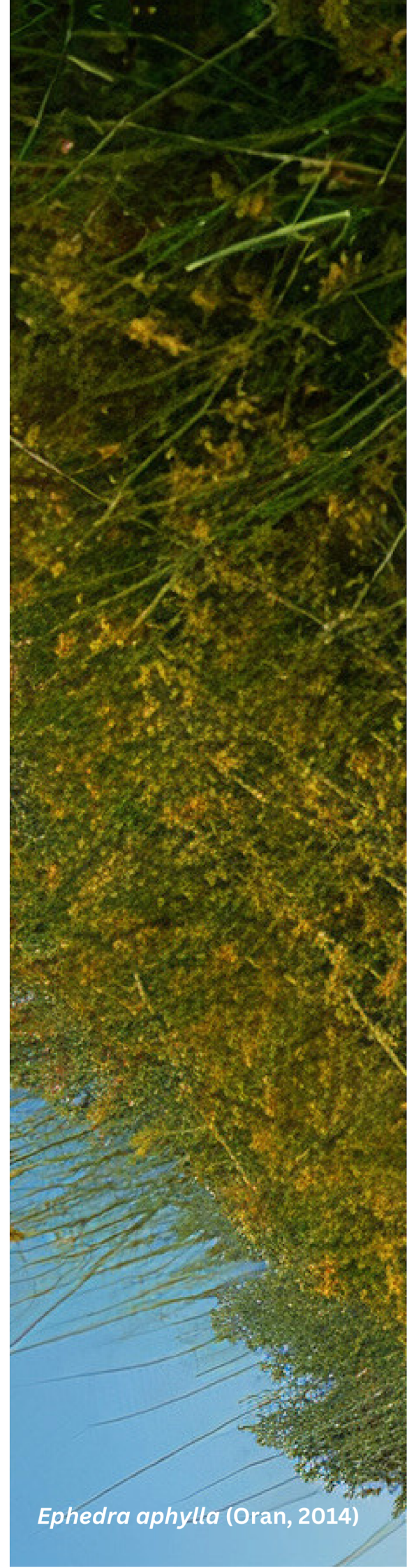
***Aloe vera* (Liliaceae) (صبرة مرة)**

They are commonly known as Aloe with the Arabic name Sabra morra. This plant can survive on little water and live on saline soils or beaches. Also, it is resistant to insects and plant diseases (Sharrif Moghaddasi and Res, 2011). It has a nonedible fruit imported to Jordan and is well recognized in the region to be of medicinal importance for skin diseases, wounds, and purgative (Lev and Amar, 2002).

Aloe plants have long been used worldwide for their medicinal properties (Al-Aboudi and Afifi, 2011). The laciferous material decoction is traditionally recommended to be used as an expectorant and recorded in the literature as Bladder stones (Qura'n, 2009). The leaves and extracted juice are the commonly used parts in traditional medicine. The plant is indicated to treat diabetes and dyslipidemia (Afifi-Yazar et al., 2011).

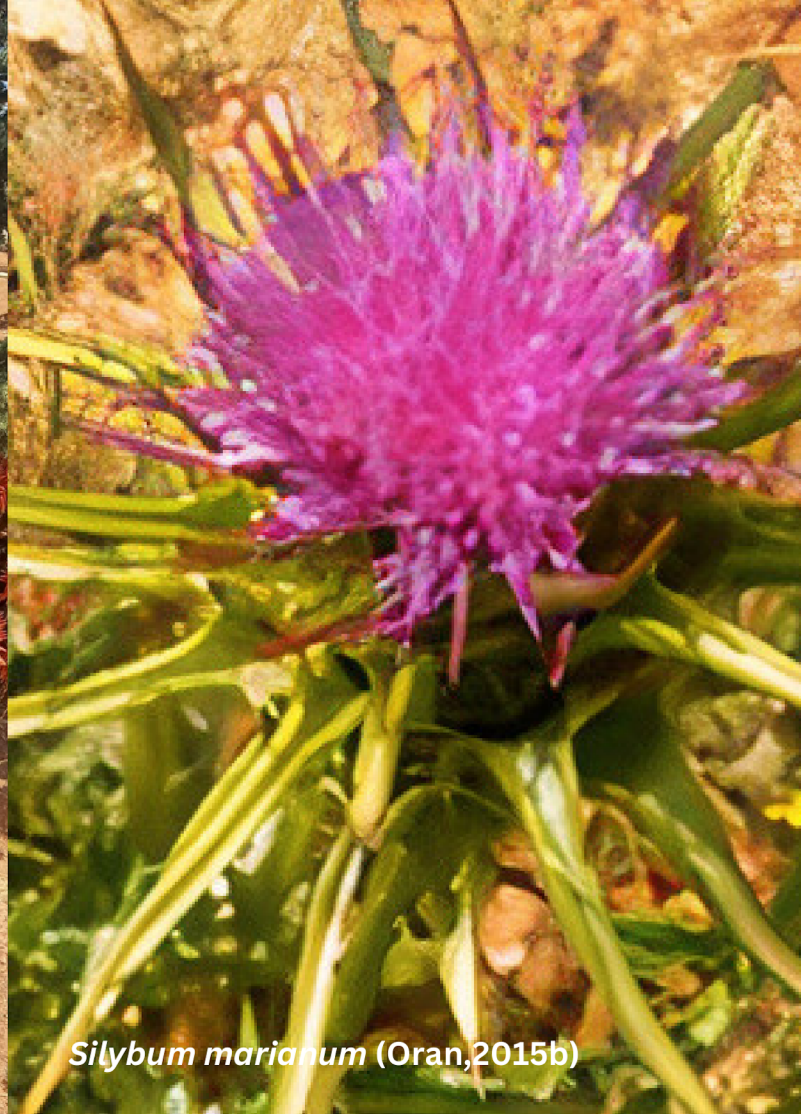
It has been used in complementary and alternative medicine for gastrointestinal diseases and has an excellent response to ulcer healing properties (Kumari et al., 2010).

