# PHYTOCHEMISTRY AND PHARMACOLOGICAL THERAPEUTIC POTENTIALS OF *COMMIPHORA MYRRHA*

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## Contents



## Summary

*Commiphora myrrha* (Family *Burseraceae*) commonly known as myrrh, is an economically important plant. Following chapter presents brief history of economic importance of *C. myrrha,* its oleo-gum-resin, commonly known as myrrh, mainly encompassing its uses in traditional medicine. The chapter also provides a brief background of family *Burseraceae* and genus *Commiphora*. Phytochemicals in *C. myrrha* oleo-gum-resin and essential oil along with their uses in different traditional medicine systems, including Ayurveda, Chinese, Unani etc., are discussed in this chapter. Pharmacological activities of *C. myrrha* against oxidative stress, pain,

inflammation, and microbes are also included in the chapter. Wound healing effects along with clinical investigations and toxicity of *C. myrrha* are also discussed. The information in this chapter has been included from available literature after meticulous search in most reliable databases and literature sources including peer reviewed research publications.

## 1. Introduction

There are approximately 374,000 plant species in the world comprising 94% of flowering plants. Humans mainly consume around 200 plant species; however, the number of consumable plants is much higher than what we consume on daily basis. An estimated over 50,000 flowering plant species worldwide are used, in one form or other, for medicinal purposes. The history of medicine goes back to thousands of years. Ancient Egyptians and Sumerians, c.a. 1500 BC, used willow bark as medicine for relieving pain. It was not until 1890s when salicin was isolated from the willow bark, which is a precursor of very well-known analgesic aspirin. However, the first modern pharmaceutical ingredient was isolated from opium in 1804 by a German scientist Friedrich Sertürner. This pharmaceutical ingredient is known as morphine and is extensively used in pain management.

A large number of similar discoveries, inventions and historical evidences point toward the largely natural origins of drugs. For ages, plants have been used in traditional medicines to treat several human ailments. For this purpose, whole plants or their parts including roots, leaves, bark, stem, seeds, fruits, and in some cases resins are utilized believing different plant parts possess different medicinal properties. In fact, modern phytochemical and pharmacological investigations confirm the medicinal effect to specific phytochemicals in plants and their different parts. During last few decades, thousands of plants have been investigated for their medicinal properties, revealing their active compounds, their extraction and pharmacological actions and mechanisms. The current chapter specifically focuses on *Commiphora myrrha* (Family *Burseraceae*) commonly known as myrrh.

The plants in the family *Burseraceae* are known to contain resin (Viscous organic substances that are translucent and are brown to yellowish in color) in their bark that can be burnt for a longer period giving a reason to sometime call this family a Torchwood family. However, the resin itself is worth more than the burning. Due to the importance of the resin, the family *Burseraceae* is also called incense tree family owing to its two most important Genera- *Boswellia* and *Commiphora*. The genus *Boswellia* is known for producing frankincense, an aromatic resin used in perfumes and incense, while genus *Commiphora* is known for myrrh resin, used in perfumery, as incense, in food flavoring and traditional medicine for various ailments. In addition to these two, there are 16 other genera in the family *Burseraceae,* comprising 540 species.

There are approximately 190 species in the genus *Commiphora* native to Africa, Arabian Peninsula and India. *Commiphora myrrha* (Nees) Engler [considered synonym of *Commiphora molmol Engler.*] is geographically distributed to Somalia, Ethiopia, Kenya, Oman and Saudi Arabia. *C. myrrha* is a shrub or small tree, with spiny branches and trifoliate leaves, having short trunk up to 4 m (13 ft) tall (Figure 1). The stem has a

thin, flaky outer bark with silvery or bluish grey appearance, covering a greener under bark. *C. myrrha* is known for its resinous exudate, commonly called myrrh that is obtained from its incised outer bark (Figure 1). Myrrh is an oleo-gum-resin with a peculiar aromatic odor known to human civilization since centuries. It has been used in religious rituals and folk medicine. Ancient Egyptians used it in embalming of the mummies. Earlier myrrh resin was used in religious rituals and as an incense, however with the emergence of medicinal knowledge about plant products, myrrh found a place in traditional medicine. In various traditional medicine systems worldwide, myrrh is used in several different herbal formulations to cure a number of ailments.

