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PHARMACOLOGICAL AND MEDICINAL PROPERTIES OF PLANTS COLLECTED IN THE ARCHAEOLOGICAL SITES OF EL-JADIDA, SAFI AND AZEMMOUR (MOROCCO)

Mohammed Fassar [1]*, Meriem Benharbit [2], Nadia Belahbib [3], Lahcen Zidane [4] and Jamila Dahmani [5]

[1,3,4,5] Ibn Tofail University, Faculty of Sciences, Laboratory of Plant, Animal and Agro-industry Production, BP 133, Kenitra, Morocco.
[2] National Institute of Archeology and Heritage Sciences, Madinat Al–Irfane, The Institutes– Hay Riyad, 10100, Rabat, Morocco.
*Corresponding Author Email: [1]mohamedfassar@gmail.com

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Abstract

Plants have been exploited since the dawn of time for their medicinal properties; they contain bioactive compounds that can be very beneficial to humans. Plants from the archaeological sites of Mazagan, Safi and Azemmour are sometimes anarchically uprooted for this purpose by the local population. This can cause serious damage to ancient buildings. The objective of this work is to identify the pharmacological and medicinal properties of vascular plants that grow on the base and surfaces of ancient walls. Thus, for each recorded plant, we try to capitalize on the data from publications found on various platforms. Thus, among 79 plant species found, 65 plants have antioxidant properties, 38 have anti-inflammatory properties, 27 have antimicrobial properties, 24 have anticancer properties, 23 have antidiabetic properties, 21 have cytotoxic properties, 15 are hepatoprotective, 12 are analgesic, 11 have antiviral properties, 11 have neuroprotective properties, 8 plants have cardioprotective properties, 8 have antiproliferative properties, 7 have antidiarrheal properties and 6 species have antipyretic properties. There are other medicinal properties recorded such as antirheumatic, antitoxic, anti-hepatitis C, anti-aging, anti-Alzheimer's, anti-asthma, anti-hyperlipidemic, anxiolytic, antifungal, antitumor, antiplasmody, antimutagenic, antigenotoxic, etc. All these properties justify the uses of these plants for medicinal purposes. They should be removed using methods that respect the substrate otherwise they can be uprooted by the local population in such a way as to destabilize the very structure of old buildings.

Keywords: Historical Monuments, Vascular Plants, Medicinal Virtues, Morocco.

1. INTRODUCTION

Plants have long been used in traditional medicine to treat various ailments. According to a WHO report, more than 80% of the world's population uses traditional medicine for primary health care (Swamy et al., 2012). Some studies (Elhawary et al., 2020) show that plants are perceived as a source of high-quality phytochemicals with antioxidant and anticancer properties. While the collection of medicinal plants can be beneficial in regions where they have high growth potential (Khaledi et al., 2018), it is less so in archaeological sites because each uprooting of a plant can leave openings that enlarge under the effect of biotic and abiotic factors. Water seeping through these openings or animals sheltering in them damages the very structure of old buildings. In developing countries, most people rely almost exclusively on traditional medicine practices and use plants as medicines for their basic health needs (Calvo and Cavero, 2014). The archaeological sites of the Mazagan fortress in El-Jadida and the ancient medinas of Safi and Azemmour are home to many medicinal plants used traditionally. These plants have antidiabetic, antioxidant, antimicrobial, antiasthmatic, antiallergic, anti-inflammatory, analgesic effects, etc. Knowing that herbal components are more effective and less dangerous than conventional chemical derivatives (Chouhan et al.,

2021), these plants are increasingly used. The aim of this work is to collect the pharmacological and medicinal properties of vascular plants recorded in the three archaeological sites: the Mazagan fortress in El-Jadida and the ancient medinas of Safi and Azemmour, based on previous studies published in reliable databases such as Scopus, Sciences direct, WOS, etc.

2. MATERIALS AND METHODS

2.1. Study Area

✓ **Mazagan Fortress**

The Mazagan Fortress, also known as the Portuguese city of El-Jadida, is located west of the city of El Jadida facing the Atlantic Ocean (Figure 1), in Morocco. It was built in 1514 by the Portuguese (Feucher, 2011).

✓ **Ancient medina of Azemmour**

Located on a hill north of the city of Azemmour (33°17'25"N 8°20'28"W), it is about a hundred kilometers south of Casablanca, between the Atlantic Ocean and the left bank of the Oum Er Rbia River (Figure 1).

✓ **Ancient medina of Safi**

Located west of the city of Safi facing the Atlantic Ocean, the old medina of Safi (32°17'56"N 9°14'23"W) (Figure 1) is of Almohad origin from the 12th century and is known as La Ketchla (The Upper Castle) (Carabelli, 2012).