Ephedra aphylla (Oran, 2014)





Aloe vera



Silybum marianum (Oran,2015b)

Besides, Aloe has potential anticancer properties against solid tumors, suggesting a possible role in chemoprevention. The plant is rich in phenols, flavonoids, terpenes, anthraquinones, minerals, vitamins, amino acids, and sugars (Afifi-Yazar et al., 2011).

The Methods for uses are many such as the extracted gel, which can be used as an ingredient in commercially available foods and cosmetics, extracted medicinal juice, and other benefits for Aloe extracts such as preservatives, or the therapeutic uses of sap for wound healing (Sudarshan et al., 2012).

***Silybum marianum* L. (Asteraceae) Holy Thistle, Lady's Thistle (خرفيش الجمال)**

Commonly known as milk thistle or Khorfaish in Arabic. It is an edible wild medicinal herbal plant

found in Jordan and neighboring countries. The flowers and seeds of *Silybum marianum* are typically used for their hepatoprotective properties, specifically for treating liver diseases. The plant parts are traditionally prepared as a decoction or infusion. *Silybum marianum* L. has the highest use value (0.54) with liver problems being one of the most commonly used for this condition characterized by a ICF value of 0.60 (Hudaib et al., 2008).

The plant is well-known in the region and is widely used as an herbal remedy. The plant is typically used for chronic inflammatory liver disease and liver cirrhosis, particularly in the southern part of the Jordan Valley.

The extract is rich in volatile oils and other beneficial secondary metabolites like silymarin, an isomeric mixture of flavonolignans (silybin, silychristin, and silydanin) (Al-Hawamdehet al., 2014). In vitro propagation for *S. marianum* was achieved in Jordan, and seedlings of the crop led to the successful production of explants (Al-Hawamdeh et al., 2014).

Ceratonia siliqua (Fabaceae) (خروب)

Known as Carob tree and Kharroob in Arabic. It is one of 118 plants belonging to 49 families used in Jordanian traditional medicine. Carob is an evergreen tree hardened up to 10m, with a wide crown and a thick trunk with rough brown bark and solid branches (Batlle and Tous, 1997).

The carob tree is native to Jordan, Turkey, and Palestine. In Jordan, trees are abundant in Ajloun mountainous forests and rangelands, in the Al-Majdal area (Jerash), Wadi Al-Yarmouk area (Irbid). Flowers grow in winter, while seed pods grow in spring (El-Shatnawi and Ereifej, 2001)

Carob pods are commonly used for cough in cold or hot beverages among people in West Amman, Wadi As-Sir, and Central Jordan (Oran and Al-Eisawi, 2015). Carob has various benefits in preventing and treating disorders mainly associated with the gastrointestinal tract (Rtibi et al., 2017).

The plant has many pharmacological activities and is considered one of the antidiabetic plants indigenous to Jordan (Al-Aboudi and Afifi, 2011). It is important in folklore medicine for its antioxidant, antibacterial, antidiarrheal, and anti-inflammatory properties. Besides, it has anti-ulcer properties and is indicated as a laxative (Rtibi et al., 2017). The methanol leaf extracts of Carob contain phenolic compounds that act as potent antioxidants, free radical scavengers, anticancer, and antimutagenic agents (Custódio et al., 2009), in addition to their hepatoprotective and nephroprotective effects (Lakkab et al., 2019). Moreover, Carob fruits or seeds treat influenza, cough, and anemia (Papaefstathiou et al., 2018). Carob Syrup is rich in calcium, a natural dietary supplement for osteoporosis, and a healthy sugar substitute. It has been used in traditional medicine to treat sore throats (El Batal et al., 2016).



