

Research Journal of Pharmacognosy (RJP) 7(1), 2020: 67-75

Received: 3 May 2019

Accepted: 17 Sep 2019

Published online: 1 Dec 2019

DOI: 10.22127/rjp.2019.184177.1494 Review article

**A Comprehensive Review about *Quercus infectoria* G. Olivier Gall**

Sayyede Fatemeh Askari1, Amir Azadi2, Bahia Namavar Jahromi3,4, Mojgan Tansaz5, Asghar Mirzapour Nasiri6, Abdolali Mohagheghzadeh1,7, Parmis Badr7,8\*

1Department of Phytopharmaceuticals (Traditional Pharmacy), School of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran.

2Department of Pharmaceutics, School of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran.

3Infertility Research Center, Shiraz University of Medical Sciences, Shiraz, Iran.

4Department of Obstetrics and Gynecology, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran.

5Department of Traditional Medicine, School of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

6Department of Natural Resources and Water Management, Khorramabad, Iran.

7Pharmaceutical Sciences Research Center, Shiraz University of Medical Sciences, Shiraz, Iran.

8Phytopharmaceutical Technology and Traditional Medicine Incubator, Shiraz University of Medical Sciences, Shiraz, Iran.



**Abstract**

Due to an interaction between gall wasp *Andricus sternlichti* Bellido and *Quercus infectoria* G.Olivier from Fagaceae, the oak galls with a wide range of industrial and pharmaceutical applications are produced. *Quercus infectoria* galls have been well-known by both ethnopharmacology and traditional medicine of Iran. The aim of current study was a comprehensive collection of Persian scholars' notions and recent findings about medicinal effects of this gall. Sixteen traditional manuscripts of one millennium were sought by two keywords (“Afs” and “Mazu”. Arabic and Persian names of *Quercus* gall, respectively), and relevant articles till October 2018 were reviewed. In traditional manuscripts, three main dosage forms from gall including decoction, powder, and poultice were found. They had been prescribed for about of thirty disorders. Except for one clinical trial, other articles described related to animal studies and antimicrobial effect evaluation. Since *Quercus infectoria* gall as an endemic natural product of Iran is a valuable source for export, ethnic usages and pharmaceutical applications, the outcomes of this study can be beneficial for researchers involved in development of natural medications.

**Keywords:** ethnopharmacology; plant tumors;*Quercus infectoria*G.Olivier; traditional Iranianmedicine



**Citation:** Askari SF, Azadi A, Namavar Jahromi B, Tansaz M, Mirzapour Nasiri A, Mohagheghzadeh A, Badr P. A

comprehensive review about *Quercus infectoria* G. Olivier gall. Res J Pharmacogn. 2020; 7(1): 67-75.

**Introduction**

Plant galls or cecidia are hypertrophic or hyperplasic cells, tissues, or organs induced by parasitic organisms [1]. One of the most important hosts prone to such abnormal outgrowth is *Quercus infectoria* G.Olivier from family Fagaceae. Grown vastly in Middle Eastern

countries like Cyprus, Syria, Turkey, Iraq and Iran, *Q. infectoria* is a small tree about 2.5 m high with 4-6 cm long leaves, and acorn fruits that are narrow scaly and cylindrical [2-4]. One habitat rich in *Q. infectoria* trees is Zagros forests of Iran, particularly in West Azerbaijan,



\*Corresponding author: badrp@sums.ac.ir

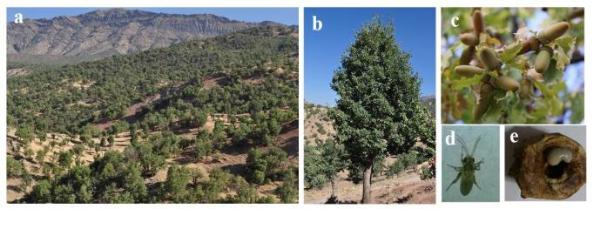
© 2018. Open access. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by-nc/4.0/)

Askari S.F. et al.



Kurdistan and Lorestan (figures 1a, 1b and 1c)

1. Originated from Celtic language, *Quercus* means “beautiful tree”, and *infectoria* refers to the process of producing galls as an infection [6-8]. Gall wasps such as *Diplolepis rosae* L., *Asterodiaspis quercicola* Bouche, *Chionaspis lepineyi* Balachowsky, *Andricus curtisii* Mueller, *Cynips quercus* Fourcroy and *Andricus sternlichti* Bellido (the gall-inducer in Iran) areresponsible for this process (figure 1d and 1e) [9-11].



**Figure 1.** a) Habitat of*Quercus infectoria*trees in Lorestanprovince of Iran; b) One *Q. infectoria* tree; c) Leaves and fruits of *Q. infectoria*; d) A gall wasp, e) A larva living inside the gall (all captured by the author)

Proliferation and development of host cells are changed after laying eggs by female wasps. When the larva is growing, the gall is formed simultaneously. Circular tunnels in galls show that the mature wasp has emerged (figure1e) [6,12]. Application of *Q. infectoria* galls dates back to ancient times when people used them as dyeing agents to provide permanent paintings in their natural surroundings. Some old drawings painted using a combination of the gall, common madder (*Rubia tinctorum* L.) extracts, blood and bear fat have remained on stones (figure 2a) [13]. Moreover, *Q. infectoria* gall has been one of the essential ingredients of natural dyes for carpet yarns to increase their quality and durability (figure 2b) [14,15]. This industrial usage in addition to medicinal indications has been mentioned in medieval manuscripts. So-called “Afs” or “Mazu” (Arabic and Persian names of *Quercus* gall, respectively) in Traditional IranianMedicine, galls cold (in first degree) and dry (in second degree) temperament shows intensive astringent effect [16,17]. Ethnic applications of gall are emollient for napkin rash, anti-infective after circumcision, pain killer for toothache, and protection from evil eye (figure 2c and 2d) [18].

The current study was conducted to cover a comprehensive review on both traditional applications in a millennial timespan and recent findings.

