



## Review

# The genus *Commiphora*: A review of its traditional uses, phytochemistry and pharmacology

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## ABSTRACT

**Ethnopharmacological relevance:** The resinous exudates of the *Commiphora* species, known as 'myrrh', are used in traditional Chinese medicine for the treatment of trauma, arthritis, fractures and diseases caused by blood stagnation. Myrrh has also been used in the Ayurvedic medical system because of its therapeutic effects against inflammatory diseases, coronary artery diseases, gynecological disease, obesity, etc.

**Aim of the review:** Based on a comprehensive review of traditional uses, phytochemistry, pharmacological and toxicological data on the genus *Commiphora*, opportunities for the future research and development as well as the genus' therapeutic potential are analyzed.

**Methods:** Information on the *Commiphora* species was collected via electronic search (using Pubmed, SciFinder, Scirus, Google Scholar and Web of Science) and a library search for articles published in peer-reviewed journals. Furthermore, information also was obtained from some local books on ethnopharmacology. This paper covers the literature, primarily pharmacological, from 2000 to the end of December 2011.

**Results:** The resinous exudates from the bark of plants of the genus *Commiphora* are important indigenous medicines, and have a long medicinal application for arthritis, hyperlipidemia, pain, wounds, fractures, blood stagnation, in Ayurvedic medicine, traditional Chinese medicine and other indigenous medical systems. Phytochemical investigation of this genus has resulted in identification of more than 300 secondary metabolites. The isolated metabolites and crude extract have exhibited a wide of *in vitro* and *in vivo* pharmacological effects, including antiproliferative, antioxidant, anti-inflammatory and antimicrobial. The bioactive steroids guggulsterones have attracted most attention for their potent hypolipidemic effect targeting farnesoid X receptor, as well as their potent inhibitory effects on tumor cells and anti-inflammatory efficiency.

**Conclusions:** The resins of *Commiphora* species have emerged as a good source of the traditional medicines for the treatment of inflammation, arthritis, obesity, microbial infection, wound, pain, fractures, tumor and gastrointestinal diseases. The resin of *C. mukul* in India and that of *C. molmol* in Egypt have been developed as anti-hyperlipidemia and antischistosomal agents. Pharmacological results have validated the use of this genus in the traditional medicines. Some bioassays are difficult to reproduce because the plant materials used have not been well identified, therefore analytical protocol and standardization of extracts should be established prior to biological evaluation. Stem, bark and leaf of this genus should receive more attention. Expansion of research materials would provide more opportunities for the discovery of new bioactive principles from the genus *Commiphora*.

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**Abbreviations:** ABTS, 2,2'-azino-di-[3-ethylbenzthiazoline sulphonate]; ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase; COX, cyclooxygenase; CNS, central nervous system; DPPH, 2,2-diphenyl-1-picrylhydrazyl; FXR, farnesoid X receptor; GC, gas chromatography; HDL, high density lipoprotein; HUVEC, human umbilical vein endothelial cells; IL, interleukin; iNOS, inducible nitric oxide synthase; JNK, c-Jun NH<sub>2</sub>-terminal kinase; LDH, lactate dehydrogenase; LDL, low density lipoprotein; 5-LOX, 5-lipoxygenase; LPS, lipopolysaccharide; MAPK, mitogen-activated protein kinase; MIC, minimum inhibitory concentration; NO, nitric oxide; ODC, ornithine decarboxylase; PLA2, phospholipase A2; ROS, reactive oxygen species; STAT, signal transducer and activator of transcription; SOD, superoxide dismutase; TG, triglyceride; TID, three times a day; TNF, tumor necrosis factor; TPA, 12-O-tetradecanoylphorbol-13-acetate; VAS, visual analogue scale; VEGF, vascular endothelial growth factor; VLDL, very-low-density lipoprotein

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## 1. Introduction

The plant resinous exudates, exemplified by frankincense, myrrh, benzoin, Dragon's blood and ferulae resina, are important resources for traditional medicines. Their medicinal functions and usages are recorded in the ancient literature of Egypt, Rome, Greece, and China (Langenheim, 2003; Nanjing University of Chinese Medicine, 2006). Myrrh, originating from Arabia, is the exudates produced by the secretory tissue in the bark of *Commiphora* species.

The genus *Commiphora* (Burseraceae) with more than 150 plant species, is distributed in the tropical and subtropical regions, especially occurring in northeastern Africa, southern Arabia and India (Langenheim, 2003; Vollesen, 1989). The plants of *Commiphora* species are characterized as small trees or shrubs with spinescent branches, pale-gray bark and reddish-brown resinous exudates.

The resinous exudates of the genus *Commiphora* are commonly used as perfume, incense, or embalming ointment, and their medicinal values have been gradually recognized by humankind (Langenheim, 2003). They are used in indigenous medicines for the treatment of wound, pain, arthritis, fractures, obesity, parasitic infection and gastrointestinal diseases (Al-Harbi et al., 1997; Zhang, 2009; Abdul-Ghani et al., 2009). Diverse secondary metabolites including terpenoids, steroids, flavonoids, sugars, lignans, etc. have been discovered in this genus (Hanuš et al., 2005). Antiproliferative, anti-inflammatory, antimicrobial, hepatoprotective and cardiovascular properties of the purified metabolites and the crude extracts have been investigated (El Ashry et al., 2003; Shen and Lou, 2008; Deng, 2007).

The distribution of fifty-one constituents and medical uses of myrrh was reviewed by El Ashry et al (2003). A review covering the chemical aspects of *Commiphora* species has appeared (Hanuš et al., 2005). Two reviews dealing with the hypolipidemic property of guggul (the resin of *Commiphora mukul*) has been published (Ulbricht et al., 2005; Sahni et al., 2005). The resin of *C. molmol* mainly used in Egypt as an antiparasitic agent, its medical

use has been summarized recently (Abdul-Ghani et al., 2009; Tonkal and Morsy, 2008). The hypolipidemic property of guggulsterones (Ramawat and Merillon, 2008) and their molecular targets (Shishodia et al., 2008), the bioactive compounds from the genus *Commiphora* and *Boswellia* have been reviewed (Shen and Lou, 2008). Plant resins with antimicrobial potential have been summarized, the resin of *Commiphora* species were included (Termentzi et al., 2011). Different from the writing objectives of above literatures, our review presents a comprehensive and up-to-date report on traditional uses, phytochemical aspects, pharmacological functions and toxicity of this genus. Besides, we focus on the pharmacological data reported since the year of 2000, to provide a probable scope of future research concerning this genus.

## 2. Traditional uses

Traditional uses, local names and the main pharmacological activities of some *Commiphora* species from different regions are listed in Table 1. The most frequently employed and investigated *Commiphora* species are *Commiphora myrrha*, *C. opobalsamum*, *C. mukul* and *C. molmol*. The resins of these *Commiphora* species exhibit diverse therapeutic utilities, such as wound, pain, fracture, mouth ulcer, inflammatory disease, stomach disorders and microbial infection.

The recognition of the therapeutic and medicinal value of myrrh (known as *guggul* in India, the resinous exudates of *C. mukul*) in Ayurvedic medical system dates from 3000 years ago. Guggul is regarded as the most important herb in the authoritative monograph Charaka Samhita for the treatment of obesity, and is used as a hypolipidemic agent to treat lipid disorder (Kuppurajan et al, 1978; Singh et al., 1994; Khanna et al., 2010). This resin is used for promoting the bone fractures union, sore throat, mouth ulcer, wounds, skin disorders, acne, intestinal worms, lymphadenopathy, as recorded in Bhava Prakasha's

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