

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Pharmacological and Phytochemical Properties of *Betula utilis*: An Overview.

Deepa Verma^{*}, Saininad Ajgaonkar, Neha Sahu, Madhavi Rane, and Nikhil Teli.

Department of Biological Sciences, VIVA College, Virar (w)-401 303, University of Mumbai, Maharashtra, India

ABSTRACT

Betula utilis, commonly known as Bhojpatra which is widely used in traditional medicine and is well known for its therapeutic values. The bark of *B. utilis* is widely used in Ayurveda and Unani system of medicine, in the treatment of various ailments and diseases such as wound healing, skin disinfectant, bronchitis, convulsions, leprosy and diseases of the blood and the ear. The plant and its active constituents are frequently used as an anti-inflammatory, hepatoprotective, antimicrobial and anti-tumour agent. The present review is therefore, an effort to give a detailed survey of the literature on its pharmacological and phytochemical properties.

Keywords: *Betula utilis*, Unani, leprosy, hepatoprotective, antibacterial

**Corresponding author*

INTRODUCTION

India is virtually a herbarium of the world. In India, we are using plants and herbs as the basic source of medicine because we are rich in them. Herbals which form a part of our nutrition and provide us an additional therapeutic effect are in demand and *Betula utilis* is one of such plant.

Betula utilis is a significant medicinal plant which is widespread throughout the Himalayan region, commonly known as Bhoj patra [1]. There are at least 250,00 species of plants out of which more than one thousand plants have been found to possess considerable pharmacological properties among these a traditional medicinal plant *Betula utilis* is a birch tree native to the Himalayas [2]. The bark of birch tree has been the subject of respect and admiration throughout prehistory and history in the modern world [3, 4]. Traditionally the bark of *B. utilis* is widely used in the treatment of various ailments and diseases such as wound healing, skin disinfectant, bronchitis, convulsions, leprosy and diseases of the blood and the ear. The white, paper-like bark of the tree was used in ancient times for writing Sanskrit scriptures and texts, writing of sacred mantras, with the bark placed in an amulet and worn for protection [5-8].

According to the Ayurvedic pharmacopeia, the bark of *B. utilis* contains triterpenoids components such as botulin, lupeol and oleanolic acid-3-acetate. Therefore, the bioavailability and toxicity of the birch triterpene extracts have attracted high interest in recent years [9-14].

Taxonomy

The plant belongs to the family Betulaceae. *Betula utilis* is a moderate-sized tree that grows along moraines around Bhojbasa, close to the snout of the Gangotri glacier in India [15]. It is a moderate-sized tree that grows up to 20 m in height. The bark is shining, reddish-white or white, with white horizontal smooth, lenticels. The outer bark consists of layers, exfoliating in broad horizontal rolls. The leaves are ovate-acuminate, elliptic and irregularly serrate. The flowers bloom in May June, in pendulous spikes. The flowers are monoecious (individual flowers are either male or female, but both sexes can be found on the plant) and are pollinated by wind. Seeds are thin and winged. The plant prefers light (sandy), medium (loamy) and heavy (clay) soils, requires well-drained soil and can grow in heavy clay soil [16]. The plant prefers acid, neutral and basic (alkaline) soli. It can grow in semi-shade (light woodland) or no shade. It requires moist soil. Its therapeutic constitutes antiseptic, aromatic, carminative and contraceptive effects [17, 18].

Table 1: Botanical Classification of *Betula utilis* [6]

Kingdom	Plantae
Division	Magnoliophyta
Class	Mangoliopsida
Order	Falages
Family	Betulaceae
Genus	<i>Betula</i>
Species	<i>utilis</i>

Table 2: Common names of *Betula utilis* [15]

English	Bhoj Patra Tree,
Hindi	Bhoj patra
Tamil	Bhurjjamaram, Purchcham
Malayalam	Bhujapatram, Bhurjjamaram
Telugu	Bhujapatri
Kannada	Bhuyapathra
Sanskrit	Bahulavalkalah, Bahupata, Bhurjapatraka
Nepali	Bhoj patra

Pharmacological Profile

Anticancer activity

Betula utilis contains botulin that can be easily converted into betulinic acid. Studies revealed that betulinic acid inhibits growth of malignant melanoma and cancers of the liver and the lung [19]. Betulinic acid was identified as a highly selective growth inhibitor of human melanoma, neuroectodermal and malignant tumour cells and was reported to induce apoptosis in these cells. Anticancer agents with different modes of action have been reported to trigger apoptosis in chemo selective cells [20]. Alterations of mitochondrial functions such as permeability transition have been found to play a major role in the apoptosis process including cell death induced by chemotherapeutic agents [2]. Antitumor cytotoxicity of betulinic acid has been extensively studied in a panel of cancer cell lines, primary tumour samples and xenograft mouse models. Some reports suggested that betulinic acid is selectively cytotoxic against melanoma cell lines [21].

Anti HIV activity

Betulinic acid has been shown to inhibit HIV-1 replication. Based on its chemical structure, betulinic acid derivatives have been reported as inhibitors of HIV-1 entry [22], HIV-protease [23]. Since a number of betulinic acid derivatives have been shown to inhibit HIV-1 at a very early stage of the viral life cycle, these compounds have the potential to become useful additions to current anti-HIV therapy, which relies primarily on combination of reverse transcriptase and protease inhibitors.