**Figure 2.** Ethnic applications of the gall in Lorestanprovince; a) An ancient pictograph on mountain stone colored by a mixture containing gall extract, Koohdasht, Lorestan, Iran (Cultural Heritage in Handicrafts and Tourism Organization of Iran, Registration No. 14300) [13];

1. The custom of application gall as a natural dye for carpet yarns in Lorestan; c) Ethnic belief of using a string of gall

for new-born babies to protect them from evil or harm; d) A string of gall, one type of talisman as a way to ward off misfortune by evil eye (all captured by the author)

**Methods**

In order to collect applications of *Q. infectoria* gall, sixteen traditional references, highly-referred texts of medieval era written by the most credible scholars of Materia Medica from one millennium (10th to 20th century) were studied. “Afs” and “Mazu” were sought as keywords in “Ketab al-Abnia an Haqaeq al-Adwia” (10thAD), “Al-Mansuri fi-Tib” (10thAD), “Al-Hawi” (10thAD), “Zakhire Kharazmshahi‟ (11thAD), “Al-Aghraz al-Tibbia wa-al Mabahess al-Alaiia” (11thAD), The Canon of Medicine (vol.2) (11thAD), “Umdat al-Tabib fi Marifat al-Nabat” (12thAD), “Kitab al-Jami li-Mufradat al-Adwiya wa al-Aghdhiya” (13thAD), “Ikhtiarat Badiee” (13thAD), “Al-Shamel fi al-Sanaate al-Tibiye al-Adwia wa al-Aghziye” (13thAD), “Hadiqat al-Azhar fi Mahiyyat al-Ushb wa-l-Aqqar” (16thAD), „Tadhkira” (17thAD), “Tohfata al-Momenin‟ (17thAD), “Makhzan-al Adviyeh” (18thAD), “Khazaen Al-Molouk” (19thAD), and Useful Plants of Iran and Iraq (20thAD) [16-31]. References Latin equivalents names were chosen according to previous publication [32] were checked manually. Recent studies by October 2018 were found by searching in Google Scholar and PubMed, using “*Quercus infectoria* G.Olivier gall” as the keyword. Review articles and papers related to multi-component formulations were excluded.

**Results and Discussion**

Desired galls have been described as green, jagged, and perforation-free, but medically-unusable galls are yellow, flattened, light and



68 Res J Pharmacogn 7(1): 67-75

Review about *Quercus infectoria* gall



perforated [16]. The gall with cold and dry temperament had been provided in three main dosage forms (decoction, powder, and poultice), targeting different tissues like gastrointestinal tract, oral cavity, nose, eye, anus, vagina and skin (table 1) [17]. Moreover, the processed gall (burnt and then extinguished in alcohol or salty vinegar) was suggested for special indications like hair dying and stopping hemorrhage. Daily dosage of the gall is one “Deram” (approximately 3.5 g) to one “Misqal” (approximately 4.5 g). If there is no access to gall for preparations, six natural products can be used as substitutes: *Punica granatum* L. (peel), *Q. infectoria* (fruit,fruit hull), *Tamarix gallica* L. (fruit), *Terminalia* *citrina* Roxb. ex Fleming (fruit), *Myrtus communis* L. (fruit), and *Juniperus sabina* L.(fruit). The gall worsens lung and throat disorders like hoarseness and cough. Long-term intake of hydrolysable tannins with astringent effect had similar adverse effects like irritation of gastric mucosa, nausea, and vomiting on mucous membranes [33]. Application of *Astragalus* *tragacantha* L. (exudate), or *Acacia nilotica* (L.)Delile (exudate), or *Apium graveolens* L. (seed) can relieve or modify disadvantages of gall [19,25,26,30]. Recent relevant articles have been summarized in tables 2 and 3 divided into clinical, animal and in vitro studies.

**Table 1.** Traditional dosage forms and indications of*Quercus* gall

|  |  |  |  |
| --- | --- | --- | --- |
| **Dosage** | **Administration** | **Indications** |  |
| **form** |  |
|  |  |  |
|  | Hair dye | Hair greying |  |
|  | (Khazab1) |  |
|  | Mouthwash | Aphtha, dental cavity, pus |  |
|  | (Mazmazeh2) |  |
| Decoction |  | Diarrhea, erysipelas, hemorrhage, |  |
|  | herpes, hypermenorrhea, leprosy, |  |
|  | Oral |  |
|  | pemphigus, psoriasis, ulcerative colitis, |  |
|  |  |  |
|  |  | umbilical hernia, vaginitis |  |
|  | Rectal | Abscess, inflammation, prolapse |  |
|  | Vaginal | Prolapse, vaginitis |  |
|  | Ocular (Kohl3) | Blepharitis, epiphora, scabies |  |
| Powder | Nasal (Nafoukh4) | Epistaxis |  |
| Buccal (Sanoun5) | Aphtha, dental cavity, pus, toothache, |  |
|  |  |
|  |  | wound |  |
| Poultice | Topical (Zemad6) | Hyperhidrosis, malodor |  |
| Rectal | Abscess, inflammation |  |
|  |  |

1Traditional cosmeceutical for changing hair color; 2liquid medication for gargling; 3powder-like formulation for ocular disease; 4fine-particle powder as an inhaler; 5buccal formulation for tooth and gum applications; 6semisolid formulation for topical applications

Gall with great potential for treatment of disorders was the main focus of the current study.



Based on traditional Iranian medicine (TIM), gall is a dying agent for grey hairs, and its topical preparation eliminates malodorous sweat and heavy perspiration. Wound healing, anti-bleeding, and antibacterial properties of gall reflect to the astringency. The powder of gall (“Nafoukh*”,* as a kind of TIM nasal powder from which is used without adding any liquid) controls nasal bleeding. Its decoction has been suggested for diarrhea, hemorrhage, and hypermenorrhea. As effective as Povidone Iodine, wound dressings of gall has been used in animal studies [40-42]. Treatment of many inflammation-related diseases like ulcerative colitis, vaginitis, blepharitis, and rectal abscess is justifiable, because gall has a significant effect on function of macrophages and neutrophils, causing release of inflammatory mediators and lytic enzymes [47]. One clinical study on gall mouthwash has shown promising result for chronic gingivitis [34]. The extracts were traditionally used for aphtha, dental cavity, toothache, and oral wounds. Anti-bacterial effect of gall methanol extract has been proved against oral pathogens such as *Streptococcus mutans*, *Streptococcus salivarius*, *Staphylococcus aureus*, *Lactobacillus acidophilus*, *Streptococcus sanguis*, *Porphyromonas gingivalis* and *Fusobacterium nucleatum* which cause dental caries andperiodontitis [48,49]. Vaginal decoction of gall, both aqueous and in vinegar, has been prescribed for vaginitis [30]. Recent studies have shown antifungal effect of its ethanol extract against *C.* *albicans* [70]. Animal studies have proved thecardiovascular effect, antidiabetic activity, hepatoprotective, and anti-inflammatory effects [37-40,49]. Oral preparations of gall [18-31], have been suggested for herpes („Namle” [21,80]), erysipelas (“Homra” [21,80]), leprosy (“Akeleh” [81]), pemphigus (“Ghorouh-e-saiye” [31,82]), and psoriasis (“Ghooba” [83, 84]), all of which are among challenging diseases. Presence of flavonoids, alkaloids, and phenols, particularly tannins, in gall has been reported through preliminary phytochemical screenings [85]. Its anti-inflammatory properties, antibacterial and anti-fungal effects are the result of such compounds. The astringency caused by tannins leads to the cure of diarrhea, hemorrhage, oral wounds, and hypermenorrhea.