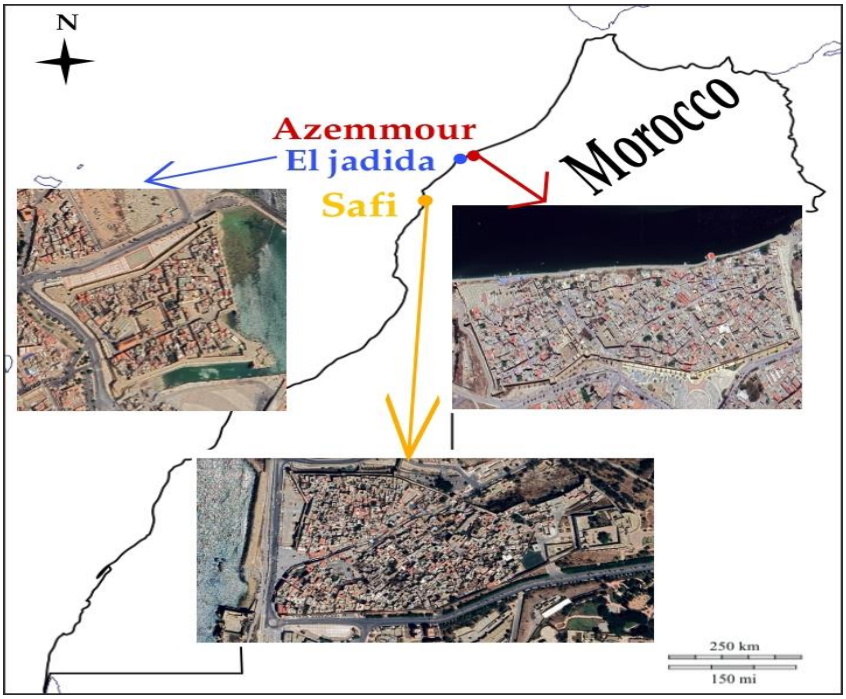

Figure 1: Location of the study area: Portuguese city of El-Jadida, **ancient medina of Azemmour** and **ancient medina of Safi**.

2.2. Data Collection

This study, conducted in 2024, consisted of reviewing international and national research web pages of Google Scholar, PubMed, Science Direct, as well as the Scopus scientific information database.

All full-text research articles published on the pharmacological and medicinal properties of plants collected from the archaeological sites of the Mazagan fortress in El-Jadida, and the ancient medinas of Safi and Azemmour, were collected. Plant collection was carried out using systematic sampling along the alleys, at the base and on the accessible surfaces of the walls and bastions, in order to establish as exhaustive a list as possible of the plant species colonizing these enclosures. This collection took place between April 2023 and April 2024 in the three sites. The identification of the collected plants was carried out using specialized documents, such as "La Flore Pratique du Maroc" (Fennane et al., 1999, 2007, 2014).

3. RESULTS

79 medicinal species among the 87 taxa encountered in the Portuguese city of Mazagan, the ancient medina of Azemmour and the ancient medina of Safi during the years 2023 and 2024 are listed with their pharmacological and medicinal properties (Table 1).

Table 1: medicinal plants found in the three archaeological sites (PCE=Portuguese city of El-Jadida; AMS= Ancient medina of Safi; AMA= Ancient medina of Azemmour).

Recorded species	Harvest location	Pharmacological activities and properties/Therapeutic action/Disease	References
Aptenia cordifolia (L.f.) Schwantes	AMS	Antihyperglycemic, antioxidant, analgesic, anti-inflammatory, hepatoprotective and cytotoxic activities.	Elhawary et al., 2020
Mesembryanthemum crystallinum L.	AMS	Antioxidant, anti-inflammatory, antibacterial, anti-obesity and antidiabetic activities	Bouftira et al., 2012 Lee et al., 2015
Mesembryanthemum nodiflorum L.	AMS	Antihyperglycemic, antioxidant, analgesic, anti-inflammatory, hepatoprotective, antitoxic, anticancer and antipyretic activity.	Elhawary et al., 2020 Doudach et al., 2013
Amaranthus deflexus L.	PCE AMS AMA	Antioxidant activities.	Jiménez-Aguilar et Grusak, 2017
Atriplex halimus L.	AMS	Antioxidant, antibacterial, antidiabetic, cytotoxic and anticancer activities. The leaves are used by indigenous Arab herbalists for the treatment of heart diseases, diabetes and rheumatism.	Walker et al., 2014 Elbouzidi et al., 2022
Beta vulgaris subsp. *Maritima* (L.) Arcang.	PCE AMS AMA	Antimicrobial (antibacterial and antifungal), antioxidant, antidiabetic, anticancer, anti-inflammatory, neuroprotective and cytotoxic properties.	Khan et al., 2024 Bouchmaa et al., 2022
Chenopodium album L.	PCE AMS AMA	This plant has nutritional, phytochemical, antioxidant and antibacterial activity. The plant is traditionally used as a laxative, anthelmintic, blood purifier, antiscorbutic, aperitif, aphrodisiac and tonic. It represents a nutraceutical food, thus offering an alternative source of nutrients.	Pandey et Gupta, 2014 Choudhary et Sharma, 2014

