

**QUERCUS INFECTORIA (MAZU): A REVIEW****Misba Naim<sup>\*1</sup>, Wajeaha Begum<sup>2</sup>, Fazly Shakoor<sup>3</sup>**

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**ABSTRACT**

*Quercus infectoria* Olivier (Fagaceae) is a small tree found in Greece, Asia minor and Iran. The galls arise on young branches of this tree as a result of attack by an insect, gall wasp. In Unani system of medicine, galls have been used since centuries for treating many diseases and a detail description is mentioned in Unani classical literature. The galls have also been pharmacologically documented to possess astringent, antidiabetic, anti-inflammatory and anti-bacterial activities. The main constituent found in galls is tannin, free gallic and elagic acid. The present review is an attempt to highlight the Unani aspect of *Quercus infectoria* galls along with its latest pharmacological research.

**KEYWORDS:** *Quercus infectoria*, galls, mazu, Unani.

**INTRODUCTION**

Turkish galls (mazu) are pathological outgrowths formed on the twig's of the Dyer's oak, *Quercus infectoria* Olivier, family Fagaceae. Galls in local speech mean swelling, kobak, growth or gallnut. These excrescences arise in consequence of the deposition of an egg by a small insect, *Alderia gallectinctoriae* Olivier, family cynipidae, often known as the gall wasp.<sup>[1,2]</sup>

**PLANT DESCRIPTION**

**Synonyms:** Oak galls, Turkish galls, Nut galls, Mecca galls, Aleppo galls.<sup>[1,3]</sup>

**Botanical name:** *Quercus infectoria* Olivier<sup>[2,3,4]</sup>

**Classification**

Kingdom : Plantae  
 Subkingdom : Tracheobionta  
 Superdivision : Spermatophyta  
 Division : Magnoliophyta  
 Class : Magnoliopsida  
 Subclass : Hamamelidae  
 Order : Fagales  
 Family : Fagaceae<sup>[2,3]</sup>  
 Genus : Quercus L.  
 Species : Quercus infectoria Olivier<sup>[5]</sup>

**Table 1: Vernaculars of Quercus infectoria.**

Language	Local name
Arabic	Ufas <sup>[3,6,7]</sup>
Bengali	Majuphal <sup>[3,6,7]</sup>
English	Oak galls <sup>[6]</sup> turkey galls, dyer's oak, Aleppo galls, mecca galls <sup>[7,8]</sup>
Gujarati	Mayaphal <sup>[3,7,8]</sup>
Hindi	Mazu, mazuphal <sup>[4,6,7,8]</sup>
Kannada	Machikai <sup>[4]</sup>
Malyalam	Majakani <sup>[3,4]</sup>
Persian	Mazu <sup>[3,6,7,8]</sup>
Sanskrit	Maju phal <sup>[3,6,8]</sup>
Tamil/siddha	Masikkai <sup>[3,4,8]</sup>
Telugu	Machikaya <sup>[3,4,8]</sup>
Unani	Iqaqualees <sup>[3]</sup>

**Fig. 1: Mazu (Quercus infectoria) : Tree and fruit.****History**

Galls were well known to the ancient writers and Pliny records the use of their infusion as a test for sulphate of iron in verdigris, possibly the earliest mention of an attempt to detect adulteration by chemical means.<sup>[2]</sup>

**Habitat**

Asia Minor extending to the borders of Persia. Found in Turkey, Syria, Persia, Cyprus and Greece.<sup>[6,9]</sup> It is a tree of subtropical climates, found in mid Mediterranean, Balkans, Anatolia and Iran. It is more common in areas with Mediterranean climate, in term of annual temperature; areas with 12-16°C temp are the optimum growth areas.<sup>[4,8,10]</sup>

**Ethanobotanical description**

The dyer's oak is a small tree or shrub about 2 m high. Its trunk is straight and has a bark full of vertical and deep cracks. Leaves are rigid, often glabrescent with spinous teeth, 4-6 cm long, lobe is triangular, with raw serrations and nodular. Fruits globose, 0.63 cm, lemon colored and tinged yellow. Cyprus oak has acorns that are 2-3 cm long. On the acorn are the dark red and cube looking formations that are called galls.<sup>[2,4,5,6,10, 11,12,13]</sup>