69

Askari S.F. et al.



**Table 2.** Recent clinical and animal studies of*Quercus infectoria*gall

***Clinical trial***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Method** | **Participants** |  | **Intervention** | **Outcome** | **Ref** |  |
| Randomized controlled, | n=20, (20-30 YO) |  | Gall Aq Ext and Listerine mouthwash, 10 | Efficient but less than of Listerine |  |  |
| with generalized chronic | | [34] |  |
| double-blind, cross-over | ml, once daily, 30 seconds, 7 days |  |  |
| gingivitis |  |  |  |  |
|  |  |  |  |  |  |
| ***Animal studies*** |  |  |  |  |  |  |
| **Assessment** |  |  | **Method** | **Outcome** | **Ref** |  |
| Cardiovascular effects of | (4×6), 45 days, C: normal rabbit chow, normal chow + 1.5 g/kg gall, | | | Decrease in total cholesterol, LDL, |  |  |
| TG, and atherogenic indices of | [35] |  |
| Met Ext in rabbit | high-fat diet, high fat diet + gall | | |  |
| plasma in high fat diet |  |  |
|  |  |  |  |  |  |
| Antidiabetic activity of | )5×6(, p.o, C: DW, P: acarbose (50 mg/kg), N: glucose (sucrose) solution, | | | Blood glucose lowering effect of | [36] |  |
| Met & Aq Ext in rat |  |  | Met Ext, Aq Ext | Met & Aq Ext at 500 mg/kg |  |
|  |  |  |  |
| Hepatoprotective effect of gall Aq | )7×5(, 28 days, p.o, C: DW (1 mL/kg/day), P: silymarin (100 mg/kg/day), | | | Prevention of free radical- mediated |  |  |
| Ext against liver injury induced by | CCl4-treated control: DW (1 mL/kg/day), gall (500, 1000 and 2000 | | | disorders including inflammation and | [37] |  |
| CCl4 in rat | mg/kg/day), gall (2000 mg/kg/day) | | | hepatotoxicity |  |  |
| Hepatoprotective effect of Aq-Eth | )6×6(, p.o, C: CMC (1% w/v), P: Silymarin (100 mg/kg), CCl4 (2 ml/kg), gall | | | Hepatoprotective effects of gall | [38] |  |
| Ext in rat |  | Ext 200, 400, 600 mg/kg | |  |
|  |  |  |  |
| Effects on caecal | )7×15(, C: DW, P: metronidazole (62.5, 125 mg/kg/day), (125,250, 500, 1000 | | | Cure in 26% and 13% of mice at a |  |  |
| concentration of 500 and of 250 | [39] |  |
| amoebiasis in mouse | mg/kg/day), 6 days, p.o, *Entamoeba histolytica* (fecal samples) | | |  |
| mg/kg/day, respectively |  |  |
|  |  |  |  |  |  |
| Wound healing activity in rat | )5×6(, p.o, C: gum acacia 2%, Aq Ext (Pet, Etr and Eta fractions 100 mg/kg) | | | Significant wound healing property | [40] |  |
| (incision, excision and dead space) |  |
|  |  |  |  |  |  |
| Wound healing property in rat | C: 0.9% NaCl, P: povidone iodine, gall water (0.1, 1 and 10 mg/mL) and | | | Significant wound healing property | [41] |  |
| organic suspension (0.1, 1 and 10 mg/mL) | | | as povidone iodine and saline |  |
|  |  |  |
| Wound healing activity in rat | )4×6(, P: Solc Oseryl® jelly, N: Vaseline™ Petroleum jelly, 10% Eth Ext, | | | Gall as a potential antibacterial | [42] |  |
|  |  | 10% Aq Ext | source and a wound dressing |  |
|  |  |  |  |  |

Spasmolytic activities of Met Ext in rat ileum and pig ileum

|  |  |  |  |
| --- | --- | --- | --- |
| Inhibitory effects on spasmogen-induced contractions [loperamide (0.3-10 |  |  |  |
| μg/mL), verapamil (4.9-49 ng/mL), gall (0.1-10 mg/mL)]. |  |  |  |
| Inhibitory effects on the KCl (30 mM)-induced contractions | Spasmolytic but less than loperamide | [43] |  |
| Inhibitory effects of the plant Ext and Loperamide on CaCl2-induced | and verapamil |  |
|  |  |

contractions, (12×5), [loperamide (0.1, 3, 1 μg/mL), verapamil (4.9, 14.7, 49

ng/mL), gall (1, 3, 10 mg/mL)]+ CaCl2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Antibacterial | efficacy | | of | an | (3×5), Streptomycin-pretreated (streptomycin-resistant *E. coli*: STEC) mice, | Effective eradication of colonization |  |  |
| ellagitannin | from | gall (Qi 4) | | in | of STEC in intestinal tract & | [44] |  |
| C: PBS, infected group, Qi 4 treatment |  |
| mouse |  |  |  |  | prevention renal injury |  |  |
|  |  |  |  |  |  |  |
| Analgesic activity in rat | | |  |  | )4×6(, i.p, P: morphine sulfate and sodium salicylate (10mg/kg), N: normal | Analgesic activity in hot plate and | [45] |  |
|  |  | saline (10 mL/kg), Met Ext (20mg/kg) | tail-flick models |  |
|  |  |  |  |  |  |  |
| Chemopreventive | | effect | against | | )5×6(, kidney tissue &blood & serum | Potent chemopreventive agent and |  |  |
| Gavage of normal saline, 7 days; a single dose of Fe-NTA on 20th day; | Fe-NTA-induced renalcarcinogenesis | [46] |  |
| chemically-induced renal toxicity | | | | | pretreated with gavage of gall (75, 150 mg/kg), 20 days, followed by | and oxidative and inflammatory |  |
| and carcinogenesis in rats | | |  |  |  |  |
|  |  | administration of Fe-NTA on 20th day; gavage of gall (150 mg/kg), 20 days | response suppressant |  |  |
|  |  |  |  |  | Eth Ext |  |  |  |
| Anti-inflammatory | | evaluation | | | Carrageenan induced paw oedema [)4×6(, C: saline, P: indomethacin (25 | Inhibitory effect on functions of |  |  |
| mg/kg), gall Ext (300 and 600 mg/kg, p.o)], histamine, serotonin and PGE2 | macrophages and neutrophils, release |  |  |
| after oral or topical administration | | | | | [47] |  |
| induced paw oedema [)5×6(, C: saline, P: indomethacin (25 mg/kg), gall Ext | of inflammatory mediators (PGE2, |  |
| in rat and mouse | |  |  |  |  |  |
|  |  |  | (200,400 and 600 mg/kg, p.o)], PMA induced mouse ear )5×4(, C: saline, P: | NO, O2•−) and lytic enzymes |  |  |

indomethacin (0.5 mg), gall Ext (0.5, 1 and 2.5 mg per ear)

(n×m): (n: number of group and m: the number in each group), Aq: Aqueous, C: Control group, DW: Distilled water, Eta: Ethyl

acetate, Eth: Ethanol, Etr: Ether, Ext: Extract, i.p: Intraperitoneally, Met: Methanol, N: Negative control group, p.o: Per-oral, P:

Positive control group, Pet: Petroleum ether, YO: years old.

