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Morus nigra L. (Black mulberry): A plant with potent medicinal value

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Abstract

The goal of growing mulberry plants, which are members of the Moraceae family, is to provide food for silk worms. Black mulberry or *Morus nigra* L. is an extensively used ancient traditional medicine that is native to Southwestern Asia. Its components and extract have a variety of bioactivities. *Morus nigra's* fruits, leaves, and root bark have a long and rich history of use in traditional medicine across the globe for a variety of therapeutic purposes. Antinociceptive, anti-inflammatory, antimicrobial, anti-melanogenic, antidiabetic, anti-obesity, anti-hyperlipidemic, and anticancer actions are a few of the biological and pharmacological therapeutic effects exhibited by *M. nigra*. Mainly based on its antioxidant capability, *M. nigra* also exhibits protective effects against a number of human organs and systems. *M. nigra* is a promising nutraceutical resource that can be used to treat and avoid a number of chronic illnesses. It exhibits antifungal, skin-whitening, anti-obesity, anti-diabetic, anti-atherosclerotic, anti-platelet, hepatoprotective, anxiolytic, anti-asthmatic, anthelmintic, antidepressant and immunomodulatory properties. Fruits from *M. nigra* contain anthocyanin and flavonoids. Additionally, *M. nigra* exhibits therapeutic and protective benefits on the female reproductive system, liver, kidney, gastrointestinal tract, and central nervous system. The majority of these qualities are ascribed to its high concentration of phytochemical components like polyphenols, flavonoids, and anthocyanins, which act as antioxidants.

Keywords: *Morus nigra* L, medicinal, anti-inflammatory, black mulberry

1. Introduction

The flowering plant species *Morus*, also referred to as mulberry, is a member of the Moraceae family. There are twenty-four varieties in the genus *Morus*. They can be found all over subtropical Asia, North America, and Africa. Similar to other *Morus* species, *Morus nigra* L., also known as black mulberry, is a rambunctiously growing rustic plant that is found in many landscapes and is used for sericulture. The long history of *Morus nigra* L. includes its therapeutic use in almost every period of traditional medicine, with various, frequently distinct uses in each system and under different names (Leonti *et al.* 2015)^[9]. The pharmaceutical properties of *Morus nigra* L. are depicted in Fig. 1.

M. nigra L. exhibit numerous pharmacological activities such as antioxidant, anti-inflammatory, anticancer, antimicrobial, antifungal, skin-whitening, antidiabetic, anti-hyperlipidemic, anti-atherosclerotic, anti-obesity, cardioprotective, cognitive enhancing, hepatoprotective, anti-platelet, anxiolytic, anti-asthmatic, anthelmintic, antidepressant, and immunomodulatory activities. Due to the analgesic and anti-inflammatory properties, bioactive compounds isolated from *M. nigra* L. have also been used as herbal medicines for both humans and animals. Although this plant has long been used medicinally, it was the expanding silk industry that brought it to public attention, leading to the spread of mulberry trees throughout the globe to meet industrial demand for mulberry leaves (Lev E 2002)^[8].

2. Anti-Inflammatory activity

The term "inflammation" refers to a group of physiological defence processes that the body employs. Major chronic illnesses are thought to start out with inflammation. Inhibiting and regulating inflammatory responses in the human body can thus be one of the core methods for treating chronic illnesses.

A number of bioactive substances isolated from *M. nigra* L. have been used as herbal remedies for both humans and animals. Known jointly as sang-Bi-Pi and used to treat lung heat, cough, edoema, and oliguria, the roots of *Morus* plants were first mentioned in the

Chinese pharmacopoeia in 500 B.C. Morusin belongs to class of flavonoids. It is one of the most significant naturally occurring prenylated flavones in the root tissue of *Morus nigra* L. Morusin has anti-inflammatory properties (Jia *et al.* 2020)^[4].

There is reduction in the amount of paw edoema when *M. nigra* L. leaves extract is used. Additionally, *M. nigra* L. leaves prevent granulomatous tissues from developing in

persistent inflammation. Mornigrol D and norartocarpetin, which have strong anti-inflammatory effects, are found in the stem bark of *M. nigra* L. The xylene-induced aural edoema can be inhibited by *M. nigra* L. fruits' total flavonoid extract.

