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Review Article

OAK GALLS: THE MEDICINAL BALLS

*Shaikh Imtiyaz[1], S Javed Ali[2], Mohd Tariq[3], Shahid S Chaudhary[4], Mohd Aslam[5]
[1]Research scholar, Dept of Moalajat (Medicine), National Institute of Unani Medicine, Bangalore, India
[2]Research scholar, Dept of Moalajat (Medicine), National Institute of Unani Medicine, Bangalore, India
[3]Research scholar, Dept of Ilmul Saidla (Pharmacy), National Institute of Unani Medicine, Bangalore, India
[4]Research scholar, Dept of Ilmul Saidla (Pharmacy), National Institute of Unani Medicine, Bangalore, India
[5]Research scholar, Dept of Moalajat (Medicine), National Institute of Unani Medicine, Bangalore, India
*Email: dribshaikh@gmail.com

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ABSTRACT
From centuries ago man has been using herbs for medicinal purposes, in traditional system of medicine like Unani, Ayurveda, Chinese medicine number of herbs and drugs of plant origin are found to be useful in curing of various ailments. Oak galls (*Mazu*) is an out 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 gallae-tinctoriae* Olivier, this is used for medicinal purposes before escape of insects in dried form as described by classical Unani literature. Keeping in view of it this literature is reviewed about medicinal properties of *Mazu* described by ancient Unani scholars along with latest research on it this review paper is formulated and an attempt is made to correlate properties of *Mazu* with latest scientific research.
Key words: Oak galls, Mazu, *Quercus infectoria*, wound healing activity, Unani Medicine

INTRODUCTION

Oak galls (*Mazu*, Turkish galls, Nut galls) are the dried galls, which are excrescences formed as a result of stimulus produced by the larva of the gall wasp *Adleria gallaetinctoriae*, and found on twigs of dyer's oak (*Quercus infectoria* Olive.), a medium sized tree occurring in Greece, Bosnia, Turkey, Syria and Persia.[1, 2] *Mazu* is graded into two types, first one is heavier, bluish outer surface and non-perforated, it is considered as best variety and it is more effective. While second one is white, lighter and perforated. The mature insect escapes into the air through a hole bored in the side of gall. [3] *Hakim Najmul Ghani* states that, it is written in *Ganjbadaward* that the *Mazu* of best variety is green in colour and its inner tissue is soft. While in *Minhajuddukan*, it has been written that *Mazu sabz* of best variety has rough surface while low grade is smooth. The plant, from which *Mazu* obtained, is not found in India. It is imported from Greece, Minor Asia and Syria.[3]In Unani system of medicine it is extensively used since ancient times for various therapeutic purposes preferably for gingivitis, leucorrhoea, wounds, rectal and uterine prolapse and several bleeding disorders etc.[3,4] Galls were well known to 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.[2]*Mazu* contains 50-70% of the tannin known as gallotannic acid.[2] The galls of *Q. infectoria* have also been pharmacologically documented to possess astringent, antidiabetic,[5] anti-tremor, local anaesthetic, [6] antiviral, [7] antibacterial, [8] antifungal,[9] larvicidal[10] and anti-inflammatory[11] activities etc.

BOTANICAL NAME: *Quercus infectoria* Olivier [1, 2, 12]
FAMILY: Fagaceae [1, 2, 12]

VERNACULAR NAMES:
Arabic: Ufas; [1] **Unani:** Iqaqualees;[13] **Urdu:** Mazu; [1]**Persian**: Mazu; [1]**English:** Oak galls, [1]Turkey galls, [2]dyer's oak; [1,2] **Sanskrit:** Maju phal; [1,12] **Hindi:** Mazu, [1,12]Mazuphal; [1]**Marathi:** Maiphala; [1] **Guajarati:** Mayaphal;[1] **Kannada:** Machikai;[1] **Telugu:** Machikaya;[1,12] **Tamil:** Mashikai;[1,12] **Malayalam:** Majakani;[1,12] **Bengali:** Majuphal.[1,12]

MORPHOLOGICAL CHARACTERISTICS

The galls are globular in shape with 10 to 25 mm diameter. They have a short basal stalk and numerous rounded projections over the surface. The galls are hard and heavy, usually sinking in water. The 'blue' variety is actually grey or brownish-grey in colour. These and to a lesser extent the olive-green 'green' galls, are preferred to the 'white' variety, in which the tannin is said to have been partly decomposed. White galls also differ from the other grades in having a circular tunnel through which the insect has emerged. The galls without the opening have insect remains in the small central cavity. Galls have a very astringent taste and non specific odour. [1, 2]

Sections through a gall show a very large outer zone of thin walled parenchyma, a ring of sclernchymatous cells, and a small, inner zone of rather thick-walled parenchyma surrounding the central cavity. The parenchymatous tissues contain abundant starch, masses of tannin, rosettes and prisms of calcium oxalate, and the rounded so called 'Lignin bodies', which give a red colour with phloroglucinol and hydrochloric acid.[2]

PARTS USED: Excrescence[1, 3, 4]
DOSE: 3-5 gms, [1, 15] 4 gms[3]