**Table 3.** Recent in vitro studies about*Quercus infectoria*gall*.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Assessment** | **Extract(s) / Tested items** | **Outcomes** | **Ref** | |  |
|  | Antibacterial activity against | Pet, Chl, Met and Aq Exts / *S. mutans*, *S.* | Maximum antibacterial activity against all | [48] |  |  |
|  | dental pathogens | *salivarius*, *S. aureus*, *L. acidophilus*, *S. sanguis* | bacteria by Met Ext |  |  |
|  |  |  |  |
|  | Antibacterial activity against | Met and Ace Exts / *S. mutans*, *S. salivarius,* | Similar antibacterial activity against oral | [49] |  |  |
|  | oral bacteria | *P.gingivalis*, *F. nucleatum* | pathogens causing dental caries and periodontitis |  |  |
|  |  |  |  |
|  | Antibacterial activity | Aq and Eth Exts / *S. aureus*, MRSA | Significant antibacterial activity against all strains | [50] |  |  |
|  | of MRSA |  |  |
|  |  |  |  |  |  |
|  | Growth inhibition of | Met, Eth, Hex, Chl and Aq Exts / *E. coli*, *B.* | Superior antimicrobial activity of Met Ext | [51] |  |  |
|  | pathogenic bacteria | *subtilis*, *S. aureus* |  |  |
|  |  |  |  |  |
|  | Cell surface hydrophobicity and | Eth Ext/ hydrophobicity of 10 clinically-isolated | Significant increase of hydrophobicity, | [52] |  |  |
|  | cell survival of *H. pylori* | *H. pylori* strains | bacteriostatic & bactericidal activities |  |  |
|  |  |  |  |
|  |  |  | Modifying hydrophobic domains, partition the |  |  |  |
|  | Cell surface properties of Shiga |  | lipids of the bacterial cell membrane, rendering |  |  |  |
|  | Eth Ext / 5 strains of STEC | the membrane more permeable and allowing | [53] |  |  |
|  | toxigenic *E. coli* |  |  |
|  |  | leakage of ions and other cell contents, leading to |  |  |  |
|  |  |  |  |  |  |
|  |  |  | cell death |  |  |  |
|  | Antibacterial property against | Met Ext / P: sodium hypochlorite (2%) and | Antibacterial property against *E. faecalis* | [54] |  |  |
|  | *E. faecalis* | chlorhexidine (2%), N: dimethyl sulphoxide |  |  |
|  |  |  |  |  |
|  | Antibacterial activity against | Aq, Met and Eth Exts / *S. aureus*, *P. aeruginosa*, |  |  |  |  |
|  | *E. coli*, *Enterobacter* spp*.*, *P. mirabilis*, *K.* | Beneficial effect as an antiseptic | [55] |  |  |
|  | wound bacteria |  |  |
|  | *pneumonia*, *K. oxytoca* and *C. freundii* |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |  |

