LIQUIRITIAE RADIX – A SHORT REVIEW OF ITS PROPERTIES AND APPLICATIONS

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Abstract. *Liquiritiae radix is a popular root plant with a very rich history and medical and industrial applications, being consumed since the old times until nowadays by human people. As the complementary medicine has developed considerably in the last decades, L. radix has become an interesting subject for researchers. The aim of this work is to highlight the most important active compounds and their application in the treatment of various types of diseases and conditions, from easy cough to antitumor effects.*

Keywords*: Liquiritiae radix, bioactive compounds, glycyrrhizin, glycyrrhitic acid, applications*

INTRODUCTION

Liquiritiae radix, roots from *Glycyrrhiza glabra* L., is a popular medicinal and aromatic plant, part of Fabaceae family, known as *Liquorice*; it is widely spread in Europe and, in the last period, even identified in Romania (GRIENKE *ET AL.*, 2014; DOBREA, 2016). Forseveral centuries, this plant had a rich history and was present and used in various forms as an alternative in traditional medicine due to its important benefits and therapeutic properties. As alternative medicine has evolved, *Liquorice* roots became common in teas, tinctures, syrup, supplements, decoction, infusions, natural sweetener and flavoring agent in pharmaceuticals or various medications. The shape of *Liquiritiae radix* is cylindrical (Figure 1), having dimensions of 0.5 to 2.5 cm in diameter and 15 to 20 cm in length, often found in warm and dry areas. Furthermore, *L. radix* has applications not only in medicine, but also in food industry (gum or chocolate), tobacco industry, cosmetics (dye, toothpaste or essential oils) and confectionery (TOHMA E*T AL.*, 2010).

Figure 1. *Liquiritiae radix*

The aim of this study was to present a short review of the most important properties of extracts of root parts of *Glycyrhiza glabra* L. and the main compounds found in the extracts.

The importance of this plant root is due to its potential impact on various medical problems, (i.e. treatment of several conditions of the heart, kidneys, lungs and respiratory system, skin, stomach, liver, brain, members, hormones and anemia). In a world with an increased percentage of anxiety-depressive disorders, with a food industry based more and more on chemicals and with a level of air pollution that reached an historic high, the development of alternative treatments to sustain the human health and to increase the life expectancy became a real necessity.

This work is a short review of the scientific literature on *Liquiritiae radix*, from the last decade. The subject of study were scientific papers in English from 2007-2017 time period, found using well-known data-bases: Science Direct, SpringerLink, Google Academics and Pub Med; the general procedure involved the identification of the published papers, using keywords as *Liquiritiae radix, L. radix* main compounds, glycyrrhzin or application of *L. radix* items; more than 100 research articles were obtained, but only 43 articles were selected, being the most correlated with our subject.

The selected articles highlighted the common and important techniques and methods of quantitative and qualitative *L. radix* components analysis from extracts or dried raw material. We can enumerate techniques such as LC (Liquid chromatography), LC/MS (Liquid chromatography mass spectrometry), LC-ESI/MS (Liquid chromatography electrospray mass spectrometry) (MONTOROA E*T AL*., 2011), NMR (Nuclear Magnetic Resonance), qHNMR (Quantitative ^{1}H NMR), capillary Electrophoresis, HPLC (High Performance Liquid Chromatography), HPLC-UV, HPTLC (High Performance Thin Layer Chromatography), UHPLC (Ultra-High Performance Liquid Chromatography), etc. These methods are applied accordingly to the purpose of the research and the target compounds.

NATURAL BIOACTIVE COMPOUNDS OF *LIQUIRITIAE RADIX*

The revised literature studies showed that *Liquorice* root (*Liquiritiae radix*) is very rich in active compounds, the main component being a terpenoid compound - glycyrrhizin (2-25% content) (FARAG *ET AL*., 2015), with a sweeter factor multiplied by 50 than the sucrose (TIAN *ET AL*., 2008), representing a combination between potassium and calcium salts of glycyrrhizic acid (ASL *ET AL*., 2008). Glycyrrhizic acid is a very active compound, reason for which its actions were investigated in detail and the results consist in the similarity with mineralocorticoids and the decrease of steroids damage to the liver and kidneys. Literature data also presents others bioactive triterpenes found in the natural extracts of *L. radix*, such as liquiritic acid, licorice acid, glycyrretol, glabrolide and isoglaborlide (PARVAIZ *ET AL*., 2014).

