



**BOSWELLIA SERRATA ROXB. A BOON OF NATURE IN THE WORLD OF
MEDICINES: A REVIEW**

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ABSTRACT

With food, cloth and shelter healthy life is the basic need & right of human being. Before the invention of synthetic drugs, man was completely dependent on medicinal plants for prevention and treatment of diseases. *Boswellia serrata* Roxb. is one of the medicinal plant which has long range of medicinal uses in pharmaceuticals, cosmetics and agriculture etc. Its bark resin, seed extract, flower extract, oil etc. is studied to the large extent providing existence of boswellic acid and other metabolites. *Boswellia serrata* leave extract and fruit extract is studied for the pharmaceutical purposes. It is the mark of future medicines. Their chemical structures and phytochemical study is helpful for the synthesis of new drugs.

KEYWORDS: *Boswellia serrata*, gum resin, bark resin, flower extract.

INTRODUCTION

Nature always proves itself the source of life, energy, eternity. Its forests are the treasures of enormous variety of plants which prove themselves the boon in the world of medicines. Since the thousands of years, people used to take plant originated products to make life better, healthy and wealthy. The demand of herbal medicines and their popularity is increasing in developing countries for primary health care because of better cultural acceptability, better compatibility with human body and lesser side effects.^[1]

Medicinal plants have curative properties due to presence of various complex chemical substances of different compositions which are found as secondary plant metabolites in one or more parts of these plants. The plant metabolites are grouped as alkaloids, glycosides, flavonoids, essential oils etc. on the basis of their compositions.^[2]

Boswellia serrata is one of the medicinal plants of *Burseraceae* family. In the plant kingdom, *Burseraceae* family is characterized with 17 genera and 600 species wide spread in all tropical region. Genus *Boswellia* contains about 25 known species. Most of them occur in Arabia, north eastern coast of Africa and India.^[3]

The word olibanum (Indian frankincense tree) is derived from the Arabic al-Luban it means the milk. The word also comes from the Arabic term for oil of Lebanon since Lebanon was the place where the resin was sold and traded with Europeans. The English word is derived from old French frankincense (i.e high quality incense) and is

used in incense and perfumes.^[4] "Gajabhakshya" a Sanskrit name sometimes used for *Boswellia* suggested that elephants enjoy this herb as a part of their diet.^[5, 6] Salai guggal contains 8-9 % essential oil, 20-23 % gum and about 50% resin.^[7, 8]

Habitat

Boswellia serrata is Indian frankincense. The tree is commonly found in West Asia, Oman, Yemen, South Africa, Sothern Arabia, and many parts of India. In India it is found in Western Himalaya, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Bihar and Orissa.^[9, 10]

Scientific Classification

Kingdom: Plantae
Order: Sapindales
Family: Burseraceae
Genus: *Boswellia*
Species: *serrata*

Vernacular Name

Unani / Arabic	: Kundur ^[11]
Arabic	: Luban ^[12]
English	: Indian frankincense
Hindi	: Kundur, Salai, Luban. ^[13, 14, 15]
Tamil	: Parangisambrani ^[13, 16]
Telugu	: Anduga, Kondagugi, Tamu ^[13]
Persian	: Kundur ^[12, 18]
Urdu	: Kundur ^[13, 17]
Sanskrit	: Ashwamuthri, Kunduru ^[13, 14]
Kannada	: Shallaki, Chitta, Gugula, Dhupa, Adimar, Tallaki, Maddi ^[13]
Trade name	: Salai, Guggul (gum resin)

Ayurvedic Properties^[19]

Kul	: Gugulukulu (<i>Burseraceae</i>)
GUNA (Properties)	: Laghu, Ruksh
RASA (taste)	: Tikta, Kashay, Madhur
VIPAK (metabolism)	: Katu
VIRYA (potency)	: Ushna

Morphology of *Boswellia serrata*^[20]

Boswellia serrata trees are usually with papery bark. Leaves alternate, crowded at the ends of branches, deciduous, imparipinnate, leaflets opposite, usually serrate.

Flowers hermaphrodite, small, white in axillary racemes. Petals 3-5, free or rarely connate, deciduous, imbricate or valvate.