Antimicrobial activity

Betulinic acid extracted from the bark of *Betula utilis*, has antibacterial activity against some important human pathogenic bacteria like *Citrobacter sp.*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella typhi*, *Salmonella paratyphi*, *Shigella boydii*, *Shigella flexneri*, *Shigella sonnei*, *Staphylococcus aureus*, *Streptococcus faecalis* and it mostly affect the gram positive bacteria [24]. A dried stored sample of bark of *Betula utilis* (Bhojpatra) has been found to be active against *Aspergillus niger* and *Aspergillus flavus* [25].

Antioxidant activity

Betulinic acid extracted from the bark of *Betula utilis* is found to possess potent antioxidant activity [26]. Though *B. utilis* has free radical scavenging activity, it reduces free radicals which may stop the free radical initiation or retard free radical chain reaction in the propagation of the oxidant mechanism. It has to be evaluated for other pharmacological properties.

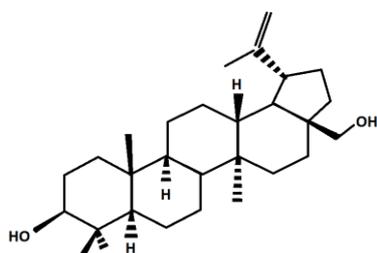
Anti-inflammatory activity

It has been reported that the ability of methanolic and water extract of *Betula utilis* reduce free radicals which may stop the free radical initiation or retard free radical chain reaction in the propagation of the oxidation mechanism. This indicates that the plants are more useful in the treatment of inflammation. During inhibition the activity of *Betula utilis* was found to be less in lipoyxygenase enzyme. It may act on free radical to reduce the inflammation. Lipoyxygenases (LOX's) are sensitive to antioxidants, and the most of their action may consist in inhibition of lipid hydroperoxide formation due to scavenging of lipidoxy or lipidperoxy-radicals formed in course of enzymic peroxidation. This can limit the availability of lipid hydroperoxide substrate necessary for the catalytic cycle of LOX [27].

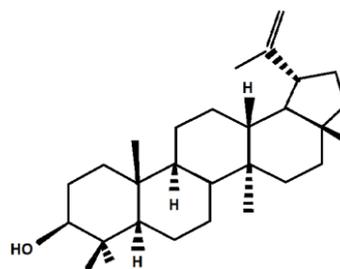
Phytochemistry

According to the Ayurvedic pharmacopeia, the bark of *B. utilis* contains triterpenoids components such as botulin, lupeol and oleanolic acid-3-acetate [28]. To date, only few analytical methods have been reported for the analysis of various bioactive ingredients in the birch bark, including betulin, betulinic acid by HPLC and GC-MS [29,30]. However, the literature shows no report till date about the simultaneous separation of betulin, lupeol, oleanolic acid, oleanolic acid-3-acetate and β -sitosterol as well as their validated

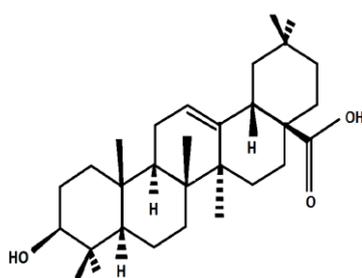
quantitative analysis by HPTLC method. All the isolated compounds were characterized and purity was found >98% as determined by HPTLC [31,32].



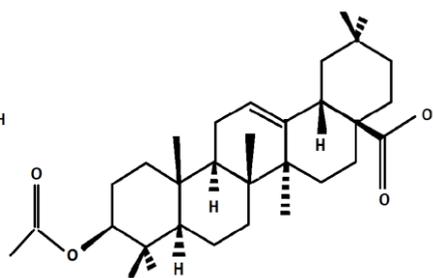
Betulin



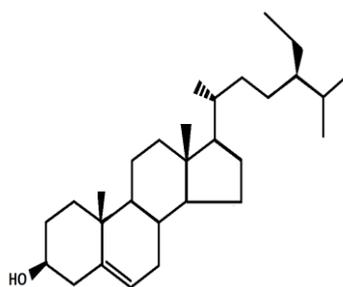
Lupeol



Oleanolic acid



Oleanolic acid-3-acetate


 β -sitosterol

Uses

- The bark of Himalayan birch was used centuries ago in India as paper for writing lengthy scriptures and texts in Sanskrit and other scripts. The bark of *B. utilis* is widely used in Ayurveda and Unani system of medicine, in the treatment of various ailments and diseases such as skin disinfectant, diseases of the blood and the ear, convulsions, wound healing, bronchitis, leprosy etc.
- The leaves of the plant show efficacy in treatment of urinary tract infections and in kidney and bladder stones. The fungal growth (*bhujra-granthi*) has also long been used in local traditional medicine.
- The wood is used for constructions of buildings, houses etc.
- The foliage is used for fodder. The most widespread use is for firewood, which has caused large areas of habitat to be eliminated or reduced [33].

CONCLUSION

The multiple benefits of *Betula utilis* made it a true miracle of nature. The stem bark used in India for the treatment of various diseases. *Betula utilis* possesses various phytochemical and pharmacological properties as discussed in present paper. Numerous studies have been conducted on different parts of *Betula utilis*, but this plant has not yet developed as a drug by pharmaceutical industries. A detailed and systematic

study is required for identification, cataloguing and documentation of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plants. However, more Clinical and Pathological studies should be conducted to investigate the active potentials of bioactive compounds present in this plant.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to: Management, VIVA Trust, Virar (W) Maharashtra. K.P.N. Kutty, Co-Ordinator, VIVA Trust, Virar (W) Maharashtra., Dr. R.D. Bhagat, Principal, VIVA College, Virar (W) Maharashtra, Non Teaching Staff , Dept. Biological sciences ,VIVA College Virar (W) Maharashtra.

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