The root contains a variety of significant flavonoids, chalcones and isoflavones such as: liquiritin, neoliquiritin, chalcones isoliquiritin, glabridin, glabrene, rhamnoliquiritin, liquiritigenin, isoliquiritigenin, neoisoliquiritin, licuraside, glabridin, galbrene, galbrone, shinpterocarpin, licoflavonol, licoisoflavones A and B, 4-O-methylglabridin, 3- hydroxy-4-O-methylglabridin, 5,8-dihydroxy-flavone-7-O-beta-D-glucuronide, glychionide A, glyzarin, glychionide B, 5-hydroxy-8-methoxyl-flavone-7-O-beta-glucuronide, hispaglabridin A and B, formononetin, kumatakenin, glabroisoflavanone A and B glabroiso-flavanone B (ASL *ET AL*., 2008; MAURYA *ET AL*., 2009; OMAR *ET AL*., 2012; PARVAIZ *ET AL*., 2014), with considerable applications in human and animal medical areas.

POTENTIAL APPLICATIONS AND BENEFIC EFFECTS IN HUMAN AND ANIMALS COMPLEMENTARY AND ALTERNATIVE MEDICAL TREATMENT

The history talks about a variety of affections, from the past, where this plant contributed as an efficient treatment. It was used in gastric and duodenal ulcers, polycystic

ovary syndrome, as anti-carcinogenic and hepatoprotective agent (DORN *ET AL*., 2016; WANG *ET AL*., 2017), for the treatment of chronic hepatitis B, chronic hepatitis C and liver cirrhosis, hirsutism, bone metabolism, for body fat mass control (OMAR *ET AL*., 2012), in swellings, bleeding, coughs, hoarseness, acidity, leucorrhoea, jaundice, hiccough, gastralgia, diarrhea, anuria (PARVAIZ *ET AL*., 2014), as anticoagulative, antidepressant, for memory enhancing, anti-diuretic or anti-platelet (MAURYA *ET AL*., 2009; BAHMANI *ET AL*., 2014), etc.

Studies present a better inhibitor potential of Glycyrrhetic acid on 11-β-hydroxysteroid dehydrogenase than glycyrrhizic acid (200-1000 times greater), thus it can cause toxicity in repeated oral administration on patients with long gastrointestinal transit period (OMAR *ET AL*., 2012). Its excessive consumption can induce hypokalcemia, muscle weakness, pseudo-hyperaldosteronism (OMAR *ET AL*., 2012) and hypertension (ASL *ET AL*., 2008).

Flavonoids, isoflavones, saponins, coumarins, chalcones, sterols or alkaloids are the main secondary compounds, which are responsible for many benefic activities in medical field as gastrointestinal disorders, antitumor or antioxidant properties of the plant (KELBER *ET AL*., 2012; WANG *ET AL*., 2013; YANG *ET AL*., 2016; MOSLEMIZADEH *ET AL*., 2017).

MAURYA *ET AL*. (2009) reported antidyslipidaemic, hypocholesterolaemic antihyperlipilaemic and antihypertriglyceridaemic activities in animal studies (i.e. syrian golden hamsters).

Extracts of this herb also have antioxidant capacity and free radical scavenging potential, evaluated to treat a variety of cerebral dysfunctions (CHIN *ET AL*., 2007; SIMMLER *ET AL*., 2013; SONG *ET AL*., 2015; LIO *ET AL*., 2017).