Stamens are many or twice as many as the petals, inserted at the base or margin of the disk equal or unequal, filament free, rarely connate at the base, staminodes 0(zero). Anthers usually versatile ovary, free ovules two (very rare one) in each cell. Fruits drupaceous, usually indehiscent containing 2, 5- pyrenes or rarely pseudo capsular dehiscent. Seeds pendulous, testa membranous, albumen 0(zero).^[20]

Flowers grow in March-April and fruits in the winter. Trees remain leafless during the entire period of flowering and fruiting.^[16] The calyx is small capsular and 5-6 lobed. The petals are 0.5-0.8 cm oblong-ovate with basal disk.

Uses in Unani Medicine**Skin and Cosmetics**

Bark is moderately effective in removal of scars^[22]. Its local application is useful in septic wound.^[23]

With duck fat it is useful in *daad* (ringworm infection).^[22, 23] It is useful in healing the wet wounds and ulcers.^[12]

Swelling

It is useful in hot inflammation of the breast in confined women. It is used with oil and camolian earth.^[22]

Ulcers

It is useful in burn-wounds and cold fissures with swine fat.^[22] Its use with honey is beneficial in wounds of burns.^[19] It is useful in all types of septic ulcers.^[12, 22]

Head

It is memory strengthener when taken as infusion regularly in fasting. To remove dandruff and drying the ulcer it is applied with sodium nitrate.^[22] *Kundur* (*Boswellia serrata* exudate) dissolved in alcohol is useful in earache.^[12, 22, 23]

Eye

It is an important drug meant to be used in red and chronic pterugium and also for treating cancer of the eye.^[22]

It is useful in eye diseases such as zakhm, night blindness.^[12, 22, 23]

Respiratory and Cardiovascular System

Kundur with honey is useful in phlegmatic cough.^[12, 23] It is given along with other drugs in inflammation of organs and pneumonia. It is also useful in hot inflammation of breast during puerperium.^[12]

Gastro-intestinal tract

It stops vomiting and even hematemesis. It facilitates digestion.^[22] It is useful in haemoptysis, hemorrhage and stomach.^[12]

Uses in Ethno medicine

The bark is sweet, acrid, cooling and tonic. It is good for *Pitta*, asthma, dysentery, ulcers, hemorrhoids and skin diseases.^[14] Bark is useful in diarrhea, piles and skin diseases.^[17]

The exuded oleo-gum resin is useful in urinary disorders. Goiter, gout, piles rheumatism, cutaneous and nervous diseases.^[1, 16, 24]

It is useful in allergy, Alzheimer, arthrosis, asthma, boil, bursitis, cancer skin, carbuncle, colitis, convulsion, cough, Crohn's disease, dyspepsia, edema, fever, inflammation, vaginosis, wound, wrinkle.^[25]

Traditional Uses

Boswellia serrata gum resin is used as an Antiseptic^[26], Antifungal and antimicrobial^[26], Anti-inflammatory^[27], Arthritis^[28], Anti obesity^[29], Asthma^[30,31], Cardiotonic^[32], Anticonvulsant.^[33]

In Ayurvedic medicine, gum-resin of *Boswellia serrata* Roxb. has been used for hundreds of years for treating arthritis. It is also used in manufacturing of the supposed to be anti wrinkle agent "Boswelox".^[34]

The qualitative phytochemical study of this plant extract indicates the presence of tannin, pentosans, lignin, holocellulose, β -sitosterol, and both volatile and non-volatile oils. The volatile oils of resin such as cadinene, eleanol, geraniol, linalool, β -pinene, phenols, terpenyl acetate, bornyl acetate etc and non volatile oils like diterpene alcohol, serratol, α - and β -amyrin and eight triterpenic acids, viz., Boswellic acid.^[35]

The studies carried out on *Kundur* (*Boswellia serrata*) reveal that oleo-gum resin exhibits potent Anti-fungal, Anti-complementary, Juvenomimetic and Anti-carcinogenic properties. Investigations on *Kundur* also revealed its beneficial effects in Immunomodulation,

Bronchial asthma, Polyarthritits, Hepatitis C-virus, Colitis and Crohn's disease.^[36]

This plant may be called 'Kalpavriksha' as each and every part of it is useful to mankind. The Phyto-constituents present in different parts are as follows.

