

## ***Lycium europaeum*: vegetative species with a multiple use**

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**ABSTRACT:** *Lycium europaeum* L., an economically important traditional medicinal plant, which can be used for re-vegetation purposes under various ecological factors due to its ability to form an association with arbuscular mycorrhizal (AM) fungi. Our study presents a synthesis of information and hypotheses found in different consulted scientific studies regarding the importance of this plant, its adaptability potentials and its biological characteristics, in order to provide scientific support to encourage the cultivation and valorization of this plant in Morocco.

**KEYWORDS:** *Lycium europaeum* L., medicinal plant, re-vegetation, arbuscular mycorrhizal fungi, Morocco.

### **1 INTRODUCTION**

*Lycium* is one of the larger genera of the Solanaceae consisting of woody shrubs distributed throughout the temperate and subtropical regions of the world, There are approximately 21 species in North America, around 35 species in South America [1], [2] and Africa, around 10 species in Eurasia, and one species in Australia.

*L. europaeum* is an important medicinal plant of Solanaceae family, consisting of woody shrubs distributed throughout all countries of the Mediterranean basin [3], also called “wolfberry” and was known since ancient times in the Mediterranean area as a medicinal plant and used in several traditional remedies to treat mouth and throat diseases, eczema, scabies and various eye diseases, animal bite and against the female infertility [4],[5], and fruits were reported to exhibit tonsillitis, aphthae and diarrhea [4]. This plant was known to European herbalists since ancient times and was traded from Far East to Europe and North Africa by the Romans.

In addition to its medicinal character, *L. europaeum* is a mycotrophic species which can be proposed as candidate for the stabilization of mobile dunes and degraded slopes conditioned by extreme environmental factors [6], It is also used as a means of demarcation between the farms[7], and it is a plant of relays not only because of its vast spatial distribution but also its long fruiting period, although the fact that it allows the fruit fly to breed and multiply practically without interruption[7].

The objective of this work is to illustrate the medicinal and ecological role of this tree and put the item on its symbiotic interest with the arbuscular mycorrhizal fungi which present an alternative way of promoting growth of this plant, thus plants used in restorations can be grown in soils with mycorrhizal fungal inocula to permit their colonization before planting, but more detailed investigations are needed to establish a further study.

### **2 GENERALITIES ON *L. EUROPAEUM***

#### **TAXONOMY**

*L. europaeum* is a species of the genus *Lycium* (Solanaceae) which consists of small to large shrubs with a wide distribution in arid to subarid, temperate to subtropical regions of the world[11],[12]. Seventeen *Lycium* species are known in southern Africa, whereas 50-60 species are found in the western hemisphere [11].

The generic name is derived from the Greek word λυκίων (lycion), which was applied by Pliny the Elder and Pedanius Dioscorides to a plant known as dyer's buckthorn, It was probably a *Rhamnus* species and was named for Lycia, the province in which it grew [13].

There is much confusion between this species and the closely related *L. barbarum* and *L. chinense*. Most, if not all, of the plants being grown as *L. europaeum* in Britain are in fact *L. barbarum* [14]. Many botanists unite the three species under the name *L. barbarum*, though they are distinct [14].

#### **GEOGRAPHICAL DISTRIBUTION**

*L. europaeum* is widespread in all countries of the Mediterranean Basin [3]. The species has been reported in Europe, Africa, Asia, Micronesia [8], Tunisia [15]; [5] and in Egypt [16], [17].

In Morocco, *L. europaeum*, has been signaled in the Rif, Targuist, Zerhoun, Aknoul, Guercif, Gharb [8], Mamora [9], Coastal dunes of Mehdia [6] and in the palm plantation in Marrakech [10], the species was also observed in the littoral zone between Larache and Machraa Ben Abbou-Marrakech and also in Sefrou (Azzaba).

It is tolerant of many soil types, including poor, shallow rocky soils, and does well on lighter soils, particularly along dry creek beds [18].

#### **BOTANICAL ASPECTS**

It is a thorny bush of around 1-5 m height: its flowers are whitish-purple with 5 petals. Under very low humidity and high temperatures this plant bears fruits from February until the end of July [7]. The fruits are small red berries (10 mm diameter), much like very small tomatoes and are sometimes eaten by wild dogs, in Arabic this fruit is called Tmatem Kleb' (literally "Dog Tomato") [7].

In the anther, the archesporium as described by Jain [19] is in the form of a plate in each lobe. The sub-epidermal wall layer differentiates as the endothecium and the innermost as secretory tape turn. There are 2 middle layers. The tapetal cells divide by normal mitosis. The sporogenous tissue is arc-shaped. There is no synchronization in the division of the mother cells of a loculus. The formation of the microspore tetrad by furrowing is of simultaneous type. The pollen grains are smooth-walled, triforate and spheroidal. They are shed at the 2-celled stage. The ovules are anatropous, unitegmic and tenuinucellate. The embryo-sac completely absorbs the nucellus and the inner integumentary layer differentiates as the Integumentary tapetum. The placental tissue proliferates as a glandular obturator. The hypodermal archesporial cell directly functions as the megaspore mother cell and divides to form a linear row of 4 megaspores, of which the chalazal functions. The development of the female gametophyte conforms to the monosporic 8-nucleate Polygonum type of embryo-sac. A mature embryo-sac with reverse polarity has also been observed. The expansional activity of the chalazal end of the embryo-sac is striking [19].