70 Res J Pharmacogn 7(1): 67-75

Review about *Quercus infectoria* gall



**Table 3.** Continued

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Assessment** | **Extract(s) / Tested items** | **Outcomes** | **Ref** |  |
|  | Pet, Eta and Eth Exts / successive extraction |  |  |  |
| Antibacterial activity | with Ace followed by Met, Aq extraction / *S.* | The highest inhibition zone diameter against *S.* | [56] |  |
| *aureus*, *S. epidermidis*, *B. subtilis*, *E. coli*, *S.* | *aureus* by Met Ext |  |
|  |  |  |
|  | *typhimurium*, *S. enteritidis, P. aeroginosa* |  |  |  |
| Antibacterial activity | Aq and Ace Exts / *S. aureus*, *S. epidermidis*, *B.* | Similar antimicrobial activity on bacterial species | [57] |  |
| *subtilis*, *E. coli*, *S. typhimurium*, *P. aeruginosa* |  |
|  |  |  |  |
| Antimicrobial activity against | Eth Ext / C: *S. aureus*, MRSA | Effective on MRSA and *S. aureus* by resulting in | [58] |  |
| MRSA | hypersensitivity to low and high osmotic pressure |  |
|  |  |  |
|  | Crude Ext / *E. coli*, *K. pnuemoniae*, *S. typhi*, *S.* | Antimicrobial activity and an alternative way for |  |  |
| Antimicrobial activity | *marcescens*, *V. cholerae*, *V. parahaemolyticus*, | [59] |  |
| human treatment |  |
|  | *E. faecalis*, *P. aeruginosa* |  |  |
|  |  |  |  |
|  | Aq and Eth Exts / *S. aureus*, coagulase negative | Potential use as one of the effective |  |  |
| Antibacterial activity | *Staphylococcus, Acinetobacter* sp., *E. coli*, *K.* | [60] |  |
| phytotherapeutic agents against MDR bacteria |  |
|  | *pneumoniae* |  |  |
|  |  |  |  |
| Morphological and |  | Complete loss of surface appendages and |  |  |
| ultrastructural changes in cell | Eth Ext / Enterohaemorrhagic *E. coli* | disruption of the cytoplasmic membrane and | [61] |  |
| structure |  | leakage of the internal contents |  |  |
| Comparative proteomic | Aq Ext / MRSA | Dose-dependent bactericidal (by involving in | [62] |  |
| analysis of differential proteins | energy metabolism and protein stress) |  |
|  |  |  |
| Biofilm removal activity | Met, Eth and Ace Exts / *S. mutans* | Potentially good sources of antibacterial and | [63] |  |
| biofilm disinfection agent |  |
|  |  |  |  |
| Inhibition of virulence factor | Met Ext/quorum sensing-controlled of *P.* | Down regulating the production of virulence | [64] |  |
| *aeruginosa* | factor |  |
|  |  |  |
| *In vitro* antifungal activity of a |  |  |  |  |
| 29-kDa glycoprotein purified | Treated 29-kDa protein with NaIO4 and pronase | Inhibition of mycelial growth of *R. solani* | [65] |  |
| from the gall |  |  |  |  |
| Antifungal activity | Met and Aq Exts / *C. albicans*, *C. krusei*, *C.* | Displaying substantial anti‑Candida activity | [66] |  |
| *glabrata*, *C. parapsilosis* and *C. tropicalis* |  |
|  |  |  |  |
| Evaluation of antifungal | Chl, Eth, Ace, Eta and Aq Exts /C: clotrimazole, | Good antifungal activity as compared to other | [67] |  |
| activity | *Penicillium* sps., *Aspergillus* sps. | extracts by Chl Ext |  |
|  |  |
| Antifungal activity | Aq and Eth Exts / *C. albicans* and *C. glabrata* | Eth Ext: more effective against *C. albicans* while | [68] |  |
| Aq Ext more effective against *C. glabrata* |  |
|  |  |  |  |
| Larvicidal activity | Eta, Met, Ace, Nbu Exts / *Anopheles stephensi* | The most larvicidal activity by Eta Ext | [69] |  |
| Liston |  |
|  |  |  |  |
| Effects on growth of intestinal | Hex, Dic and Met Exts /*Blastocystis hominis,* C: | The highest anti-protozoa activity by Met Ext | [70] |  |
| protozoa parasite | Metronidazole |  |
|  |  |  |
| Cytotoxicity and the effect on |  | Inhibition of melanogenesis in non-toxic |  |  |
| melanin synthesis in B16/F10 | Met Ext / C: Kojic acid | [71] |  |
| concentrations |  |
| melanoma |  |  |  |
|  |  |  |  |
| Tyrosinase inhibitory activity | Met Ext (Pet, Chl, Eta and Met fractions) | Potent antityrosinase effect by Eta-Met fraction | [72] |  |
| Cytotoxic effects towards | Met, Eth and Aq Exts / HeLa and Caov-3 cancer |  |  |  |
| cervical (Hela) and ovarian | Anticancer effect (a novel antiproliferative agent) | [73] |  |
| cell lines and MDCK (nonmalignant cell line) |  |
| (Caov-3) cancer cell lines |  |  |  |
|  |  |  |  |
| Proliferation and activity of | Aq Ext | Enhancing Cell proliferation and increasing ALP | [74] |  |
| human fetal osteoblast cell line | and osteocalcin levels |  |
|  |  |  |
| Two new compounds from the |  | Exhibiting NO and O2•− (related to |  |  |
| gall with nitric oxide and | Eth Ext | pathophysiology of almost all ailments) inhibitory | [75] |  |
| superoxide inhibiting ability |  | effect |  |  |
| Salivary amylase inhibition | Gallotannin of gall | Inhibitory effect on HSA | [76] |  |
| Antioxidant activity | Eth Ext | Potent antioxidant activity in chemical and | [77] |  |
| biological models |  |
|  |  |  |  |
| In vitro immunomodulatory | Treated macrophages with Aq Ext | An increase in phagocytic activity of | [78] |  |
| activity | macrophages |  |
|  |  |  |
| Lipase inhibitory activity | Eth Ext | A potential for treatment of obesity | [79] |  |

Ace: Acetone, Aq: Aqueous, *B. subtilis*: *Bacillus subtilis*, C: Control group, *C. albicans*: *Candida albicans, C. freundii:*

*Citrobacter freundii, C. glabrata*: *Candida glabrata*, *C. krusei*: *Candida krusei*, *C. parapsilosis*: *Candida parapsilosis*, *C.*

*tropicalis*: *Candida tropicalis*, Chl: Chloroform, Dic: Dichloromethane, *E. coli*: *Escherichia coli*, *E. faecalis*: *Enterococcus*

*faecalis*, Eta: Ethyl acetate, Eth: Ethanol, Ext: extract, *F. nucleatum*: *Fusobacterium nucleatum*, *H. pylori*: *Helicobacter pylori*,

Hex: Hexane, *K. oxytoca*: *Klebsiella oxytoca*, *K. pneumoniae*: *Klebsiella pneumoniae*, *L. acidophilus*: *Lactobacillus acidophilus*,

MDR: multidrug resistant, Met: Methanol, MRSA: Methicillin-resistant *S. aureus,* N: Negative control group, Nbu: N-butanol, P:

Positive control group, *P. aeruginosa*: *Pseudomonas aeruginosa*, *P. gingivalis*: *Porphyromonas gingivalis*, *P. mirabilis*: *Proteus*

*mirabilis,* Pet: Petroleum ether, *R. solani*: *Rhizoctonia solani, S. aureus*: *Staphylococcus aureus*, *S. enteritidis*: *Salmonella*

*enteritidis, S. epidermidis:Staphylococcus epidermidis, S. marcescens*: *Serratia marcescens, S. mutans*: *Streptococcus mutans, S.*

*salivarius*: *Streptococcus salivarius*, *S. sanguis*: *Streptococcus sanguinis, S. typhi: Salmonella typhi, S. typhimurium*: *Salmonella*

*typhimurium*, *V. cholera*: *Vibrio cholera*, *V. parahaemolyticus*: *Vibrio parahaemolyticus*



71

Askari S.F. et al.



**Conclusion**

The traditional usages of *Q. infectoria* gall have been mentioned in the present study. Since no clinical study supporting these ideas was found, they are considered as notions for further studies, leading to potential new drugs from this endemic natural product.

**Acknowledgments**

This study was a part of the Ph.D. thesis of Sayyede Fatemeh Askari under grant No. 94-01-05-10420 from Shiraz University of Medical Sciences. The authors wish to express their gratitude to vice chancellor for research of Shiraz University of Medical Sciences. The authors would like to thank Mr. Ali Zarouni and Mr. Suleiman Lotfi for providing some photographs.

**Author contributions**

Sayyede Fatemeh Askari participated in designing the work, reviewing recent and traditional literature, and drafting the manuscript. Asghar Mirzapour Nasiri prepared data about Lorestan. Abdolali Mohagheghzadeh, Amir Azadi, Bahia Namavar Jahromi, Mojgan Tansaz and Parmis Badr contributed in conception of the work and revised the manuscript critically and also Parmis Badr designed the work, contributed in drafting, and critical revision.

**Declaration of interest**

The authors declare that there is no conflict of interest. The authors alone are responsible for the accuracy and integrity of the paper content.