Chenopodium murale L.	PCE AMS AMA	Antimicrobial, antifungal, antioxidant, antipruritic, antinociceptive, anthelmintic, cytotoxic, antiprotozoal, antidiabetic, acetylcholinesterase, anticancer, nematicidal and antidiarrheal activity.	Rehman et Rao, 2023
Chenopodium mambrosioides L.	PCE AMS AMA	Anti-arthritic, acaricidal, amoebicidal, anthelmintic, anticancer, antibacterial, antidiabetic, antidiarrheal, antifertility, antifungal, anti-inflammatory, antileishmanial, antimalarial, antinociceptive, antipyretic, antioxidant, antisickle, antischistosomal, antiulcer, anxiolytic, bone regenerating, immunomodulatory, insecticidal, molluscicidal, trypanocidal and vasorelaxant activity.	Kasali et al., 2021
Salicornia europaea L.	PCE AMS AMA	Secondary metabolites of S. Europaea. Have biological activities Antioxidant, antidiabetic, cytotoxic, anti-inflammatory, antibacterial, anticancer, antiulcer, antifibrotic, antiviral, antiatherosclerotic, immunostimulatory, cardioprotective, antiproliferative, hepatoprotective and antihepatocarcinomas.	Kim et al., 2021
Schinus molle L.	AMS	Antioxidant, antimicrobial and antifungal properties.	Martins et al., 2013 do Prado et al., 2018
Schinus terebinthifolius Raddi,	PCE AMS	Antioxidant and anticancer, analgesic, antitumor and anti-inflammatory activities. Schinus species are characterized by pungent-smelling essential oils, concentrated especially in the fruits, which are used to treat respiratory disorders.	Carvalho et al., 2013 Rosas et al., 2019
Apium nodiflorum (L.) Lag.	AMA	Antioxidant, antimicrobial, anticancer, anti-inflammatory, cardiovascular and antidiabetic, antidiarrheal activity. Protective effects against major disease risks, including cancer, diabetes, cardiovascular disease and Alzheimer's disease.	Maggi et al., 2018 Salehi et al., 2019
Ferula Communis L.	AMA	Antioxidant, antibacterial, antibacterial, antifungal, amoebicidal, antimycobacterial, anticoagulant, antiproliferative, antifeedant for aphids, iontophoretic and apoptotic properties. Cytotoxic and apoptosis-inducing activities, aphrodisiac, osteoblastic proliferation and differentiation.	Rahali et al., 2018 Nouioura et al., 2024
Scandix pecten-veneris L.	PCE AMS AMA	Significant antimutagenic, antioxidant, anti-lipoxygenase and antimicrobial capacities. It can be used as a dietary supplement and as a food material in food industries.	Sharifi-Rad et al., 2016
Arisarum vulgare O.Targ. Tozz.	PCE AMS AMA	Remarkable antioxidant activity and antibacterial activity, cytotoxic and antitumor properties.	Aydin et al., 2017
Phoenix dactylifera L.	PCE AMS AMA	This plant has multiple activities: anti-inflammatory, antihyperglycemic, antihyperlipidemic, anticancer, neuroprotective, nephroprotective, antihyperlipidemic, fertility.	Echegaray et al., 2020
Trachycarpus fortunei	PCE AMS	Remarkable antibacterial activity in different parts of the plant.	Ahmed et al., 2017