**Formation of galls**

These galls are the vegetable growths formed on the young twigs of the dyer's oak, *Quercus infectoria* (Fagaceae), as a result of the deposition of the eggs of the gall-wasp *Adleria gallectinctoriae* among the leaf buds of the plant.<sup>[2,4,5,6,10,13]</sup>

Abnormal development of vegetable tissue round the larva is due to an enzyme-containing secretion, produced by the young insect after it has emerged from the egg, which by the rapid conversion of starch into sugar stimulates cell division. As starch disappears from the neighbourhood of the insect, shrinkage occurs and a central cavity is formed in which the insect passes through the larval and pupal stages. Finally if the galls are not previously collected and dried, the mature insect or imago bores its way out of the gall and escapes. During these changes color passes from a bluish-grey through olive green to almost white.<sup>[1,2]</sup>

**Characteristics of galls**

Aleppo galls are globular in shape, 10-25 mm in diameter, average weight is about 3.8 gm (1.8-4.2gm). They have short, basal stalk and numerous round projections on the surface galls have no specific odor and have a very astringent taste followed by a sensation of sweetness. The so called 'blue' variety is actually of grey or brownish grey color. These and the olive green 'green' galls are preferred to 'white' variety, in which tannin content is less. White galls also differ in having a circular canal through which the insect has emerged. Galls without opening have insect remains in the small central cavity.<sup>[1,2,3,4]</sup>

**Temperament**

Cold I and dry II, [3,6,7,11,12,13]

Cold II and dry III. [6,7,11,12]

**Actions and Uses**

Qabiz<sup>[3,6,7,11,12,13]</sup> Habise haiz<sup>[3,11,13,14]</sup> Mane ruaf<sup>[11,12]</sup> Habisuddam<sup>[3,7,12,13,14]</sup> Dafaee  
 Taffun<sup>[7,11,12,13,14]</sup> Mujaffif<sup>[7,11,13,14]</sup> Muqawwie danda wa lissa<sup>[3,6,7,12,14]</sup> Mumsik, Muhallil,  
 Naafe nutue rehm

**Table 2: Uses in unani system of medicine.**

Ailment/Disease	Method of administration
Aakela	Applied locally as paste or as a dusting powder. <sup>[7,11,12,13]</sup>
Alopecia	Applied locally as paste when mixed with vinegar. <sup>[6,7,11,12,13]</sup>
Anal prolapse	Decoction is used as sitz bath or as abdasht, or its decoction is applied as a paste. <sup>[6,7,12,13]</sup>
Anal ulcer	In form of sitz bath and aabdasht or locally as paste or dusting powder. <sup>[6,7,12,13]</sup>
Apthous ulcers	Decoction is mixed with vinegar and used in form of mouthwash. <sup>[6,11,12]</sup>
Bad odor	Applied or rubbed on body. <sup>[6,7,11,12]</sup>
Chronic diarrhea	Powder orally with water. <sup>[3,6,7,11,12,13,14]</sup>
Epiphora	Very fine powder can be used as kohl, surma. <sup>[6,7,13]</sup>
Epistaxis	In form of khesanda or nakchhikni. <sup>[6,7,11,13]</sup>
Freckles	Applied locally as paste when mixed with vinegar. <sup>[6,7,12,13]</sup>
Gingivitis	Powder/decoction is mixed with vinegar and rubbed or applied locally on teeth and gums or mixed in tooth powders. <sup>[6,7,11,12,13]</sup>
Hematuria	First heated on flames and then its powder is mixed with vinegar, taken orally, or as humool (suppository). <sup>[7,11,12]</sup>
Herpes	Applied locally when mixed with vinegar or as a dusting powder. <sup>[7,11,12,13]</sup>
Hyperhidrosis	Applied or rubbed all over body. <sup>[6,7,11,12,13]</sup>
Intestinal ulcer	Powder orally with water. <sup>[6,7]</sup>
Leucorrhea	Powder is taken orally with water, its decoction is used as sitz bath or as abdasht. <sup>[6,11,12,13]</sup>
Menorrhagia	Powder is taken orally with water. <sup>[6,7,11,12,13]</sup>
Pharyngitis	Decoction is used as mouthwash and for gargling. <sup>[7,11,12,13]</sup>
Proctitis	Applied locally as paste, or as a dusting powder. <sup>[6,7,12,13]</sup>
Ringworm	Applied locally as paste when mixed with vinegar. <sup>[6,7,12,13]</sup>
Salaque	Used as kohl, surma. <sup>[6,7,11,12,13]</sup>
Uterine prolapse	Decoction is used as sitz bath or as abdasht. <sup>[6,12]</sup>
Wound	As a dusting powder on fresh wounds. <sup>[6,7,12,13]</sup>

