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• Review

Phytochemical profile and biological activity of *Juglans regia*

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ABSTRACT

Juglans regia Linn. (Juglandaceae), popularly known as English or Persian walnut, is a valuable medicinal plant with a potency to cure various diseases in traditional medicine. Since ancient time, different local ethnic groups have used various part of *J. regia* for a wide array of ailments including helminthiasis, diarrhea, sinusitis, stomach ache, arthritis, asthma, eczema, scrofula, skin disorders, diabetes mellitus, anorexia, thyroid dysfunction, cancer and infectious diseases. Biological activities of *J. regia* have been reported in several peer review journals and scientific attention is increasing. The present review attempts to provide comprehensive information on plant description, ethnobotanical use, toxicity, phytochemical profile, pharmacology, clinical studies and current research prospective of the *J. regia*. Currently, there is an immense interest on isolation/identification of active constituents from walnut and screening those active compounds for pharmacological activities. In addition, researchers are performing clinical trials as well as screening various solvent extracts or fractions of *J. regia* in several animal diseases models to identify promising therapeutic benefits. In the present work, we review the latest information based on published scientific investigations of *J. regia*.

Keywords: plant extracts; *Juglans regia*; medicine, traditional; phytochemicals; pharmacology

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1 Introduction

It is well accepted that herbs serve as a rich source of medicines for various ailments. However, the ethnopharmacological uses of these medicinal plants may vary due to the principles of individual traditional medicine system and formulations prepared by local ethnic groups. For example, the Ayurvedic system is most popular in south Asian countries like India and Nepal; acupuncture and traditional Chinese medicine are practiced in China, Korea and Japan; the Unani system is practiced mostly in Middle-East countries[1]. At present, these different systems of alternative medicine practice are flourishing worldwide. Therefore, it is essential to compile a database of evidence-based scientific information pertaining to the use of herbal medicines, their identification features, abundance of phyto-constituent, indication of medical use, harmful effects and other characteristics. Each plant yields secondary metabolites, including compounds like essential oils, phenolic compounds, terpenoids, alkaloids, steroidal compounds, glycosides, terpenes, and tannins, which may be responsible for various therapeutics effects. These plant constituents possess numerous favourable physiological properties, such as antioxidant, anti-inflammatory and anti-atherosclerotic[2–4]. Various parts

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of *Juglans regia,* English or Persian Walnut, containing potent chemical constituents, have been continuously used since antiquity to treat diverse ailments, including diarrhoea, hyperglycaemia, cancer, infectious disease, anorexia, eczema, asthma, helminthiasis, arthritis, sinusitis, stomach-ache, skin disorders, among others. This review focuses on the most recent information on the pharmacological and phytochemical profiling of *J. regia*.

2 Ethnobotanical use

The leaves of *J. regia* are popular in complementary and alternative therapy as antimicrobial, depurative, keratolytic, antidiarrheal, carminative, anthelmintic, astringent, tonic, hypoglycaemic and for the treatment of sinusitis, cold and stomachache[5–7]. In Turkish folk medicine, fresh leaves of *J. regia* are used on the forehead and body to alleviate fever and on joints to reduce pain from rheumatism[8,9]. Similarly, in Iranian traditional medicine, the kernel from *J. regia* has been used for colitis[10]. In Palestine, *J. regia* has been used to treat diabetes, cardiac disease and inflammatory conditions[11,12], as well as to improve vascular and prostate health in elderly males[13]. In China, the bark from branches and exocarp from the immature, green fruit have been used for the treatment of gastric, liver and lung cancer[14,15]. In Mexico, it is used by traditional healers for protection from liver damage[16]. In Nepal, the bark paste is used to treat arthritis, skin diseases, toothache and to promote hair growth; the seed coat is used for healing wounds[17]. In Calabrian indigenous medicine, the shell of *J. regia* is used to treat malaria[18].

3 Reported phytochemicals

3.1 Steroids

The steroidal phytochemicals reported in *J. regia* are shown in Figure 1[19,20].

3.2 Flavonoid C-glycoside

The flavonoid C-glycoside phytochemicals reported in *J. regia* are shown in Figure 2[21].

3.3 Flavones

The flavones reported in *J. regia* are shown in Figure 3[19,22].

3.4 Essential oil component

The essential oil component phytochemicals reported in *J. regia* are shown in Figure 4[19,20,23–25].

3.5 Tannins

The tannins reported in *J. regia* are shown in Figure 5[26].

3.6 Miscellaneous

Organics acids: The organics acids reported in *J. regia* are shown in Figure 6[22,27–29].

Phenolic aldehyde: The phenolic acids reported in *J. regia* are shown in Figure 7[28,30].

Monoglyceride: The monoglyceride reported in *J. regia* is shown in Figure 8[30].

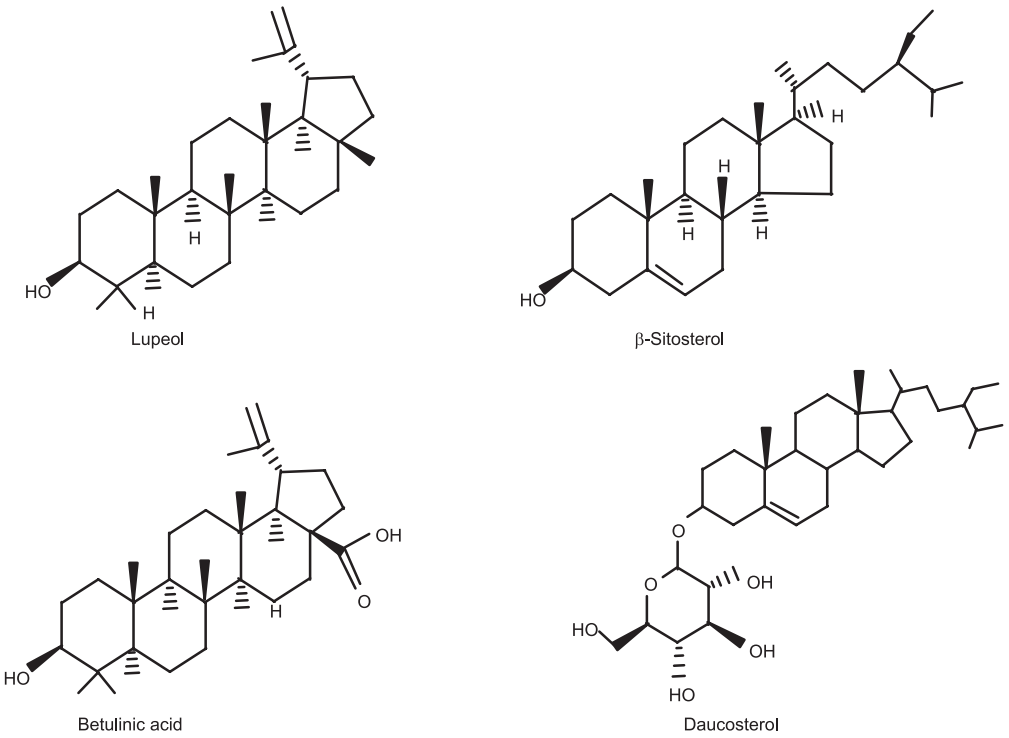

Figure 1 Steroidal chemical constituents present in *Juglans regia*