(Hook.) H.W endl.	AMA		
Asparagus a cutifolius L.	AMS AMA	Antimicrobial, antifungal, antiproliferative, antioxidant, cytotoxic activities.	Kaska et al., 2018 Mohammed et al., 2021
Anacyclus radiatus subsp. *Coronatus* (Murb.) Humphries	PCE AMS AMA	Antioxidant, anti-inflammatory, analgesic and antimicrobial properties.	Sissi et al., 2022
Calendula arvensis L.	AMS	Antimicrobial, antioxidant, anti-inflammatory, antidiabetic, antispasmodic, antiemetic, anthelmintic, antirheumatic and diaphoretic properties. The plant can be used as a treatment for neurological disorders, microbial diseases and typhoid diseases, skin diseases, digestive disorders and high blood pressure.	Khouchlaa et al., 2023
Centaurea aspera L.	PCE AMS AMA	Antibacterial, antifungal, antiviral and antioxidant activities.	Khammar et Djeddi, 2012
Centaurea calcitrapa L.	AMA	Antioxidant, antihemolytic, cytotoxic, antimicrobial and anti-inflammatory activities.	Trabsa et al., 2020 Dimkić et al., 2020
Erigeron bonariensis L.	PCE AMS AMA	Antioxidant, antibacterial and anti-inflammatory properties, anti-aging and cytotoxic. It has been used as a diuretic, hemostatic agent and antidiarrheal agent.	Elgamal et al., 2020 Mahanuret al., 2023
Laphangium luteoalbum (L.) Tzvelev	PCE	The plant has shown antifungal activity.	Dube et al., 2022
Leontodon saxatilis Lam.	PCE AMS AMA	Cytotoxic, antioxidant and antiviral activities.	Çiçek et al., 2021
Pallenis spinosa (L.) Cass.	PCE AMA	Antioxidant, anticancer and cytotoxic activity.	Al-Qudah et al., 2017
Phagnalon saxatile (L.) Cass.	PCE AMS AMA	Stronger antioxidant capacities.	Haddouchi et al., 2021
Senecio vulgaris L.	PCE AMS AMA	Antimicrobial and antifungal activity	Loizzo et al., 2004
Silybum marianum (L.) Gaertn.	AMS	Antioxidant, antiviral, antidiabetic, anti-amnesic, cardioprotective, hepatic protective, hypocholesterolemic, antihypertensive, neuroprotective, anticancer, anti-aflatoxin and antidote activity.	Porwal et al., 2019
Sonchus oleraceus L.	PCE AMS AMA	Antioxidant, cytotoxic and antibacterial activities.	Yin et al., 2007 Jimoh et al., 2011
Sonchus pinnatifidus Cav.	AMS	Analgesic activities (stomach ache, headache).	Amri et Kisangau, 2012

Symphyotrichum squamatum (Spreng.) G. L. Nesom	PCE AMS AMA	Antioxidant and allelopathic activities.	Abd-ElGawad et al., 2019
Scolymus hispanicus L	PCE AMS AMA	Antioxidant, antimicrobial and anti-inflammatory activities. This plant could be considered as a natural source of nutrients and bioactive antioxidants contributing to the fight against malnutrition and micronutrient deficiencies and as a prospective tool in the treatment of oxidation-related diseases.	Aboukhalaf et al., 2023 Kandil et al., 2020
Xanthium spinosom L.	AMA	Xanthatin extracted from *Xanthium spinosum* has cytotoxic, anti-angiogenic and antiviral properties.	Romero et al., 2015
Brassica tournefortii Gouan	PCE AMA	Antioxidant, cytotoxic and antibacterial activities.	Rahmani et al., 2019
Coronopus squamatus(Forsskal) Ascherson.	PCE AMA	Hepatoprotective and antioxidant activity.	Embaby et al., 2012
Diplotaxis tenuisiliqua Delile	PCE AMS AMA	Antioxidant, anti-inflammatory, antibacterial, hypoglycemic and hypolipidemic activities, as well as its cytotoxicity and antiproliferative properties.	Ressurreicao et al., 2024
Echium humile subsp *pycnanthum* (Pomel) Greuter&Burdet	PCE AMA	Antioxidant, antimicrobial and anti-inflammatory activity.	Aouadi et al., 2021 Aouadi et al., 2022 Benlakhdar et al., 2021
Raphanus raphanistrum L.	PCE AMS AMA	Antioxidant and antibacterial activity.	Iyda et al., 2019
1. *Polycarpon tetraphyllum* (L.) L.	PCE AMS	Antioxidant, antimicrobial and antiproliferative activities.	Uysal, 2023
Spergularia fimbriata (Boiss. & Reut.) Murb.	PCE AMS AMA	Antidiabetic, anticholinesterase and antioxidant activities.	Vinholes et al., 2011
Convolvulus Althaeoides L.	PCE AMS AMA	Cytotoxic, antioxidant and antibacterial effect.	Salehi et al., 2019
Convolvulus arvensis L.	PCE AMS AMA	Cytotoxic, antioxidant, vasorelaxat, immunostimulant, epithelial protective, antibacterial, antidiarrheal and diuretic effect.	Al-Snafi et al., 2016
Umbilicus rupestris (Salisb.) Dandy	AMA	Antioxidant activity and potential inhibition of some of the bacteria analyzed. Preventive effect against parasitic infections.	Harumi Iyda et al., 2019 Benhouda et al., 2019
Euphorbia terracina L.	PCE AMS AMA	Antioxidant and antimicrobial activities.	El-Amier et al., 2016