Ceratonia siliqua

***Dittrichia viscosa* L. Greute. (نبته الطيون)**

Native to the Mediterranean region, often found in ruderal environments such as roadsides. Its Arabic name is Taioon, and its Synonym is (*Inula viscosa* L.), the plant species belonging to the Asteraceae family. In Jordan, Taioon is widely recognized and used in traditional medicine (Hudaib et al., 2008; Parolin et al., 2014). This species has been recorded in Irbid, Jerash, Mafraq, Madaba, Karak, Tafilah, and Ma'an (Royal Botanic Garden Edinburgh, 2014).

This plant is one of the most used plants in traditional medicine in Showbak (Al-Qura'n, 2009). It has been shown to have various therapeutic properties, such as immunomodulatory, anticancerous, anti-inflammatory, antimicrobial, and antioxidant effects (Oran, 2014). The whole plant parts are typically used to prepare an infusion commonly used as an anthelmintic for lung disorders and as a nerve tonic (Al-Qura'n, 2009). The leaves of the plant are used in traditional medicine by locals, prepared as a decoction, and are known for their muscle relaxant properties.

The plant has a use value of 0.17. To prepare the decoction, 200 grams of plant material is boiled in 1 liter of water for 10 minutes. The resulting decoction can be used as a steam bath or added to a regular bath (Hudaib et al., 2008).

The plant has beneficial properties, including balsamic, healing, antipyretic, antidiabetic, and antiphlogistic effects, and has been used since ancient times to treat wounds, injuries, bruises, and intestinal disorders.

It is an important food source for caterpillars of butterflies and moths, as they feed on the plant sap for growth and development. However, improper use of *D.viscosa* can lead to serious problems and cell damage (Parolin et al., 2014).



(A) *Varthimia iphionoides* plant, (B) flower of the *Varthimia iphionoides* plant.
(Al-Rimawi, et al., 2022)



***Varthemia*
iphionoides (Boiss.
&C.I.Blanche) Brullo**
Synonyme:
***Chiliadenus*
iphionoides (كتيلة،
صغيرة)**

Varthemia iphionoides is a member of the Asteraceae (Compositae) family and is found in several regions, including Palestine, Jordan, Syria, Lebanon, and Sinai. It has been recorded as a medicinal plant for human use (Oran, 2014) and is frequently used in traditional medicine as a decoction or infusion to treat various medical conditions. With various health benefits, *Varthemia iphionoides* is a medicinal plant native to Jordan that shows promise as an anti-inflammatory agent and possesses several pharmacological therapeutic properties, such as anticancer, antimicrobial, antioxidant, antispasmodic, and antiplatelet activities (Abdelhalim and Al-Munawarah, 2020). This plant has been traditionally used in Jordanian medicine to alleviate pain, treat flatulence, heal wounds, and address eye and urinary issues (Al-Bakheit et al., 2017).

Among the medical issues that can be treated using this plant, diabetes is one of the most common. Additionally, it can be used to address kidney stones and eye infections. Locals frequently use *Varthemia iphionoides* to treat various abdominal ailments (Oran, 2014). The traditional use of this herb involved treating abdominal pain, weight loss, and cold and hyperacidity symptoms (Abbas et al., 2019).

The plant is distributed worldwide and grows in Jordan in different areas such as Amman KarakZarqa.



(b)

(a)



Malva parviflora L. (Al Sheikh et al., 2012)



***Malva parviflora* L. (Malvaceae), Cheesweed, Mallow (خبيزة)**

Wadi Rum Ma'an and Jordan Vally (Royal Botanic Garden Edinburgh, 2014).; the plant is growing in cold and warm regions and has been used as traditional medicine in Jordan and other neighboring countries. Despite few pharmacological studies on this plant, the upper parts of the plant are commonly used as food and traditional medicine in Jordan; herbalists have used leaves and roots to treat cough, ulcers, and boils (Bouriche et al., 2011). The extract is prepared as lotions and is commonly used to relieve wounds and heal swelling. In addition, extracts are used as an antitussive, laxative, expectorant, and carminative. Leaves and seeds were also used to relieve tooth pain (Nimri et al., 1999).

Usually, roots clean wounds, swellings, and inflammation (Bouriche et al., 2011). Seeds were used as anti-dandruff to soften hair shafts and emollients (Rasheed et al., 2017).