**References**

1. Mani MS. Ecology of plant galls. Dordrecht: Springer, 1964.
2. Ahmad W, Zeenat F, Hasan A, Abdullah A, Nargis A, Tarannum T. Mazu (*Quercus* *infectoria*, Oliv)-an overview. *Ind J Unani Med*. 2011; 4(1): 17-22.
3. Shrestha S, Kaushik VS, Eshwarappa RSB, Subaramaihha SR, Ramanna LM, Lakkappa DB. Pharmacognostic studies of insect gall of *Quercus infectoria* Olivier (Fagaceae). *Asian Pac J Trop Biomed*. 2014; 4(1): 35-39.
4. Ansari SAH , Wasim A, Rizwan MK, Azhar H. Ethnopharmacology of *Quercus infectoria* Olivier -galls: a review. *Hippocratic J Unani* *Med*. 2016; 11(3): 105-118.
5. Mehrnia M, Nejadsattari T, Assadi M, Mehregan I. Taxonomic study of the genus

*Quercus* L. Sect*. Quercus* in the Zagrosforests of Iran*. Iran J Bot*. 2013; 19(1): 62-74.

1. Patel S, Rauf A, Khan H. The relevance of folkloric usage of plant galls as medicines: finding the scientific rationale. *Biomed* *Pharmacother.* 2018; 97(1): 240-247.
2. Merriam-Webster. Nutgall. [Accessed 2018].

Available from: https://www.merriam-webster.com/dictionary/nutgall.

1. Online etymology dictionary. [Accessed

2018]. Available from: https://www.etymonline.com/word/fir.ref=et ymonline\_crossreference.

1. Moghaddam M. An annotated checklist of the

scale insects of Iran (*Hemiptera*, *Sternorrhyncha*, *Coccoidea*) with newrecords and distribution data. *ZooKeys*. 2013; 334: 1-92.

1. Zargaran MR, Sadeghi SE, Tavakoli M. Morphobiological specifications of Mazooj gall in oak forests of west Iran. *Iran J Forest* *Range Prot Res*. 2008; 5(2): 105-113.
2. Sadeghi SE, Melika G, Stone G, Tavakoli M, Barimani H, Zeinali S. A review of oak gall wasps of Iran, distribution, host plants and introducing a managing programm for their`s protection. *Iran J Biol*. 2013; 27(3): 450-464.
3. Guzicka M, Karolewski P, Giertych MJ. Structural modification of *Quercus petraea* leaf caused by *Cynips quercusfolii*-histological study of galls. *J Plant Interact*. 2017; 12(1): 7-13.
4. Lotfi S. Iranian colorful paintings (humian and mirmalas). Tehran: Pazineh, 2016.
5. Onal A, Sari A, Soylak M. Ellagic acid from gallnut (*Quercus infectoria*): extraction and determination of its dyeing conditions for natural fibres*. J Sci Ind Res*. 2005; 64(7): 491-495.
6. Shahid M, Ahmad A, Yusuf M, Khan MI, Khan SA, Manzoor N, Mohammada F. Dyeing, fastness and antimicrobial properties of woolen yarns dyed with gallnut (*Quercus* *infectoria* Oliv.) extract. *Dyes Pigm*. 2012;95(1): 53-61.
7. Al-Ishbili AK. Umdat al-tabib fi marifat al-nabat. Beirut: Al Gharb al Islami press, 1990.
8. Al-Rhazes M. Al mansuri fi tib. Zaker ME, Trans. Tehran: Tehran University of Medical Sciences Press, 2008.
9. Hooper D. Useful plants of Iran and Iraq. Tehran: Iran University of Medical Sciences Publication, 2003.



72 Res J Pharmacogn 7(1): 67-75

Review about *Quercus infectoria* gall



1. Movaffag Heravi AM. Ketab al-abnia an haqaeq al-adwia. Bahmanyar A, Ed. Tehran: University of Tehran press, 1967.
2. Al-Rhazes M. Al hawi [liber continent]. 1st ed. Afsharipour S, Trans. Tehran: Academy of Medical Sciences Publication, 2005.
3. Jorgani SI. Zakhireye Kharazmshahi. Alinaghi H, Ed. Tehran: Safirardehal press, 2016.
4. Jorjani SE. Al-aghraz al-tebbiehval-mabahes al-alayieh. Tehran: Tehran University of Medical Sciences Press, 2006.
5. Avicenna. The canon of medicine. 2nd ed. Sharafkandi A, Trans. Tehran: Soroush press, 1997.
6. Ibn al-Baitar. Kitab al-jami li-mufradat al-adwiya wa al-aghdhiya. Beirut: Dar al-ketab al-elmiye press, 1992.
7. Ansari Shirazi A. Ikhtiarat-e-badiee. Shams Ardakani MR, Ramazani M, Eds. Tehran: Choogan press, 2009.
8. Gharashi A. Al-shamel fi-alsanaat-altebyah. Tehran: Iran University of Medical Sciences Publication, 2008.
9. Al-Ghassani AQ. Hadiqat al-azhar fi mahiyyat al-ushb wa-l-aqqar. Beirut: Dar al-ketab al-elmiye press, 1985.
10. Al-Antaki D. Tadhkira. Tehran: Iran University of Medical Sciences Publication, 2003.
11. Tonkaboni MM. Tohfeh al- Momenin. 1st ed. Rahimi R, Shams Ardekani MR, Farjadmand F, Eds. Tehran: Shahid Beheshti University of Medical Sciences, 2007.
12. Aghili MH. Makhzan-al-advia. Shams Ardakani MR, Rahimi R, Farjadmand F, Eds. Tehran: Tehran University of Medical Sciences Publication, 2009.
13. Ahmad SD. Khazaen al-molouk. Tehran: Iran University of Medical Sciences Publication, 2003.
14. Badr P, Abolhassanzadeh Z, Aminsafaee M,

Azadi A, Mohagheghzadeh A. Entrepreneurship based on traditional Iranian medicine manuscripts: winter startup 2016 by

phytopharmaceutical technology and traditional medicine incubator (Shiraz). *Trad* *Integr Med*. 2017; 2(1): 9-14.

1. Sariozlu NY, Kivanc M. Gallnuts (*Quercus* *infectoria* Oliv. and *Rhus chinensis* Mill.) andtheir usage in health. Nuts and seeds in health and disease prevention. 1st ed. Preedy V,



Watson R, Patel V, Eds. Amsterdam:

Elsevier, 2011.