Phyto-constituents

Bark: - The bark is reported to contain: tannin, 9.1; pentosans, 18.3; lignin, 28.8; holocellulose, 48.7% and β -sitosterol. It is reported to be used in diarrhea, piles and skin diseases.^[37, 38]

Stem:- The oil-gum-resin obtained from the stem yields both volatile and non-volatile oils furnishing cadinene, eleanol, geraniol, linalool, β -pinene, phenols, terpenyl acetate, bornyl acetate, α -thujene, 2,2,4-trimethylcyclopent-3-en-1-yl acetic, α -camphelenic and α -campholytic acids (volatile oil); a new diterpene alcohol serratol, α - and β -amyrin and eight triterpenic acids, viz., β -Boswellic acid, its 11-Keto derivatives and their acetates, 24-dien-21-oic acid, 3 α - and 3 β -hydroxytirucall-8, 3 α -acetoxytirucall-8, and 3-ketotirucall-8 from non-volatile oil of resin.^[38]

Leaves: On steam distillation, the fresh leaves gave an essential oil having the following composition; Volatile oil: p-Cymene, 2.2; methylchavicol, 4.0; δ -limonene, 3.9;

α -terpineol, 13.6; α -pinene, 2.5; bornyl acetate, 20.0; α -terpineolene, 1.9; α -phellandrene and δ -thujone^[37,38]

Flowers and seeds:- The flowers and seeds are eaten. The seeds contain moisture, 9.0; crude protein, 8.0; pentosans, 29.3; and water sol mucilage, 1.2%. In folk medicines the dried, powdered flowers are used in colds and fevers.^[37, 38]

Boswellic acid is different from other known non-steroidal anti-inflammatory drugs in its mode of action and relatively free from side effects as most NSAIDs (non-steroidal anti inflammatory drugs) act through the inhibition of prostaglandins produced by stimulated phagocytes.^[39]

The oil was characterized by the high content of the monoterpenes (34) which constituted 97.3% in which *E*- β -ocimene and limonene were the major constituents. The remaining 2.7% was accounted for the sesquiterpenes (16) in which the *E*-caryophyllene was the major constituent.^[40]

The GC/MS chromatogram of the hydro distillate revealed the presence of 34 monoterpenes (Figure1) and 16 sesquiterpenes (Figure 2) that were identified through comparison of the fragmentation patterns in resulting mass spectra with those published in literature.^[41]