Mercurialis ambigua L.f.	PCE AMS AMA	Antihypertensive, laxative, abortifacient, lactation suppression and antihyperglycemic activity. For sore throat and lung diseases, osteoarthritis, hair loss, skin bleaching agent.	Blanco-Salas et al., 2019
Ricinus communis L.	AMA	Anticancer, antidiabetic, reversible antifertility, Leishamidic, hepatoprotective, antioxidant, insecticide, acaricide, lipolytic, anthelmintic, larvicide and mosquitocide activity, toxicological property, anticonvulsant, laxative and uterine contraction, anti-asthmatic, bone regeneration, antimicrobial, anti-inflammatory, ophthalmic and antiulcer activity.	Chouhan et al., 2021
Medicago polymorpha L.	PCE AMS AMA	Antioxidant and cytotoxic activities.	Khan et al., 2013
Retama monosperma (L.) Boiss.	AMS AMA	Antioxidant, anti-aging activity in human keratinocytes, antibacterial, antiproliferative activity on human cervical cancer cells, antitumor, antileukemic, anti-inflammatory, antifungal activity.	El Yadini et al., 2023
Frankenia laevis L.	PCE AMS AMA	Antibacterial and antifungal activity, antioxidant activity, enzyme inhibition and cytotoxicity.	Saidana et al., 2014 Rodrigues et al., 2022
Erodium ciconium (L.) L'Hér.	PCE AMS AMA	Antimicrobial and antifungal activity.	Stojanović-Radić et al., 2010
Lamium amplexicaule L.	PCE AMS AMA	Antioxidant, antiviral, antimicrobial, anti-inflammatory, antinociceptive and pain therapy, cytotoxicity and cytoprotective, antityrosinase activity.	Salehi et al., 2019
Malva parviflora L.	PCE AMS AMA	Antioxidant, hepatoprotective, anticancer, neuroprotective, antidiabetic, antifungal, anti-inflammatory, anti-irritant, healing, analgesic, anti-ulcerogenic activity.	Naser et al., 2022
Marrubium vulgare L.	PCE AMS AMA	Analgesic, antinociceptive, anti-inflammatory, antiedematogenic, antispasmodic, gastroprotective, antihypertensive, antidiabetic, antihyperlipidemic, antihepatotoxic, immunomodulatory, antioxidant, antimicrobial, molluscicidal, mosquitocidal, anticancer and antiprotozoal activity.	Lodhi et al., 2017
Ficus carica L.	PCE AMS AMA	Antipyretic, anti-inflammatory, antispasmodic antiplatelet, anthelmintic, hepatoprotective, anticonstipation, hypoglycemic, hypocholesterolemic, hypolipidemic, anticancer, cytotoxicity, antiviral, antimutagenic, antiangiogenic, erythropoietic, hemostatic, antimicrobial, antioxidant, free radical scavenger, immunostimulant, antiwart and irritant activity.	Badgujar et al., 2014
Eucalyptus globulus Labill.	AMS	Action Deodorant, Allergic, Antiseptic, Stimulant, Antimalarial, vermifuge, spasmodic, irritant and parasitic, Antihistamine and anti-inflammatory.	Vishin et Sachin, 2014
Bougainvillea spectabilis Willd.	AMS	Antimicrobial, antiviral, antidiabetic, anti-inflammatory and anti-fertility activity.	Bhat et al., 2011 Swamy M et al., 2012 Ikpeme et al., 2015