**Dosage**

Gall: 1-3 gm powder<sup>[6,12]</sup> 4 masha<sup>[3,6,11]</sup> 10-20 grains powder, infusion or decoction (in 13).<sup>[8]</sup>

**Muzir (toxic):** Chest/ throat diseases.<sup>[6,7,11]</sup>

**Musleh (correctives):** Katira, samagh arabi, zardi baize neem brasht.<sup>[6,7,11]</sup>

**Badal (substitute):** Maaei,<sup>[6,7,11,14]</sup> juft baloot, post anar, halila zard,<sup>[6,7,11]</sup> samrauturfa.<sup>[14]</sup>

**Murakkabat (compound formulation)**

- Majoon muqawwi rehm<sup>[3]</sup>
- Sufoofe habis
- Sufoofe muallif
- Sunoone zarad
- Sunoone muqawwie dandan
- Qurse bandishe khoon<sup>[15]</sup>
- Qurse pechish.<sup>[6,7,11,13,15]</sup>

**Modern pharmacological actions**

Analgesic, antidote, alkaloid, astringent,<sup>[4,16]</sup> hypoglycemic, styptic, sedative, tonic, anti-bacterial, anti-fungal, anti-viral and anti-inflammatory, anti-ulcer activity etc.<sup>[1,16,17,18]</sup>

**PHYTOCHEMICAL CONSTITUENTS**

Galls contain 50-70% of the tannic acid,<sup>[16]</sup> gallic and ellagic acid<sup>[9]</sup> besides starch, sugars, essential oil, and anthocyanins. They were also found to contain beta-sitosterol, amenoflavone, hexamethyl ether, isocryptomerin, calcium oxalate, methyl oleanolate.<sup>[1,2,3,4,8,13,16,17]</sup>

**PHARMACOLOGICAL STUDIES****Antibacterial activity**

- Ethanol extract displayed relatively better inhibitory activity towards all tested urobacterial species and significantly inhibited the growth of the gram negative bacteria. Thus helps in preventing UTI. Proposed etiopathogenesis was tannins prevent bacteria from adhering to cells because hydrolysable tannins contain structures similar to the bacterial binding receptors on the surface of urinary tract cells and thereby preventing adherence of the bacteria to the cell surface receptors.<sup>[18]</sup>

- Mechanism of *Quercus infectoria* (nutgalls) extract and its component were investigated for anti-methicillin –resistant *Staphylococcus aureus* (MRSA). The appearance of pseudomulticellular bacteria in the nutgall ethanol extract cell and the synergistic effect of the plant extract with beta-lactamase-susceptible penicillins indicated that the extract may interfere with staphylococcal enzymes including wall autolysins and beta-lactamase.<sup>[19]</sup>

#### **Anti-microbial activity**

- Active compounds present in crude ethanol extract shows antibacterial activity with dose dependent manner. Their mode of antimicrobial action may be related to their ability to inactivate microbial adhesions, enzymes, cell envelope transport proteins, complex with polysaccharides etc.<sup>[19]</sup>
- The antimicrobial activity of *Q. infectoria* was examined using different solvents of varying polarity and efficacy was compared. The results obtained from this study reveal that *Quercus infectoria* galls have antimicrobial activity against Gram-positive *Bacillus subtilis*, and *Staphylococcus aureus* and Gram-negative bacteria *Escherichia coli*. All extracts from the galls inhibited the Gram-positive bacteria better than Gram-negative bacteria.<sup>[20]</sup>

#### **Anti-inflammatory activity**

Effect of alcoholic extract of *Q. infectoria* galls was evaluated on various experimental models of inflammation. Oral administration of gall extract significantly inhibited carrageenan, histamine, serotonin and prostaglandin E<sub>2</sub> induced paw edemas, while topical application of gall extract inhibited phorbol-12-myristate-13-acetate induced ear inflammation. Proposed pathophysiology: the anti-inflammatory activity of the galls may be related to inhibition in functions of macrophages and neutrophils wherein the extract inhibits the release of inflammatory mediators, viz. PGE<sub>2</sub>, NO, O<sub>2</sub>- and lytic enzymes from these cells.<sup>[21]</sup>