ACTIONS DESCRIBED IN UNANI TIBB

- *Habise Haiz*[1, 14]
- *Qabiz* (astringent) [1,3, 13,15, 16]
- *Mane Ruaaf* [13,14,15]
- *Habisuddam* (Haemostatic) [1,13, 14,15, 16]
- *Dafae Taffun* (Antiseptic)[15]
- *Mujaffif* [13] (Desicative)
- *Muqawwie Danda wa lissa* [1, 3, 4, 13, 14, 15, 16]

- *Mumsik* [13]
- *Muhallil* [14] (Anti-inflammatory)

USES DESCRIBED IN UNANI TIBB

- *Kasrate irq* [15] (Excessive perspiration)
- *Irque muntin* [15] (Foul sweating)
- *Qarhae amaa* [13,15] (Intestinal ulcers)
- *Is'hale kuhna* [1,3,13,14,15] (Chronic diarrhoea)
- *Qulae dahan* [3,13,14, 15] (Mouth ulcers)
- *Warame lissa* [3,15] (Gingivitis)
- *Istirkhae luhat* [15]
- *Namla* [3,13,15] (Herpes)
- *Aakela* [3,15]
- *Daad* [13,5] (Ring worm)
- *Daus Salab*[15]
- *Jhaein*[3,14,15]
- *Salaque* [14,15]
- *Damaa*(*Dhalka*)[14,15] (Epiphora)
- *Ruaaf*[13,14,15] (Epistaxis)
- *Kasrate Haez* [15] (Menorrhagia)
- *Baolud Dam* [15] (Haematuria)
- *Khuruje Miqad* [15] (Anal Prolaps)
- *Warame Miqad* [14,15] (Proctitis)
- *Quruhe Miqad* [13,15] (Anal ulcers)
- *Sailanur Raham* [3,13,15] (Leucorrhoea)
- *Khuruje raham* [3,13] (Uterine Prolapse)
- *Bawasire Damavi*[1] (Bleeding piles)
- *Jarabe aain* [15] (Blephritis)

POLYHERBAL UNANI FORMULATIONS

Majoon Muqawwi Rahem, [1]*Sufoofe Habis*, [17] *Sufoofe Muallif*, [17] *Sunoone zarad*, [17] *Sunoone muqawwie dandan*, [17] *Qurse bandishe khoon*, [17] and *Qurse Pechish*.[17]

ETHNOBOTANICAL ACTIONS

Astringent, [12, 18] Analgesic, [18] Antidote, [18] Hypnotic, [18] Hypoglycaemic, [18] Sedative, [18] and Tonic. [18]

ETHNOBOTANICAL USES

Bleeding,[18] Bronchosis,[18] Carcinoma,[18] Cough,[18] Dermatosis,[18] Diabetes,[18] Diarrhoea,[18] Dysentery,[18] Eczema,[12,18] Fever,[18] Gingivitis,[18] Gonorrhoea,[18] Haemoptysis,[18] Heavy metal poisoning,[18] Impetigo,[12,18] Intertrigo,[12] Inflammation[18], Infection[18], Hyperhydrosis[18], Leucorrhoea[18], Malaria[18], Menorrhagia[18], Pharyngitis[18], Polyp[18], Prolapse[18], Stomatosis[18], Tonsillitis[18], Wart and Wound.[18]

CHEMICAL CONSTITUENTS

Mazu contains 50-70% of the tannin known as gallotannic acid. This is a complex mixture of phenolic acid glycosides varying greatly in composition. It is prepared by fermenting the galls and extracting with water-saturated ether. *Mazu* also contain gallic acid (about 2-4%), ellagic acid, sitosterol, methyl betulate, methyloleanolate, starch and calcium oxalate. Nyctanthic, roburic and syringic acids have more recently been identified as the CNS- active component of the methanolic extract of galls. Tannic acid is hydrolysable tannin yielding gallic acid and glucose and having the minimum complexity of pentadigalloyl glucose. Solutions of tannic acid tend to decompose on keeping with formation of gallicacid, a substance which is also found in many commercial samples of tannic acid. It may be detected by the pink colour produced on the addition of a 5% solution of potassium cyanide.[2] The main constituent of tannin is pentadigalloyl-glucose.[19] The galls also contain gum, sugar and essential oil.[20] Pure gallic acid assumes the form of white or nearly colourless feathery crystals of a beautiful silky luster. The commercial acid, however, is usually of a pale yellow colour. It is soluble in alcohol, and also, sparingly in ether. Its solution in water undergoes decomposition when exposed to air. When strongly heated, gallic acid is converted into meta-gallic acid.[21]

SCIENTIFIC REPORT

Antibacterial activity

In a study mechanism of *Quercus infectoria* extract and its components were investigated for anti-methicillin-resistant Staphylococcus aureus. The appearance of pseudomulticellular bacteria in the treated cells and the synergistic effect of the plant extract with beta-lactamase-susceptible penicillins suggest that the extract may interfere with staphylococcal enzymes including autolysins and beta-lactamase.This study results provide scientific data on the use of the oak galls, which contain mainly tannin contents up to 70% for the treatment of staphylococcal infections.[22]