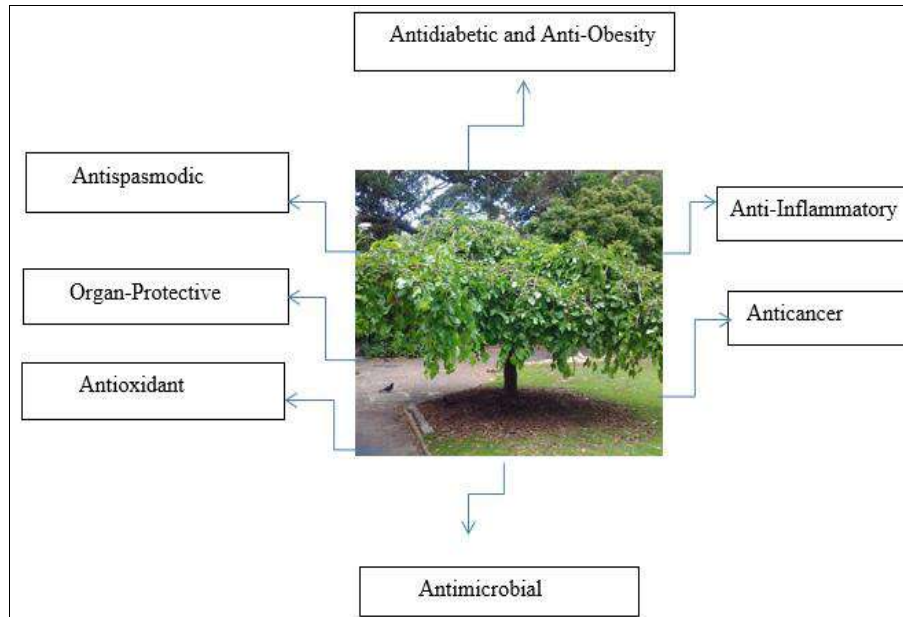


Fig 1: The pharmaceutical properties of *Morus nigra* L.

3. Anticancer activity

Cancer is a fatal disease condition characterised by uncontrollable and unremitting cell proliferation. *Morus nigra* L. plant extracts were used by the ancient Egyptians to reduce inflamed tumours and corrode ulcers. In Ayurvedic therapy, numerous *M. nigra* L. formulations are still used to treat cancer (Ahmad *et al.* 1985)^[2]. Human T- and natural killer (NK-) lymphocytes can be selectively stimulated to proliferate and become activated, while T lymphocytes can be killed by the mannose-specific jacalin-related lectin morniga M, which is extracted from *M. nigra* L.

M. nigra L. fruit extract reduces cell viability against HT-29 in human colorectal cancer. *M. nigra* L. leaves exhibit anticancer properties against the HeLa cell type, which represents human cervical cancer. Additionally, against a number of human adenocarcinoma cell lines, *M. nigra* L. seeds exhibit anti-proliferative and apoptotic effects.

Morusin is a prenylated flavone that was isolated from the branch and root bark of several varieties of the Morus tree. It has a variety of pharmacological properties, including anti-tumor properties (Kim *et al.* 2016). When used against different human cancer cell types, such as lung and kidney cell carcinomas, morusin shows blatant cytotoxicity. In addition, it exhibits action against a variety of cancers, including hepatocellular carcinoma (Gao *et al.*, 2017)^[3], colorectal cancer (Lee *et al.*, 2008)^[7], cervical cancer (Wang *et al.*, 2013)^[12], breast cancer (Kang *et al.*, 2017)^[5].

4. Antimicrobial activity

M. nigra L. leaves have antimicrobial effects on *E. coli*, *Bacillus cereus* and *enterococci*. Dental caries-causing bacterial species like *Streptococcus mutans*, *Escherichia coli*, *Staphylococcus aureus* and *Bacillus subtilis* are

susceptible to the effects of *M. nigra* L. leaves. Additionally, *M. nigra* L. leaves have antimicrobial properties against *E. coli*, *Bacillus cereus* and *Enterococcus faecalis*. The *M. nigra* L. fruits' total flavonoid extract exhibits antibacterial properties against inflammatory pain-causing microbes. Against both Gram-positive and Gram-negative bacterial strains, the raw fruits of *M. nigra* L. exhibit antimicrobial properties.