**Fig. 1: *L. europaeum* developing in the mobile dunes of Mehdia (northwest of Morocco 2016)**



**Fig. 2:** *L. europaeum* developing between tiles (Mehdia Northwest Morocco 2016)



**Fig. 3:** Fruits of *L. europaeum* (Mehdia Northwest Morocco 2016)



**Fig. 4:** Phenomenon observed in *L. europaeum*: thickening of the stem as a racket and bud formation after breaking the extremity or insect bites (Mehdia Northwest Morocco 2016)

### 3 IMPORTANCE OF THE PLANT

#### MEDICINAL USES

*L. europaeum* has been quoted as a potential edible [20], but no records of a specific food use of its green parts have been described before. Dried stems of this taxon also play a specific religious role in southern Italy [21].

The traditional Moroccan pharmacopoeia [22],[23] considers *L. europaeum* (Euro-Mediterranean species) as a medicinal plant [24] which can be used to treat mouth and throat diseases, eczema, scabies and various eye diseases, animal bites and against the female in fertility [4], [5].

In Tunisia *L. europaeum* L. is used for eczema [25], and in the Eastern Mediterranean region of Israel *L. europaeum* L. root decoction is used to treat High blood pressure and diabetes [26] and its powder is used for Rheumatic and constipation in the coastal region of Libya [27], its fruit are effective against tonsillitis, aphthae and diarrhea [4] and are traditionally consumed in Turkey during autumn for the prevention and therapy of cold and infectious diseases, kidney and liver disorders, diabetes, high blood pressure and also as diuretics and sedatives [28],[29],[30]. Ghali *et al.* [31] demonstrate that *L. europaeum* may inhibit the proliferation of cancer cells and induce apoptosis and could provide protection from oxidative stress diseases thanks to its high antioxidant molecules content.

The fruits of many members of this genus are a very rich source of vitamins and minerals, especially in vitamins A, C and E, flavanoids and other bio-active compounds. It is also a fairly good source of essential fatty acids, which is fairly unusual for a fruit. It is being investigated as a food that is capable of reducing the incidence of cancer and also as a means of halting or reversing the growth of cancers [32], but some caution should be exercised with this species, since it belongs to a family that often contains toxins.

#### ECOLOGICAL FUNCTIONS

In addition to its medicinal characteristics, *L. europaeum* is also used to provide hedges around the hotels in order to prevent intrusion of animals or to provide ornamentation, inside the oases, it is used also as a means of demarcation between the properties of different owners and could act as a significant reservoir for the medfly, due to its early and long ripening period, this plant may be an important medfly host in April-May when preferred hosts (i.e. citrus other than lemon, apricots and peaches) are absent [7].

It can also be planted to stabilize banks [14] and is a good candidate to fix the mobile dunes, it has a remarkable longitudinal and vertical growth and it allows the installation of other vegetation behind it [6].

### 4 ASSOCIATIONS AND INTERACTIONS

Arbuscular mycorrhizae (AM) are the most common types of mycorrhizal partners and occur in most plant families [33], [34]. Host plants colonized by these fungi often exhibit enhanced mineral uptake [35], [36], [37]) and have reduced infection by soil-borne pathogens.

*L. europaeum* is a mycotrophic species; mycorrhizal symbiosis enhance the growth and health of this plant, increasing root surface, stem diameter, leaf weights and area and root length, the mycorrhizal root colonization of the inoculated plants is about 26.83% [38].

Different studies have shown that the number of spores in the rhizosphere of this plant, is equally 75 and 50 spores / 100g of soil respectively in the mobile and the immobile dunes of Mehdia northwest of Morocco [6], and Agwa & Al-Sodany [39] reported that the number of spores in *L. europaeum* rhizosphere soil was about 136.7 spores / 100g of soil in coastal sand dunes of El-Omayed Biosphere Reserve in Egypt.

### 5 PESTS AND DISEASES

*L. europaeum* is host to a range of different phytophagous, *Diaphorina lycii* Loginova [40], *Trioza lienhardi* Burckhardt [41],[42], *Carpophilus davidsoni* Dobson [43], *Neoceratitis lycii* Coquillett [44], *Burckhardt* [45], *Ceratitis capitata* Wiedemann [7], *Coleophora vigilis* Meyrick [46], *Aceria eucricotes* [47], and pathogens such as *Puccinia turgida* P. Syd & Syd. [48], *Arthrocladiella mougeotii* Lév. [49], [50]. Twenty-four viruses are known from non-African *Lycium* [51].



Fig. 5: *L. europaeum* presenting galls on the leaves due to insect bites (Mehdia Northwest Morocco 2016)

## 6 CONCLUSION

Although *L. europaeum* is not commercially utilized or cultivated in Morocco, despite its importance in the traditional medicine recognized for centuries, and its mycotrophic character that presents another way to promote the growth of this plant, which can be used as natural ways to stabilize the slope and mobile dunes, it seems important that future studies may develop around the use and valorization of this plant.

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