Malva (Cheesweed) contains essential phytochemicals that possess anti-inflammatory, antimicrobial, and antioxidant properties. (Shale et al., 1999). The antioxidants include tocopherols, ascorbic acid, β -carotenes, and glutathione, in addition to different minerals such as manganese, iron, copper, zinc, and phosphorous (Rasheed et al., 2017).

In addition value; the leaves and immature fruits used for salads have a mild pleasant taste to be an alternative to lettuce and be cooked as a green (Rasheed et al., 2017).

Alkanna strigosa (الهوا الجوي)

Alkanna strigosa Boiss and Hohen belong to the Boraginaceae family and is commonly used in traditional medicine to treat various ailments (Bajes et al., 2022). The plant was found to be present in Mediterranean areas and in Ajloun, Salt, Dibeen, Amman, Ma'an, Shoback, Azraq, and Petra (Royal Botanic Garden Edinburgh, 2014). This plant is relevant to *Alkanna tinctorium* species which is very popular in Jordanian folk medicine (Aburjai et al., 2019).

The plant extract is abundant in alkanin and shikonin, which have shown significant efficacy against *Staphylococcus aureus*, *Escherichia coli*, and *Bacillus subtilis* bacteria (Bajes et al., 2022).

Both species are traditionally used as decoction extracts for their anti-inflammatory, antibacterial, skin diseases, and wound healing properties. *Alkanna strigosa*, locally known as Hawa Jawi, is widely used in Jordan and surrounding areas for treating various ailments. The most common use of *A. strigosa* among Jordanians in rural and urban areas is for treating wounds and burns. The plant is prepared in an ointment base and applied directly to the affected area. Honey and beeswax are often added to the formula, and many believe that this formula is more effective than some hospital procedures (Aburjai et al., 2019).



Alkanna strigosa (Al Sheikh et al., 2012)

AUGMENTED REALITY

The integration of Augmented Reality (AR) and Virtual Reality (VR) technologies is revolutionizing the way we learn about medicinal plants and their benefits. By incorporating AR as an extension of VR in plant identification, knowledge, and documentation, we can meet the requirements of contextual and adaptive ubiquitous learning that are increasingly popular in fields such as education and tourism. This approach is particularly relevant to the ICH innovative project, which aims to develop cutting-edge digital products for the medicinal plants of Petra and other Jordanian sites.

AR and VR can be used to create immersive experiences that allow users to explore the world of medicinal plants more interactively and engagingly. AR and VR can be used to create virtual environments that simulate the natural environment of medicinal plants, create interactive educational experiences, create interactive simulations, and create interactive experiences that allow users to explore the medicinal properties of different plants.

AR technology combines digital images and media, such as 3D models, to enhance the real-world experience. It can be done through the use of various devices, such as smartphones, tablets, and connected glasses (Zhao et al., 2018). Learning about plants for their medicinal or a source of food from Petra has gradually become a way for people to understand nature. It draws the attention of tourists and people interested in learning more.

Due to the increasing popularity of intelligent mobile terminals, learning systems based on these devices are being developed to provide a new way for the public audience to imagine and observe the real form of important species and to acquire knowledge about some endangered and toxic plants that may be collected by mistake for their assumed healing activities.

To collect reliable information about Petra's commonly used medicinal plants, the suggested method is to interview practitioners, women/nonpractitioners, and men/nonpractitioners at interviewees' herbal stores and homes, using the native language (Arabic). We can select practitioners who utilize medicinal plants as part of their remedy preparation advising and application. Also, we can consider all users and nonpractitioners who treat patients in their immediate circle of family and friends.

The requested detailed information from the interviewee will concern the nature and identity of the herbs and their therapeutic uses and preparations. Each interviewee will be asked first about the primary diseases they deal with, then which plant/s species is/are used for treating the particular disorder. The questionnaire should address several aspects: herbal sources of the medicinal plants, the socio-economic situation in the communities, personal education, source, and extent of his knowledge.

The interviewee will be asked to identify the plant species from his plant collection or plants grown in the field. The identity of each plant species mentioned by the interviewee should be checked and confirmed by a professional botanist using live specimens and photographs. Voucher specimens should be kept. The advantages of computerized databases are their ability to provide researchers with the necessary information to develop their apps.

AR will then facilitate knowledge transmission and feed the circle of information exchange between studies and the public audience. This technology can also help in disseminating knowledge to the public. One of the most important factors currently being considered is the use of this technology in storing ethnopharmacological information. This will allow researchers to create a product to help conserve endangered species.

As part of the ICH innovative project, researching to create innovative digital products for the medicinal plants of Petra or other Jordanian sites is of great importance.

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