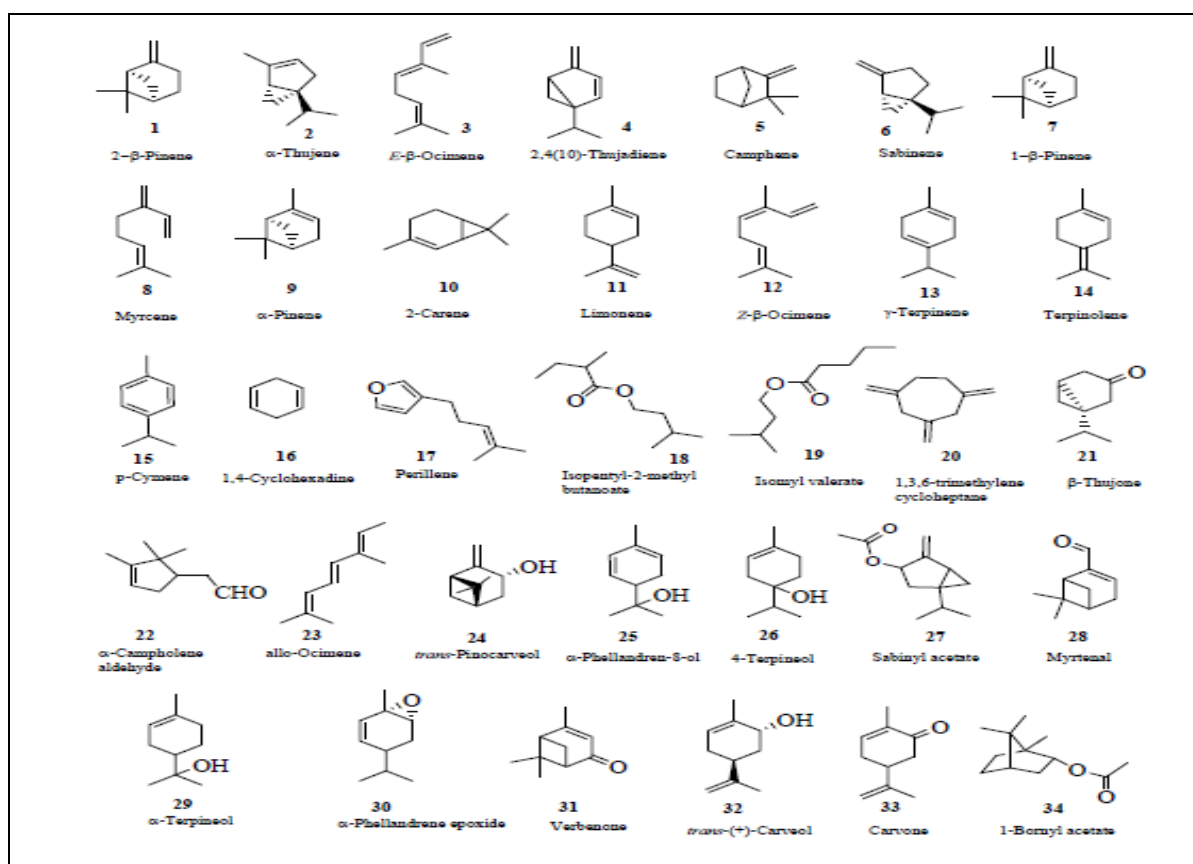


Figure 1. Monoterpenes from the essential oil of *Boswellia sacra* resin.