Olea europaea L.	PCE AMS AMA	Anti-cardiovascular, antiviral, antimicrobial, antioxidant, hypolipidemic, antidiabetic, thyroid, anticancer, enzyme inhibition, antihypertensive and cardioprotective, antinociceptive, gastroprotective, neuroprotective and diuretic activities.	Yaseen Khan et al., 2007 Hashmi et al., 2015
Oxalis pes-caprae L.	PCE AMS AMA	Cytotoxic, phytotoxic, antibacterial, antifungal, neuroprotective, antioxidant and anti-inflammatory activities.	Naila et Ibrar, 2018 Gaspar et al., 2018
Cymbalaria muralis G.G aertn., B.Mey. & Scherb.	PCE AMS AMA	Antioxidant, anti-inflammatory and antimicrobial activity.	Cheriet et al., 2024
Plantago coronopus L.	PCE AMS AMA	Antioxidant, antimicrobial, neuroprotective, anti-inflammatory and antiviral activities.	Pereira et al., 2017
Ammophila arenaria (L.) Link	AMA	Antioxidant activity	Merchaoui et al., 2019
Cynodon dactylon (L.) Pers	PCE AMS AMA	Antipyretic, analgesic, vermifuge, anticataleptic, anti-inflammatory, anticonvulsant, anti-inflammatory, cardioprotective, antidiarrheal, antimicrobial, antioxidant, antibacterial, anticancer, antiarrhythmic and antidiuretic Activity.	Shendye et Gurav, 2014
Hordeum murinum L.	PCE AMS AMA	Activities against colds, colic and throat ailments.	Chaachouay et al., 2016
Lolium multiflorum Lam.	PCE AMS AMA	Antioxidant, anti-inflammatory and antiseptic activities.	Choi et al., 2016
Emex spinosa (L.) Campd.	PCE AMS AMA	Antibacterial, antifungal, anti-inflammatory, antipyretic, analgesic, antidiabetic, antiulcer, anticancer and cytotoxic activities.	Abd El-Kader et al., 2006 Ajaib et al., 2022 Donia et al., 2014
Polygonum aviculare L.	PCE AMS AMA	Antioxidant, anti-inflammatory, antidiabetic, anticancer and dermatoprotective activities.	Benrahou et al., 2023
Polygonum maritimum L.	PCE	Antioxidant, antibacterial, anti-inflammatory and Antidiabetic activity.	El-Haci et al., 2013 Rodrigues et al., 2017
Asperula arvensis L.	PCE AMS AMA	Tonic, antidiarrheal and diuretic activity. It is used as a cleanser of the blood and lymphatic system and for skin diseases and cancer treatments.	Kayiş et Kaya , 2024
Misopates orontium (L.) Raf.	PCE AMS AMA	Analgesic, antispasmodic, antioxidant, anticancer, antimicrobial, anti-inflammatory and hepatoprotective activity.	Ajaib et al., 2020 Akbar et Ishtiaq, 2020 Akbar et al., 2020
Verbascum sinuatum L.	PCE AMS AMA	Antioxidant, antimicrobial, anticancer, neuroprotective and cardiovascular protection activity.	Donn et al., 2023
Hyoscyamus albus L.	PCE AMS AMA	Antidiabetic, antioxidant, antimicrobial, antiasthmatic, antiallergic, anti-inflammatory,	Al-Snafi et al., 2018

		analgesic, hepatoprotective and antipyretic activity.	
Lycium europeum L.	PCE AMS AMA	Cardioprotective, antioxidant, hepatoprotective, Anti-inflammatory, antidiabetic, anticancer, antimutagenic, neuroprotective, nephroprotective, neuroprotective, antihypertension, anticoagulant, anti-influenza, antitoxic, antiviral, anti-hepatitis C, anti-aging, anti-Alzheimer's, anti-asthma, anti-hyperlipidemic, anxiolytic, analgesic, anti-allergic, antihypertensive, antiatherosclerotic, antiplatelet, antiatherogenic, antifungal, antitumor, cytotoxic, anti-plasmodial, antimutagenic, antigenotoxic and hallucinogenic activities.	Wannes et Tounsi, 2020
Nicotiana glauca Graham	PCE AMS AMA	Antibacterial, antioxidant, antidiabetic and hepatoprotective activity.	Ozdenefe et al., 2023 Janakat et Al-Merie 2002
Solanum nigrum L.	PCE AMA	Antiproliferative activity/cancer prevention, antioxidant activity /degenerative disease; Anti-aging, antiepileptic activity/epilepsy, anti-inflammatory activity /respiratory conditions, hepatoprotective activity/liver disease and toxic effect.	Jain et al., 2023
Solanum Sodomaeum L.	AMA	Anticancer, antidiabetic, antimicrobial, toxic, antineoplastic and antitumor activity.	Jain et al., 2023 Saad, 2019 Cham et Wilson, 1987 Cham et al., 1987
Parietaria judaica L.	PCE AMS AMA	Antibacterial and Depurative activity (blood purification).	Khaledi et al., 2018 Calvo et Cavero, 2014
Urtica urens L.	PCE AMS AMA	Antioxidant, anti-inflammatory, antinociceptive, diuretic, depurative, antidiabetic and antirheumatic activity.	Mzid et al., 2016 Marrassini et al., 2010