M. nigra's seeds, leaves, and stem bark are antibacterial to *P. acnes* and *S. epidermidis*. The strongest antimicrobial properties are found in the stem bark of *M. nigra*. Additionally, *M. nigra* stem barks cause cellular membrane injury and leakages of nucleic acids, proteins, and ions when used against *P. acnes*. The aerial parts of *M. nigra* can be used to extract oxyresveratrol, moracin M, cyclomorusin, morusin, and kuwanon C, all of which have antibacterial properties against *S. aureus*, *B. subtilis*, *Micrococcus flavus*, *S. faecalis*, *Salmonella abony*, and *P. aeruginosa*, with morusin having the strongest activity.

One of the top 10 causes of death worldwide is the infectious illness tuberculosis (TB), which is brought on by the *Mycobacterium tuberculosis bacterium*. TB is a treatable and preventable disease, but the prevalence of cases of extensively or multidrug-resistant TB has risen due to resistance to conventional antibiotic treatments for M. tuberculosis. In this regard, there is an increasing need for new drugs with innovative therapeutic targets, such as protein tyrosinase phosphatases (PTPs).

Potential PTP inhibitor options for M. tuberculosis include Diel-Alder-type adducts from the root bark of *M. nigra* L. We can obtain substances from *M. nigra*, including Kuwanon L, G, and H, cudraflavanone A, morusin, oxyresveratrol, chalcomoracin, and norartocarpetin. These

substances prevent TB. Black mulberry fruits exhibit antimicrobial action against *Candida* spp., the most prevalent cause of fungal infections worldwide. *S. epidermidis* is also susceptible to the antimicrobial effects of *Morus nigra* L.

5. Antioxidant activity

An excessive rise in intracellular oxidising species, such as reactive oxygen species implicated in the reduction of antioxidant defence capacity, is a sign of oxidative stress. Ageing, cancer, diabetes, atherosclerosis, chronic inflammation, neurodegenerative diseases, rheumatoid arthritis, human immunodeficiency virus (HIV) infection, ischemia and reperfusion injury, and obstructive sleep apnea

are just a few of the clinical conditions it plays a crucial part in. The phytochemical molecules and flavonoids both have antioxidant properties.

It has been widely reported that mulberries are abundant in anthocyanin components, which exhibit remarkable antioxidant properties as well as other health advantages, including anti-inflammatory, antimicrobial, anti-obesity, antidiabetic, anti-hyperlipidemic, anti-hypertensive, cardioprotective (reduced risk of coronary heart disease and stroke). Antioxidants present in *Morus nigra* L are depicted in table 1. *Morus nigra*'s roots, fruits and root bark contain phenolic compounds. Phenolic compounds are of considerable biomedical interest due to their antioxidant properties.

Table 1: Antioxidants present in *Morus Nigra* L.

Type of Antioxidant	Antioxidant
Geranylflavonoids	5'-geranyl-5,7,2',4'-tetrahydroxyflavone Kuwanon E Kuwanon U
Chalcones	2,4,2',4'- tetrahydroxychalcone Morachalcone A
Arylbenzofurans	Macrourin B Moracin O Moracinoside M Morunigrol C Morunigrol D
Coumarins	Mulberoside D Xerobside 5,7- dihydroxycoumarin-7-O-β-D-glucopyranoside 7-[[6-O-deoxy-α-L-mannopyranosyl]-β-D-glucopyranosyl]oxy]-2H-1-benzopyran -2 - one 5,7-dihydroxycoumarin-7-[6-O-β-D-apiofuranosyl-β-D- glucopyranoside]

6. Antidiabetic and anti-obesity activity

A chronic endocrine condition known as diabetes mellitus causes hyperglycemia due to a metabolic disease that affects insulin secretion, production, and/or usage. It is closely linked to the emergence of a number of significant complications affecting the cardiovascular, nervous, and renal systems that can raise incidence and mortality in diabetic patients. There are now several types of antihyperglycemic medications. However, a number of unfavourable side effects, including hypoglycemia, gastrointestinal discomfort, weight gain, and hepato-renal toxicity brought on by the use of these drugs have sparked research into the development of new, more potent, and safer naturally-occurring antidiabetic agents with various therapeutic pathophysiological mechanisms and targets.