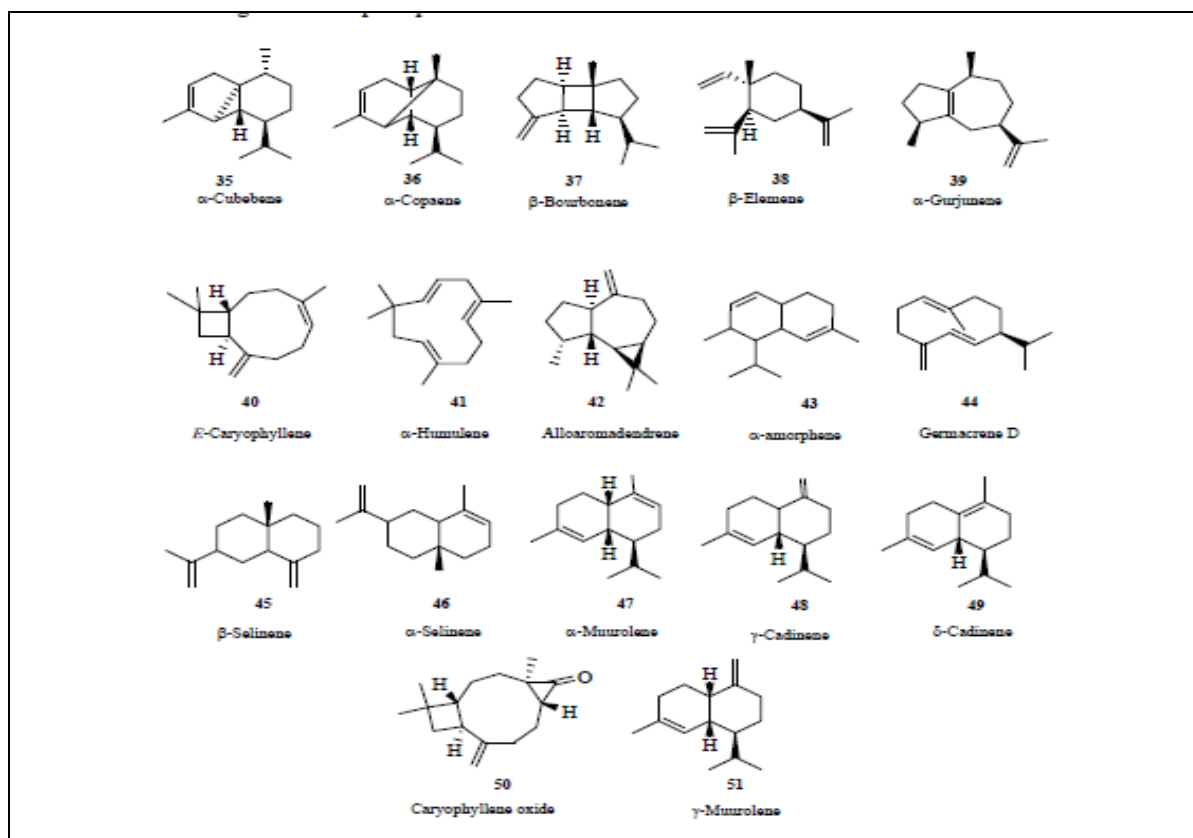


Figure- 2 Sesquiterpenes from the essential oil of the *Boswellia sacra* resin.

The oil contains a high proportion of monoterpenes (97.3%) in which *E*- β -ocimene and limonene were the main constituents. The remaining 2.7% was accounted for by sesquiterpenes, in which *E*-caryophyllene was the major constituent.

The monoterpenes were identified as 2- β -pinene (0.1%), α -thujene (6.6%), *E*- β -ocimene (32.3%), 2,4(10)-thujadiene (0.2%), camphene (0.6%), sabinene (5.2%), 1- β -pinene (1.8%), myrcene (6.9%), α -pinene (5.3%), 2-carene (0.8%), limonene (33.5%), *Z*- β -ocimene (0.2%), γ -terpinene (1.0%), terpinolene (0.4%), *p*-cymene (0.2%), 1,4-cyclohexadiene (0.1%), perillene (0.1%), isopentyl-2-methyl butanoate (0.1%), isomyl valerate (0.1%), 1,3,6-trimethylenecycloheptane (0.1%), β -thujone (0.1%), α -campholene aldehyde (0.2%), *allo*-ocimene (0.1%), *trans*-pinocarveol (0.1%), *p*-mentha-1,5-dien-8-ol (0.2%), 4-terpineol (0.2%), sabinyl acetate (0.1%), myrtenal (0.1%), α -terpineol (0.1%), α -phellandrene epoxide (0.1%), verbenone (0.1%), *trans*-(+)-carveol (0.1%), carvone (0.1%) and 1-bornyl acetate (0.1%).

The sesquiterpenes were identified to be α -cubebene (0.1%), α -copaene (0.3%), β -bourbonene (0.1%), β -elemene (0.3%), α -gurjunene (0.1%), *E*-caryophyllene (0.9%), α -humulene (0.2%), *alloaromadendrene* (0.0.1%), α -amorphene (0.1%), germacrene D (0.1%), β -selinene (0.1%), α -selinene (0.1%), α -murolene (0.1%), γ -cadinene (0.1%), caryophyllene oxide (0.01%) and γ -murolene (0.1%).^[40]

The medicinal plants find application in pharmaceutical, cosmetic, agriculture and food industry. The use of medicinal herb for curing disease had been documented in history of all civilization. Isolation and characterization of bioactive constituent of extract of *Boswellia serrata* shows presence of Tetrahydro-2 H – Pyran-2, 3, 4, 5-tetrol.^[42]

Karunakar Rao Kudle et al.^[43] have reported a cost effective of green synthesis of silver nanoparticles from the extract of *Boswellia serrata* flowers as a reducing agent and their spectroscopic analysis showed the size of nanoparticles to be between 60-84 nm.^[43] The gum resin is reported to contain a mixture of triterpene acids known as Boswellic acid (α, β, γ boswellic acid) acetyl- β boswellic acid, 11-keto- β -boswellic acid, acetyl-11-keto- β -boswellic acid and their derivatives.^[53]