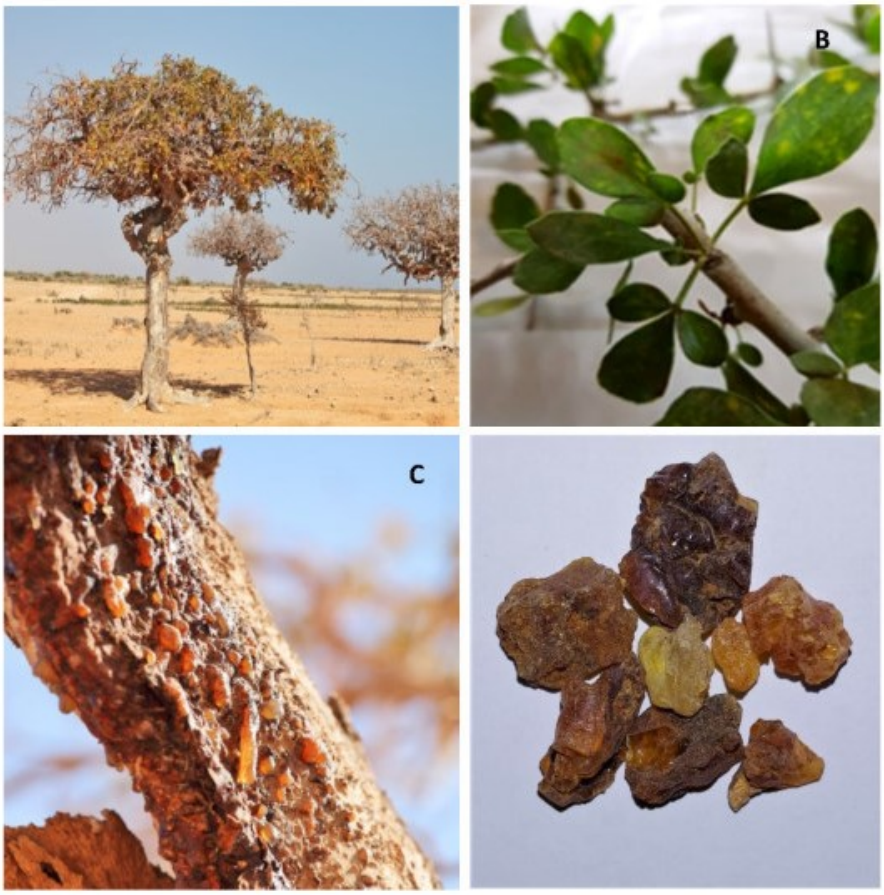


Figure 1. *Commiphora myrrha* (A) Whole plant; (B) Leaves; (C) Myrrh oleo-gum-resin exuding from the stem of the tree; and (D) myrrh oleo-gum-resin obtained from *Commiphora myrrha*. (Image credits: (A) and (C) Alraddadi BG and Hyun-Jae Shin; (B) Shalabi and Otaif)

## 2. Phytochemistry

### 2.1. Phytochemicals in Commiphora Myrrha Oleo-Gum-Resin

Myrrh oleo-gum-resin or 'myrrh' is a yellow to brown colored dried exudate that is obtained from incised barks of the trees belonging to genus *Commiphora*. However, true myrrh is obtained only from *C. myrrha*. Other main species that yield different kinds of myrrh resin include *C. abyssinica* (Abyssinian myrrh), *C. guidottii* (Sweet myrrh), *C.*

*mukul* (Guggul), *C. erythraea*, and *C. africana* etc. Myrrh resin is rich in natural organic compounds (also called secondary metabolites), and contain several inorganic elements as well. Researchers utilized different analytical tools and techniques to investigate phytochemicals in a plant or its products. These techniques include gas chromatography (GC), gas chromatography-mass spectrometry (GC-MS), liquid chromatography (including HPLC, UPLC, LC-MS, LC-MS-MS), nuclear magnetic resonance (NMR), thin layer chromatography (including HPTLC) etc. Different extraction methods are also applied to extract different kinds of phytochemicals by utilizing various organic solvents. Other than these, a number of chemical reaction-based colorimetric methods are also used to identify classes of phytochemicals, such as total polyphenols, total flavonoids etc., in a sample extracted from plant or its products. Phytochemical analysis procedures are more or less similar to investigations involving different plants. This section focuses on phytochemical constituents in *C. myrrha* oleo-gum resin simply called myrrh gum or resin.

Myrrh oleo-gum resin comprises 25-40% alcohol-soluble resin, 30-60% water-soluble gum and 3-8% essential oil. Several phytochemical screenings have revealed presence of flavonoids, alkaloids, phenolic compounds, terpenoids, tannins, quinines, lignans and glycosides in the resin. Terpenoids are also among the major constituents, and are responsible for most of the medicinal properties of myrrh.