Anti-bacterial activities were related to the inhibition of bacterial infection and scavenging of hydroxyl radical produced during carcinogenesis (PARVAIZ *ET AL*., 2014); antimicrobial and antifungal activity against *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Candida albicans* (GUPTA *ET AL*., 2008, ANAGHA *ET AL*., 2014) and anti-*Helicobacter pylori*activity (WITTSCHIERA *ET AL*., 2009) were reported too. Furthermore, its antiviral activity was analyzed against HIV virus, SARS virus, yellow fever virus, chronic hepatitis C virus (SEKI *ET AL*., 2008, PARVAIZ *ET AL*., 2014).

Antiprotozoal activity, DNA-protective activity, suppressive action and cyclooxygenase inhibition have been identified by different researchers. Many experiments recorded estrogen (menopausal symptoms (HAJIRAHIMKHAN *ET AL*., 2013)) and progesterone activities (ASL *ET AL*., 2008; MAURYA *ET AL*., 2009; CHEEL *ET AL*., 2010; OMAR *ET AL*., 2012; BAHMANI *ET AL*., 2014).

β - glycyrritinic acid, present in the *L. radix* extract, presents anti-inflammatory activity in animals (e.g. caused by *H. pylori* infections (SHIN *ET AL*. 2007; AYALA *ET AL*., 2014) or IgE-induced allergic diseases as anaphylaxis, asthma or rhinitis (DONG *ET AL*., 2007)) but also on humans (e.g. myocardial edema, skin and lung disease and allergenic reactions).

In studies conducted by SAHA *ET AL* (2011) and WANG *ET AL* (2016) the antidemulsive, expectorant and antitussive activities of the compounds isolated from this root has been proven and TSCHIGGERL *ET AL*. (2011) presented various tea blends containing this plant in the treatment of sore throat, cough and bronchial catarrh.

Antileukemic and anti-UV-B irradiation effects are due to 18-α-Glycyrrhetinic and 18-β-Glycyrrhetinic acid from *L. radix* (CHIN *ET AL*., 2007; CAO *ET AL*., 2016), even in treatment of breast and gastric cancer (DONG *ET AL*., 2007). Also, *L. radix* can induce a favorable modification on P-glycoprotein expression and activity (Wu et al. 2016) and the anti-convulsant activity in the PTZ- induces seizure (CHOWDHURY *ET AL*., 2013).

Liquiritiae radix is a main herbal component in a variety herbal drugs used for different pharmacological effects in Europe and worldwide (KELBER *ET AL*., 2012), such as: Padma 28 (Indo-Tibetan remedy) (applied in intermittent claudication, peripheral arterial occlusive disease, antioxidant and transcriptional activation of cytoprotective genes actions) (KLEIN *ET AL*., 2013), STW 5 - Iberogast® (Steigerwald Arzneimittelwerk GmbH, Darmstadt, Germany) (for functional gastrointestinal disorders of the upper and lower abdomen and liver functions) (BONATERRA *ET AL*., 2013; OTTILLINGER *ET AL*., 2014; SEBASTIÁN-DOMINGO, 2014), GutGard, Caved S®, Carbenoxolone® and Biogastrone® (for gastrointestinal disorders) (PURAM *ET AL*., 2013). Furthermore, recent studies showed that this herb is an essential component in Bushenhuatanyizhi (BHY) medicine used for strengthening kidney-essence, phlegm elimination and developing mental therapy even in pacients with Alzheimer's disease and dementia (Liu *ET AL*., 2013). Moreover, in the Chinese alternative medicine this herb is common in many preparations as Die Da Sun Shang wine, Wu Mei Shang Yu decotion, Gui Zhi Wu Ling decotion, Yu Feng pellet and Tian Ma Shou Wu tablets (LIN *ET AL*., 2015) with applications in most of human body disorders.

CONCLUSIONS

The short review of published studies creates a panorama of benefits of *L. radix.* We emphasize the importance of *L. radix* compounds in various herbal based products for the treatmeant of both complex and elementary affections, as a re-evaluating of the traditional customs.

Roots extract of *L. radix* are very common in Romanian plant markets today and it makes people able to more easily return to traditional medicine, even if our instincts are developed for modern medicine.

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