M. nigra L. exhibits strong anti-diabetic properties. Black mulberry roots and bark are well-known traditional remedies for diabetes, arthritis, and hypertension as well as diuretics (Abbas *et al.* 2014; Ribeiro *et al.* 2017) [1, 11]. *M. nigra* L leaf extracts raise insulin levels while lowering plasma glucose levels. Numerous phenolic substances and isoprenylated flavonoids that were extracted from *M. nigra* L. twig extracts exhibit potent anti-diabetic properties. Fruit from black mulberries has anti-obesity property.

7. Organ-Protective activity

The bark juice of *M. nigra* L was used by the ancient Egyptians as an antidote to the poison of dangerous snakes, as well as preparations of *M. nigra* L. for corroding ulcers and dispersing inflamed tumours (Pliny the Elder 2015) [10]. Malondialdehyde (MDA) levels are decreased and DNA damage prevention is demonstrated by *M. nigra* L extract.

One of the main methods for postponing neurodegenerative processes is *M. nigra*'s antioxidant and anti-aging properties. The liver tissue's fatty deterioration and the cytoplasm's distension can both be reduced by *M. nigra* L. leaf extract.

Hepatic enzyme concentrations are decreased by *M. nigra* L. berry extracts. Fruits from *M. nigra* L are hepatoprotective. Fruits from *M. nigra* L are protective against diabetic nephropathy and associated renal tissue damage. Additionally, *M. nigra* L leaf extract enhances biochemical indicators of kidney performance (serum creatinine, urea, and uric acid).

Fruits from *M. nigra* L. can guard against severe gastric ulcers caused by acidified ethanol. The capacity of *M. nigra* L. fruit extract to lessen oxidative stress associated with the development of gastric injury by acidified ethanol is suggested by the fact that it prevents GSH depletion and promotes a partial reduction of LOOH. Pharmacological benefits of *M. nigra* L. fruits include their lack of risk for a number of adverse effects, including rebound acid hypersecretion, hypergastrinemia, gastric polyps, and atrophic gastritis.

8. Antispasmodic activity

Antispasmodics are frequently used to treat conditions involving impaired smooth muscle contraction and release in order to treat movement disorders, breathing issues, gastrointestinal cramps, and muscle spasms. Antispasmodics are crucial in the treatment of these illnesses.

The search for novel antispasmodics that can function as bronchodilator agents and/or gastrointestinal smooth muscle relaxants is of great interest given the development of

tolerance to existing drugs and molecules. Comparing *M. nigra* L. to other *Morus* species like the white (*M. alba* L.) and the red (*M. rubra* L.) mulberry, *M. nigra* L. has the greatest total phenolic and flavonoid content. Prenylated phenolic compounds are especially abundant in the root bark of *M. nigra* L. Bark extract from the *M. nigra* L. root exhibits smooth muscular relaxing properties.

9. Conclusions

M. nigra L. is a promising nutraceutical resource that can be used to treat and avoid a number of chronic illnesses. Anti-inflammatory, antimicrobial, anti-melanogenic, antidiabetic, anti-obesity, anti-hyperlipidemic, and anticancer actions are just a few of the pharmacological traits that *M. nigra* L. exhibits. Additionally, *M. nigra* L. exhibits therapeutic and protective benefits on the female reproductive system, liver, kidney, gastrointestinal tract, and central nervous system. The majority of these qualities are a result of its high concentration of phytochemical components, including polyphenols, flavonoids, and anthocyanins, which act as antioxidants. *M. nigra* L. is a promising nutraceutical resource that can be used to treat and avoid a number of chronic illnesses.

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