4. DISCUSSION

In general, understanding the properties and uses of medicinal plants is the result of a long experience accumulated and transmitted from one generation to another. Populations have long used medicinal plants to prevent and treat diseases. The plants recorded in the study area were also found to be rich in medicinal virtues. Indeed, 65 plants would have antioxidant activities, 38 plants would have anti-inflammatory activities, 29 would be antibacterial, 27 would be antimicrobial, 24 would be anticancer, 23 would have antidiabetic activities, 21 would be cytotoxic, 15 plants would have hepatoprotective activities, 12 would have analgesic activities, 11 would be antiviral, 11 would have neuroprotective activities, 8 could be cardioprotective, 8 would be antiproliferative, 7 would have antidiarrheal activities and 6 species could be antipyretic (Figure 2). In addition to this, other activities were noted from the exploitation of the publications found. These activities would be antirheumatic, antitoxic, anti-hepatitis C, anti-aging, anti-Alzheimer, anti-asthma, anti-hyperlipidemic, anxiolytic, antispasmodic, anti-allergic, antihypertensive, antiatherosclerotic, antiplatelet, antiatherogenic, antifungal, antitumor, anti-plasmodium, anti-mutagenic, antigenotoxic, hallucinogenic (Table 1).

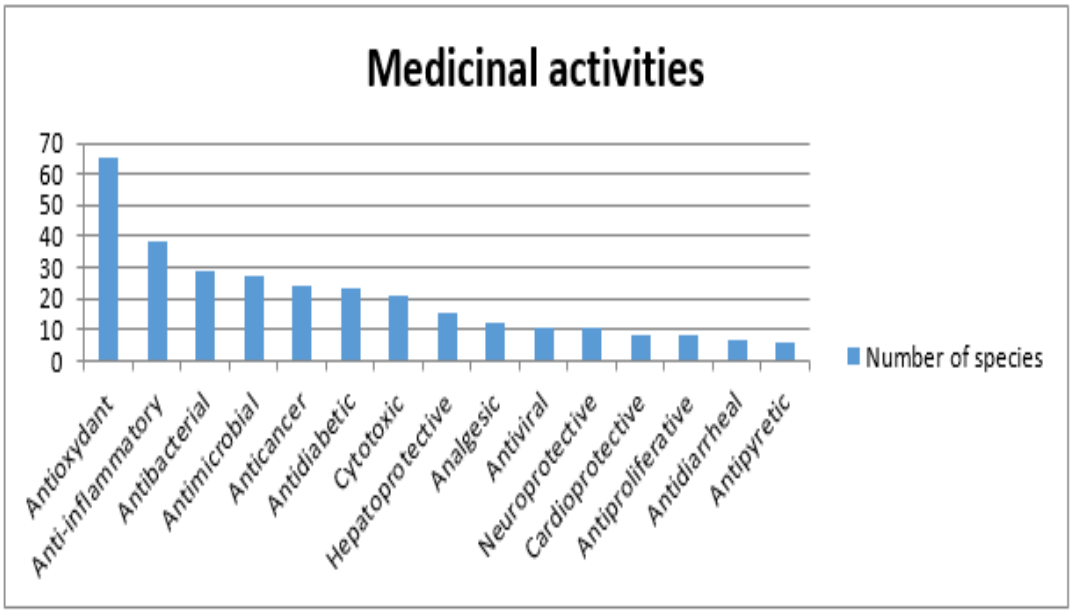

Figure 2: Medicinal properties of plants recorded in the three archaeological sites of Eljadida, Safi and Azemmour.

- **Antioxidant Activity**

A large proportion of the plants listed, around 78%, would have antioxidant capacities (Figure 2). Oxidative stress maintains a causal relationship between various incurable diseases such as diabetes, aging, cancer, heart disease, inflammatory diseases (Kasture et al., 2020). The antioxidant properties of phenolic and flavonoid compounds present in foods are well known. Plants rich in phenolic compounds can be an excellent source of antioxidants (Bouchmaa et al., 2022). Reactive oxygen species ROS play a crucial role in the development of many pathological diseases such as Alzheimer's disease, atherosclerosis, Parkinson's disease, inflammation, cancer, hypertension and heart attack (Adegbola et al., 2020). Dietary intake of foods rich in antioxidants has been shown to have an inverse relationship with the incidence of a number of diseases in humans (Benhammou et al., 2009). Among the antioxidant species encountered in the study area and which are the most cited in previous works, there are: *Mesembryanthemum crystallinum*, *Chenopodium album*, *Polygonum maritimum*, *Lycium europeum*, *Nicotiana glauca*, *Centaurea aspera* (Table 1).