The characteristic aromatic odor in myrrh is attributed to furanosesquiterpenes in it. Several researchers who investigated phytochemical constituents of *C. myrrha* resin have been successful in identifying different secondary metabolites. Table 1 presents secondary metabolites identified in myrrh resin in several different investigations.

### 2.2. Phytochemicals in *Commiphora Myrrha* Oleo-Gum-Resin Essential Oil

Commonly called myrrh oil, the essential oil is obtained by hydrodistillation of the myrrh oleo-gum resin. As it represents the volatile fraction of the oleo-gum resin, it mainly contains terpenoids, similar to those are identified in the resin phytochemical analyses. Essential oil obtained from myrrh resin contain sesquiterpenes, monoterpenes, and low molecular weight aromatic compounds. The main constituents of the essential oil include

- germacrone,
- furanoeudesma-1,3-diene,
- curzerene,
- β-elemene,
- limonene,
- cinnamaldehyde,
- cuminaldehyde,
- myrrholic acid,
- eugenol,
- α-pinene
- lindestrene.

Phytochemical composition of the myrrh resin and its essential oil may vary depending on several factors including geographical region, soil type, climatic conditions etc.

## 3. Uses of *Commiphora Myrrha* Oleo-Gum-Resin in Traditional Medicine

### 3.1. Myrrh Oleo-Gum-Resin Uses in Ayurveda

Myrrh is known as 'Bola', 'Hirabol', or 'Gandhrasa' in Ayurveda, an ancient system of traditional medicine that originated in India. 'Bola' is described as bitter, hot, and astringent. In Ayurveda myrrh is regarded as astringent and considered as an expectorant. It is used alone or in combination with other herbs for external or internal applications. It is used to treat inflammation, asthma and other lung ailments, fever, gynecological problems, mouth ulcers, skin conditions, wounds etc. It is specifically used for pharyngitis, gingivitis and mouth ulcers.

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**Biographical Sketches**

**Dr. Wajhul Qamar** completed his M.Sc. and Ph.D. in Toxicology from Jamia Hamdard, New Delhi, India in 2006 and 2011 respectively. His area of research focused on toxicological and pharmacological investigation of various chemicals and drugs. He has investigated pharmacological, chemoprevention, and anticancer activities of several phytochemicals. He has also investigated toxic effects of cigarette smoke on rat lungs. His experience includes several target organ toxicity studies including inhalation toxicity, hepatotoxicity, nephrotoxicity, dermal toxicity, GIT toxicity, reproductive organ toxicity. He has an expertise in development of animal models for various toxicological and pharmacological studies. In the past he has qualified for (i) Junior Research Fellowship (ICMR-JRF/May 2006) awarded by Indian Council for Medical Research (ICMR), Govt. of India, (ii) National Eligibility Test (NET/Dec. 2006) for lectureship awarded by Council of Scientific and Industrial Research (CSIR), Govt. of India, (iii) Senior Research Fellowship (CSIR-SRF/March 2009) awarded by Council of Scientific and Industrial Research (CSIR), Govt. of India, (iv) Professor Ajit Verma award for the best poster presentation at XXX annual conference of Society of Toxicology, India (STOX 2010). Dec. 9th – 11th, 2010. He has published several research reports in international journals. He has also authored several book chapters, mainly in the area of phytomedicines. He invented two devices for in-vivo experiments on rodents and got US patents for the same. Currently he is working as Associate Professor in College of Pharmacy, King Saud University, Riyadh, Saudi Arabia. He is also serving as Managing Editor of Saudi Pharmaceutical Journal since 2016. He has always been very keen to utilize his knowledge of toxicology for the benefit of human kind. He recently got involved in a national interest project focusing on risk assessment of cigarette litter and its impact on the environment and human health.

**Dr. Mohd Aftab Alam** (Ph.D. Pharmaceutics, Hamdard University, New Delhi, India), is associate professor at College of Pharmacy, King Saud University, Riyadh, Saudi Arabia. His research work comprises different aspects of pharmaceutical sciences including drug delivery and formulation development, herb ‐ drug interactions, drug ‐ drug interactions, bioanalysis, chemical analysis, medical devices, quality control of pharmaceutical formulations. Dr. Aftab also taught courses related to quality control and quality assurance at different levels. He has developed and modified numerous research techniques and pharmacological models. He has worked in Academia as well as Pharmaceutical Industry. Dr. Aftab has supervised pharmaceutical research at different levels and participated in numerous research projects. He spreads health awareness in community and has presented awareness talk on

Medicine Consumption and Public Awareness on All India Radio. As an inventor, he has several patents associated with pharmacy and health sciences.