1. Choudhary A, Smitha C, Suresh D, Basu S. Clinical evaluation of efficacy of *Quercus* *Infectoria* and *Mimusops elengi* Linn. herbalpreparation in inhibition of gingivitis. *Adv* *Hum Biol*. 2015; 5(3): 68-76.
2. Joukar S, Askarzadeh M, Shahouzehi B, Najafipour H, Fathpour H. Assessment of safety and therapeutic efficacy of *Rosa* *damascena* L. and *Quercus infectoria* oncardiovascular performance of normal and hyperlipidemic rabbits: physiologically based approach. *J Toxicol*. 2013; Article ID 769143.
3. Kumar S, Dubey D. Evaluation of *Quercus* *infectoria* (galls) extracts for the managementof diabetes. *Int J Pharm Pharm Sci*. 2016; 5(4):1948-1954.
4. Pithayanukul P, Nithitanakool S, Bavovada R. Hepatoprotective potential of extracts from seeds of *Areca catechu* and nutgalls of *Quercus infectoria*. *Molecules*. 2009; 14(12):4987-5000.
5. Lodhi G, Singh HK, Pant KK, Rao CV, Hussain Z. Hepatoprotective effects of *Quercus infectoria* gall extract against carbontetrachloride treated liver injury in rats. *Int J* *Appl Res Nat Prod*. 2012; 5(3): 17-22.
6. Sawangjaroen N, Sawangjaroen K, Poonpanang P. Effects of *Piper longum* fruit, *Piper sarmentosum* root and *Quercus infectoria* nut gall on caecal amoebiasis inmice. *J Ethnopharmacol*. 2004; 91(2-3): 357-360.
7. Jalalpure S, Patil M, Alagawadi K. Wound healing activity of the galls of *Quercus* *infectoria* Olivier. *J Nat Remedies*. 2002;2(1): 54-58.
8. JC C, Yusuf A, Keng SL, Walluilah S, Ghazali FC, Mohsin S. Role of *Quercus* *infectoria* Oliv. on wound healing. *Malays J Med Sci*. 2007; 14: 163.
9. Iklls S. Effect of *Quercus infectoria* extracts on dermal wound healing in rats and assessment of its antimicrobial activity. M.Sc. thesis. University of Malaya, Kuala Lumpur, Malaysia, 2006.
10. Thaina P, Poonpanang P, Sawangjaroen K. Comparison of spasmolytic activities of *Piper longum*, *P. sarmentosum* and *Quercus infectoria* extracts with loperamide andverapamil in rat and guinea pig intestinal tissues. *Trad Med Nutr*. 2005; 6: 183-189.

73

Askari S.F. et al.



1. Voravuthikunchai SP, Suwalak S, Mitranan
   1. Ellagitannin from *Quercus infectoria* eradicates intestinal colonization and prevents renal injuries in mice infected with *Escherichia coli* O157: H7. *J Med Microbiol*.2012; 61(10): 1366-1372.
2. Fan SH, Ali NA, Basri DF. Evaluation of analgesic activity of the methanol extract from the galls of *Quercus infectoria* (Olivier) in rats. *Evid Based Complement Altern Med*. 2014; Article ID 976764.
3. Rehman MU, Tahir M, Ali F, Qamar W, Khan R, Khan A, Lateef A, Hamiza O, Sultana S. Chemopreventive effect of *Quercus infectoria* against chemicallyinduced renal toxicity and carcinogenesis. *Int*
   1. *Drug Dev Res*. 2012; 4(2): 336-351.
4. Kaur G, Hamid H, Ali A, Alam MS, Athar
   1. Antiinflammatory evaluation of alcoholic extract of galls of *Quercus infectoria*. *J* *Ethnopharmacol*. 2004; 90(2-3): 285-292.
5. Vermani A. Screening of *Quercus infectoria* gall extracts as anti-bacterial agents against dental pathogens. *Indian J Dent Res*. 2009; 20(3): 337-339.
6. Basri DF, Tan LS, Shafiei Z, Zin NM. In vitro antibacterial activity of galls of *Quercus* *infectoria* Olivier against oral pathogens. *Evid Based Complement Altern Med*. 2012;Article ID 632796.
7. Sucilathangam G, Gomatheswari SN, Velvizhi G, Vincent CP, Palaniappan N. Detection of anti-bacterial activity of medicinal plant *Quercus infectoria* against MRSA isolates in clinical samples. *J Pharm* *Biomed Sci*. 2012; 14(8): 1-5.
8. Satirapathkul C, Leela T. Growth inhibition of pathogenic bacteria by extract of *Quercus* *infectoria* galls. *Int J Biosci Biochem Bioinforma*. 2011; 1(1): 26-31.
9. Voravuthikunchai SP, Limsuwan S, Mitchell
   1. Effects of *Punica granatum* pericarps and *Quercus infectoria* nutgalls on cell surfacehydrophobicity and cell survival of *Helicobacter pylori*. *J Health Sci*. 2006;52(2): 154-159.
10. Voravuthikunchai SP, Suwalak S. Changes in cell surface properties of shiga toxigenic *Escherichia coli* by *Quercus infectoria* G.Olivier*. J Food Prot*. 2009; 72(8): 1699-1704.
11. Nagesh L, Sivasamy S, Muralikrishna K, Bhat KG. Antibacterial potential of gall extract of *Quercus infectoria* against



*Enterococcus faecalis*-an in vitro Study.

*Pharmacogn J.* 2012; 4(30): 47-50.

1. Darogha SN. Antibacterial activity of *Quercus infectoria* extracts against bacterialisolated from wound infection. *J Kirkuk Univ* *Sci Stud*. 2009; 4(1): 20-30.
2. Basri D, Ha F, Jantan I. Antibacterial activity of the galls of *Quercus infectoria*. *Malays J Sci*. 2005; 24(1): 257-262.
3. Basri DF, Fan S. The potential of aqueous and acetone extracts of galls of *Quercus* *infectoria* as antibacterial agents. *Indian J Pharmacol*. 2005; 37(1): 26-29.
4. Chusri S, Voravuthikunchai S. Damage of staphylococcal cytoplasmic membrane by *Quercus infectoria* G. Olivier and itscomponents. *Lett Appl Microbiol*. 2011; 52(6): 565-572.
5. Mekseepralard C, Boriboonkaset S, Kamkaen N. Screening of antimicrobial activity of *Kaempferia galanga* and *Quercus* *infectoria* against eight reference strainmicroorganisms. *Planta Med*. 2007; 73(9): 229-250.
6. Wan WNA, Masrah M, Hasmah A, Noor NI. In vitro antibacterial activity of *Quercus* *infectoria* gall extracts against multidrugresistant bacteria. *Trop Biomed*. 2014; 31(4): 680-688.
7. Suwalak S, Voravuthikunchai SP. Morphological and ultrastructural changes in the cell structure of enterohaemorrhagic *Escherichia coli* O157: H7 followingtreatment with *Quercus infectoria* nut galls. *J* *Electron Microsc*. 2009; 58(5): 315-320.
8. Khairon R, Zin NM, Abdul Rahman M, Basri DF. Comparative proteomic analysis of differential proteins in response to aqueous extract of *quercus infectoria* gall in methicillin-resistant *Staphylococcus aureus*. *Int J Proteomics*. 2016; Article ID 4029172.
9. Mohammadi-Sichani M, Karbasizadeh V, Dokhaharani SC. Evaluation of biofilm removal activity of *Quercus infectoria* galls against *Streptococcus mutans*. *Dent Res J*. 2016; 13(1): 46-51.
10. Mohabi S, Kalantar-Neyestanaki D, Mansouri S. Inhibition of quorum sensing-controlled virulence factor production in *Pseudomonas aeruginosa* by *Quercus infectoria* gall extracts. *Iran J Microbiol*.2017; 9(1): 26-32.
11. Yamunarani K, Jaganathan R, Bhaskaran R, Govindaraju P, Velazhahan R. In vitro