- **Anti-inflammatory Activity**

Inflammation is known as a symptom of many diseases (Elhawary et al., 2020). Several plants have anti-inflammatory action and can be used to heal the discomforts due to injury or other. This action then reduces the burning, rashes, itching and swelling associated with inflammation. As the importance of preventive and therapeutic approaches to combat inflammatory diseases increases, many researchers have focused on identifying anti-inflammatory substances from natural products (Choi et al., 2016). Plants with anti-inflammatory action constitute 48% of the species recorded in the study area (Figure 2). Among these plants, we cite: *Chenopodium ambrosioides*, *Urtica urens*, *Eucalyptus globulus*, *Marrubium vulgare*, *Malva parviflora*, *Ricinus communis* and others. All these plants are used by the local population to soothe pain.

- **Antimicrobial Activity**

Medicinal plants play a crucial role in meeting essential health needs and represent a new source of natural antibacterial and antifungal agents (Salehi et al., 2019). Many active substances are present in plants, including those with antimicrobial properties. In this context, some plants recorded in the study area such as *Apium nodiflorum*, *Olea europaea* and *Ricinus communis* offer good opportunities mainly due to their essential oils; indeed, they have been used for centuries as antifungals (Maxia et al., 2012; Yaseen Khan et al., 2007; Chouhan et al., 2021). This is also the case for *Erodium ciconium*, *Chenopodium murale* and *Schinus molle*, whose effectiveness against microbes such as fungi has been demonstrated by numerous studies (Stojanović-Radić et al., 2010; Rehman and Rao, 2023; Martins et al., 2013; do Prado et al., 2018). Other studies have shown that some plants such as *Calendula arvensis* exhibit significant inhibition on pathogens (Khouchlaa et al., 2023).

- **Anticancer Activity**

Cancer is among the leading causes of death worldwide. Synthetic chemotherapeutic drugs should therefore be substituted by natural products that have the ability to inhibit the growth of cancer cells with fewer side effects. Plant extracts have been shown to be a promising source of cytotoxic compounds (Khouchlaa et al., 2023). Some of the plants that have shown anticancer activities based on previous studies include *Salicornia europaea*, *Phoenix dactylifera*, *Pallenis spinosa* and *Retama monosperma* (Table 1). Plant phytochemicals such as flavonoids, polyphenols, alkaloids, saponins, terpenes, and other metabolites present in plant extracts are known to have anticancer properties; they have shown an exceptional ability to scavenge free radicals and inhibit lipid peroxidation, which preserves the body system from oxidative damage and subsequently decreases the risk of unwanted cellular mutations (Elbouzidi et al., 2022).

- **Antidiabetic Activity**

Diabetes, like many other chronic diseases, has adverse effects on people's health and can lead to various complications (Bouchmaa et al., 2022). Diabetes is caused by an unusual abnormality of insulin, the action of which is impaired, or by a complete deficiency of insulin that leads to an imbalance in glucose metabolism and results in a syndrome known as diabetes mellitus (Bhat et al., 2011). Medicinal plant extracts that can lower blood glucose levels without side effects are known to be effective as antidiabetic remedies. Plant species that have been shown to have antidiabetic effects include *Spergularia fimbriata*, *Beta vulgaris* subsp. *maritima*, *Malva parviflora*, *Bougainvillea spectabilis*, *Emex spinosa*, *Solanum Sodomaeum*, and *Urtica urens* (Table 1).

- **Other Medicinal Activities**

Plants have played a vital role in reducing pain since ancient times, and today, the focus is on their role and ability to heal, as well as their therapeutic properties for different diseases. The informed public and health professionals have a great interest in studying these herbs and evaluating their therapeutic properties. Pharmacological activities: hepatoprotective as in *Coronopus squamatus*, *Ficus carica* and *Lycium europeum*; cardioprotective as in *Verbascum sinuatum*, *Cynodon dactylon* and *Silybum marianum*; analgesic as in *Anacyclus radiatus* subsp. *coronatus*, *Sonchus pinnatifidus* and *Misopates orontium*; neuroprotective as in *Oxalis pes-caprae*,

Plantago coronopus; antiproliferative as in *Asparagus acutifolius*, *Diplotaxis tenuisiliqua*, *Polycarpon tetraphyllum*, *Solanum nigrum* and others (Table 1). All this shows that the plants listed have multiple pharmacological properties beneficial for the local population.

5. CONCLUSION

Archaeological sites are home to vascular plants with multiple pharmacological and medicinal properties that are beneficial to the local population. These plants are known for their many virtues and are subsequently collected by local residents. The problem that arises in the case of archaeological sites precisely is the way in which these plants are harvested; their uprooting can lead to openings that deepen with rainfall or the movement of animals causing damage to old buildings. The conservation of these sites requires raising awareness among the local population about the importance of old buildings. Any collection of plants in these enclosures should be prohibited for residents who should obtain their medicinal herbs elsewhere.

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