Wound healing activity

In an experimental trial ethanol extract of the shade-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 definite, positive effect on wound healing, with a significant increase in the levels of the antioxidant enzymes, superoxide dismutase and catalase, in the granuloma tissue. This wound healing potential may be due to its action on antioxidant enzymes. [23]

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 hypoglycaemic 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 285.52 to 206.57mg/dl, 6h after oral administration of extract ($P<0.01$). [24]

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 E2 (PGE2) induced paw oedemas, while topical application of gall extract inhibited phorbol-12-myristate-13-acetate (PMA) induced ear inflammation. The extract also inhibited various functions of macrophages and neutrophils relevant to the inflammatory response.[25]

Larvicidal activity

An effort to assay *Anopheles stephensi* larvae with gall extracts of *Quercus infectoria* was made under laboratory conditions at Mysore. Ethyl-acetate extract was found to be the most effective of all the five extracts tested for larvicidal activity against the fourth instar larvae, with LC (50) of 116.92 ppm followed by gallotannin, n-butanol, acetone, and methanol with LC (50) values of 124.62, 174.76, 299.26, and 364.61 ppm, respectively. The efficacy in killing mosquito

larvae may make this plant promising for the development of new botanical larvicide.[26]

Analgesic activity

A fraction of methanol extract of galls showed analgesic activity in rats and significantly reduces blood pressure in rabbits. Another fraction showed CNS depressant activity and moderate anti-tremorine activity by causing a delay in onset and decrease in severity of tremorine-induced tremors. It also showed anaesthetic action due to complete blockade of isolated frog sciatic nerve conduction.[27]

Antioxidant activity

The antioxidant activity of ethanolic extract of *Quercus infectoria* galls was investigated employing several established in vitro model systems. Their protective efficacy on oxidative modulation of murine macrophages was also explored. Gall extract was found to contain a large amount of polyphenols and possess a potent reducing power. The results indicate that *Q. infectoria* galls possess potent antioxidant activity, when tested both in chemical as well as biological models.[28]

Effect on inflammatory bowel disease

In an experimental study the evaluation of the effect of *Quercus infectoria* olivier in experimentally induced inflammatory bowel disease in rats was carried out. Sprague Dawley rats (200-300 gm) of either sex were randomly allocated to 6 groups (n=6). Except Group I (normal) and II (vehicle control) colitis was induced on 11th day by N-ethylmaleimide (NEM, 3%, 0.1 ml, intrarectally) in animals of groups III (model control), IV (std), V (test-300 mg/kg p.o) and VI (test-450 mg/kg p.o). 5-Amino salicylic acid (100 mg/kg p.o), *Quercus infectoria 300 mg/kg* and *450 mg/kg was administered to* groups IV, V and IV respectively for 18 days orally. On 18th day of study rats were sacrificed, colon was scored histologically and various antioxidant parameters were measured in isolated colon tissue. Treatment with 5-Amino salicylic acid, *Quercus infectoria* significantly prevented the changes induced by NEM in physical and oxidative stress parameters. There was also significant improvement in histological scoring like colon mucosal damage index (CMDI), disease activity index (DAI), microscopic scoring, macroscopic scoring and histopathology of treatment groups as observed in group III. the results of this study suggest that *Quercus infectoria* therapy has beneficial effects on the course of experimental colitis.[29]

Anticancer activity

This study was carried out to determine the potential of galls of *Q.infectoria a*s an antiproliferative agent towards cervical cancer cells (HeLa) and ovarian cancer cells (Caov-3). The toxicity *in vitro* was evaluated on non malignant cell line (MDCK). HeLa and Caov-3 cancer cell lines and MDCK were incubated in 96-wells plate in the presence and absence of QI galls extracts (methanol, ethanol and aqueous extracts) for 72 hours. The antiproliferative activity of QI galls extracts towards the cell lines were investigated by Methylene Blue Assay and the OD values were read at 660nm. The inhibitory concentrations at 50 % cell population (IC50 values) were determined followed by observation of the morphological features of apoptosis by Hoescht stain. The lowest IC_{50} value for HeLa cell line was 2.82±0.21 µg/ml treated with QI galls ethanol extract and the lowest IC_{50} value for Caov-3 cell line was 6.50±0.24 µg/ml treated with QI galls aqueous extract. The QI galls ethanol extract showed relatively low toxicity to normal cell control (MDCK) with IC_{50} of 74.99±0.09 µg/ml. The cells treated with QI galls ethanol extracts, morphological changes were consistently observed that eventually leads to detachment of cells from monolayer and DNA (chromatin) condensate. From the results, it can be suggested that QI galls extracts have potential as anticancer agent and further study should be carried out to elucidate the active compound of the extracts.[30]

CONCLUSION

Quercus infectoria is used by ancient Unani physicians from centuries ago because of its medicinal properties. It is also found to be effective by different phytochemical, experimental and clinical studies carried out on modern parameters. Hence claims of Unani physicians are found to be true but further studies are needed to explore its other medicinal and useful properties.

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