#### **Hepatoprotective action**

- The alcoholic extract of fruits can offer 36% liver protection against carbon tetrachloride induced toxicity at a dose of 800 mg/kg. (Patel et al, Indian drugs, 1988, 25,244).<sup>[4]</sup>
- In a study, galls of *Quercus infectoria* were evaluated for their hepatoprotective effect against carbon tetra chloride (CCl<sub>4</sub>) induced hepatotoxicity in rats. Subcutaneous injection of CCl<sub>4</sub>, administered twice a week, produced a mark elevation in the serum levels of aspartate transaminase (AST), alanine transaminase (ALT) and tumor necrosis

factor (TNF- $\alpha$ ). Daily oral administration of aqueous ethanolic extract of *Quercus infectoria* galls at 200, 400 and 600 mg/kg doses produced a dose dependent reduction in the serum levels of liver enzymes and inflammatory mediators and attenuated the necroinflammatory changes in the liver.<sup>[22]</sup>

### **Nephroprotective anti tumour activity**

*Quercus infectoria* acts as a potent chemopreventive agent and suppresses Fe-NTA induced renal carcinogenesis and oxidative and inflammatory response in wistar rats. Oral administration of *Quercus infectoria* at doses of 75 and 150 mg/kg b wt effectively suppressed renal oxidative stress, inflammation and tumour incidence. Chemopreventive effects were associated with up-regulation of xenobiotic metabolizing enzyme activities and down regulation of serum toxicity markers.<sup>[23]</sup>

### **Wound healing property**

In an experimental trial, ethanol extract of the shaded dried leaves of *Quercus infectoria* were studied for its effect on wound healing in rats, using incision, excision and dead space wound models, at two different dose levels of 400 and 800 mg/kg. The plant showed a definitive, positive effect on wound healing, with a significant increase in the levels of the antioxidant enzymes, superoxidase dismutase and catalase, in the granuloma tissue. This wound healing potential may be due to its action on antioxidant enzymes.<sup>[24]</sup>

### **Antidiabetic activity**

R. Saini et al tested the methanolic extract of roots of *Quercus infectoria* Olivier at a dose of 250 mg/kg and 500 mg/kg body weight respectively for anti-diabetic activity compared with glibenclamide, an oral hypoglycemic agent (3mg/kg) in alloxan induced hyperglycaemic rats. The blood glucose levels were measured at 0, 2h, 4h and 6h after the treatment. This reduced the blood glucose from 282.52 to 206.57mg/dl after oral administration of extract ( $P < 0.01$ ).<sup>[25]</sup>

### **Larvicidal activity**

An effort to assay *Anopheles stephensi* larvae with gall extracts of *Quercus infectoria* was made under laboratory conditions. Ethyl-acetate extract was found to be most effective for larvicidal activity against the fourth instar larvae, followed by gallotannin, n-butanol, acetone, and methanol respectively.<sup>[26]</sup>

**Anticandida activity**

Methanol and aqueous extracts of *Q. infectoria* galls were tested for anti-candida activity against *Candida albicans*, *Candida krusei*, *Candida glabrata*, *Candida parapsilosis* and *Candida tropicalis*. Results showed that both methanol and aqueous extracts displayed substantial anti-candida activity and pyrogallol was the major component of both crude extracts. Pyrogallol has been reported to have various biological activities such as candidicidal and fungicidal activities.<sup>[27]</sup>

**Antioxidant activity**

Ethanol, acetone and water extract of *Quercus infectoria* were evaluated for antioxidant activity via DPPH radical scavenging and metal chelating assays. Ethanolic extract have the highest antioxidant activity with  $94 \pm 0.05$  using DPPH assay, other extracts had less activity. Potent antioxidant activities may be due to high presence of flavonoid and tannins.<sup>[28]</sup>

**CNS depressive activity**

The methanolic fractions of the galls of *Quercus infectoria* exhibited neuropharmacological activity in laboratory animals. Chemical characterization of the CNS active component identified it as syringic acid. Isolated and pure syringic acid was studied and it suggest significant local anesthetic and sedative activity of the compound.<sup>[29]</sup>

**CONCLUSION**

The above literature shows that the description of mazu in Unani medicine is century's old and now modern pharmacology also proves galls of *quercus infectoria* having medicinal properties. This validates the sayings of Unani physician and further research and clinical trials are needed to explore its mechanism of action in day to day clinical practice.

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