Volatile oil contains α -thujene, α -phellandrene, β -Phellandrene, α -terpineol, δ -limonene, myrcene, α -terpene, *p*-cymene^[54]; a diterpene alcohol serratol and four tetracyclic triterpene acids 3- α -acetoxytirucall-8,24-dien-21-oic acid, 3-ketotirucall-8, 24-dien-21-oic acid, 3- α -hydroxytirucall-8,24-dienoic acid, 3- β -hydroxytirucall-8,24-dien-21-oic acid.^[44-57]

According to Rastogi Ram P et al^[55-58] it is also found to contain arabinose, rhamnose, glucose, galactose, Fructose, idose, galacturonic acid and β sitosterol isolated from gum.^[55-58] Essential oil from gum gave phenol-*o*-cresol, *m*-cresol, *p*-cresol, Thymol, and

carvacrol and carboxylic acid- α -campholenic acid, 2, 2, 4-trimethylcyclopent-3-en-1-yl acetic acid and campholytic acid.

The research has implicated^[59] a beneficial role for the resin in the treatment osteoarthrities, soft tissue rheumatism, low back pain, Gout and rheumatoid arthritis which is a creeping disease causing great physical suffering. It is possible to alleviate physical pain, Increase movement (mobility) and prevent further tissue injury through proper treatment with *Boswellia serrata*. On the other hand Boswellic acid^[60] “significantly reduced the infiltration of leucocytes into the knee joint” in turn significantly reducing inflammation causing immune white blood-cell response.

In *Boswellia serrata* gum resin Boswellic acid exhibit anti-inflammatory activity. The gum resin has anti-inflammatory, anti-atherosclerotic and anti-arthritis activities. The gum is well known house hold fumigant and is used as an anti-inflammatory agent when applied externally.^[62]

The study of Ziyaurrahman A.R. et al.^[63] showed anti-convulsion effect of *Boswellia serrata* in alcoholic extract against Pentylenetetrazole (PTZ), Picrotoxin (PTX) and Maximal electro shock (M.E.S.) induced convulsions in mice.

Poornima Agrawal et al.^[64] have formulated and evaluated the herbal gel containing *Boswellia serrata* extract, Curcuma longa extract, and Oil of Wintergreen. The gel formulation was designed by using alcoholic extract of *Boswellia Serrata*, *Curcuma Longa* and evaluated using physiological measurements.

Inoculation of *Boswellia Serrata* plantlets with *Piriformospora Indica* is beneficial for overall growth and ex.vitro survival in comparison to untreated control plantlets.^[65] Comparative isolation and Structural investigation of polysaccharides from *Boswellia serrata* and *Boswellia Carteri* BIRDW were studied by A Herrmann et al.^[66] as per their reports the carbohydrate content indicated the presence of 20-30% polysaccharides in the resins of both plants.

An euphane triterpenoid 20,22 – epox pha-24-ene-3-one and a long chain compound 5',6'-epoxytridec -1-[4'(5'), 9'(10')- ditetradecen], 13-[12''(13'') – pentadecen] – dioate are isolated from the oleo gum resin of the plant *Boswellia serrate*.^[67]

The ethnomedicinal plant *Boswellia serrata*, 3-0-Acetyl-11-Keto- β -Boswellic acid (AKBA) is the most active compound of *Boswellia* extract and is the potent inhibitor of 5-lipoxygenase (5-Lox), a key enzyme in the biosynthesis of leukotrienes from arachidonic acid in the cellular inflammatory cascade.^[68,69]

Tissue culture of *Boswellia serrata* Roxb. examined the effect of biotic and abiotic elicitors on production of four major components of boswellic acid as, 11-Keto- β -Boswellic acid (KBBA), acetyl-11-Keto- β -Boswellic acid (AKBBA), β -Boswellic acid (BBA) and acetyl β -Boswellic acid (ABBA) in callus culture.^[70]

Thus the present study review gives an idea about uses and phytoconstituents of *Boswellia* species. Proper investigations of the phytochemicals will make this plant species a boon in the world of medicines.

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