74 Res J Pharmacogn 7(1): 67-75

Review about *Quercus infectoria* gall



antifungal activity of a 29-kDa glycoprotein purified from the galls of *Quercus infectoria*. *Acta Phytopathol Entomol Hung*. 2005; 40(1-2): 43-54.

1. Baharuddin NS, Abdullah H, Abdul Wahab WA. Anti-candida activity of *Quercus* *infectoria* gall extracts against *Candida* species. *J Pharm Bioallied Sci*. 2015; 7(1): 15-20.
2. Vanga S, Pingili M, Tharigoppula S. Phytochemical screening and evaluation of antifungal activity of gall extracts of *Quercus* *infectoria*. *Int J Pharm Sci Res*. 2017; 8(7):3010-3013.
3. Hassan HF. Study the effect of *Quercus* *infectoria* galls extracts on growth of *Candida albicans* and *Candida glabrata in vitro* which isolated from vaginal swabs*. Iraq J Vet Med*. 2011; 35(2): 85-94.
4. Aivazi AA, Vijayan V. Larvicidal activity of oak *Quercus infectoria* Oliv.(Fagaceae) gall extracts against *Anopheles stephensi* Liston. *J* *Parasitol Res*. 2009; 104(6): 1289-1293.
5. Sawangjaroen N, Sawangjaroen K. The effects of extracts from anti-diarrheic Thai medicinal plants on the *in vitro* growth of the intestinal protozoa parasite: *Blastocystis* *hominis*. *J Ethnopharmacol*. 2005; 98(1-2):67-72.
6. Jamshidzadeh A, Shokri Y, Ahmadi N, Mohamadi N, Sharififar F. *Quercus* *infectoria* and *Terminalia chebula* decreasemelanin content and tyrosinase activity in B16/F10 cell lines. *J Pharm Pharmacogn* *Res*. 2017; 5(5): 270-277.
7. Sharififar F, Dehghan-Nudeh G, Raeiat Z, Amirheidari B, Moshrefi M, Purhemati A. Tyrosinase inhibitory activity of major fractions of *Quercus infectoria* galls. *Pharmacogn Commun*. 2013; 3(1): 21-26.
8. Hasmah A, Nurazila Z, Chow C, Rina R, Rafiquzzaman M. Cytotoxic effects of *Quercus infectoria* extracts towards cervical(Hela) and ovarian (Caov-3) cancer cell lines. *Health Environ J*. 2010; 1(2): 17-23.
9. Hapidin H, Rozelan D, Abdullah H, Hanaffi WNW, Soelaiman IN. *Quercus infectoria* gall extract enhanced the proliferation and activity of human fetal osteoblast cell line (hFOB 1.19). *Malays J Med S*ci. 2015; 22(1): 12-22.
10. Hamid H, Kaur G, Abdullah ST, Ali M, Athar M, Alam MS. Two new compounds

from the galls of *Quercus infectoria* with nitric oxide and superoxide inhibiting ability. *Pharm Biol*. 2005; 43(4): 317-323.

1. Zajácz Á, Gyémánt G, Vittori N, Kandra L. Aleppo tannin: structural analysis and salivary amylase inhibition. *Carbohydr Res*. 2007; 342(5): 717-723.
2. Kaur G, Athar M, Alam MS. *Quercus* *infectoria* galls possess antioxidant activityand abrogates oxidative stress-induced functional alterations in murine macrophages. *Chem Biol Interact*. 2008; 171(3): 272-282.
3. Yahya A, Wahab WNAWA, Abdullah NA. *In vitro* immuno-modulatory activity ofaqueous *Quercus infectoria* gall extract. *Asian J Med Biomed*. 2018; 2(S1): 30.
4. Thubthimthed S, Laovitthayanggoon S,

Siriarchavatana P, Chaithongsri K, Banchonglikitkul C. Anti-lipase activity of *Quercus infectoria* G.Olivier extract. *Thai J Pharm Sci*. 2013; 38(1): 106-108.

1. Tavasoli A, Emami SA, Tayarani-Najaran N, Nikakhtar Z, Tayarani-Najaran Z. A new document of herpes simplex virus report in Islamic traditional medicine. *Iran J Basic* *Med Sci*. 2016; 19(3): 228-230.
2. Azizi MH, Bahadori M. A history of leprosy in Iran during the 19th and 20th centuries. *Arch Iran Med*. 2011; 14(6): 425-430.
3. Atarzadeh F, Kamalinejad M, Dastgheib L, Amin G, Jaladat AM, Nimrouzi M. *Cassia* *fistula:* A remedy from traditional Persianmedicine for treatment of cutaneous lesions of *Pemphigus vulgaris*. *Avicenna J Phytomed*. 2017; 7(2): 107-115.
4. Khalilzadeh S, Shirbeigi L, Naghizadeh A, Mehriardestani M, Shamohammadi S, Tabarrai M. Use of mineral waters in the treatment of psoriasis: perspectives of Persian and conventional medicine. *Dermatol* *Ther*. 2019; Article ID: 12969.
5. Atyabi A, Shirbeigi L, Eghbalian F. Psoriasis and topical Iranian traditional medicine. *Iran J Med Sci*. 2016; 41(S3): 54.
6. Shrestha S, Kaushik VS, Eshwarappa RSB ,

Subaramaihha SR, Ramanna LM, Dhananjaya Bhadrapura Lakkappa DB. Pharmacognostic studies of insect gall of *Quercus infectoria* Olivier (Fagaceae). *Asian Pac J Trop Biomed*. 2014; 4(1): 35-39.

**Abbreviations**

TIM: traditional Iranian medicine



75