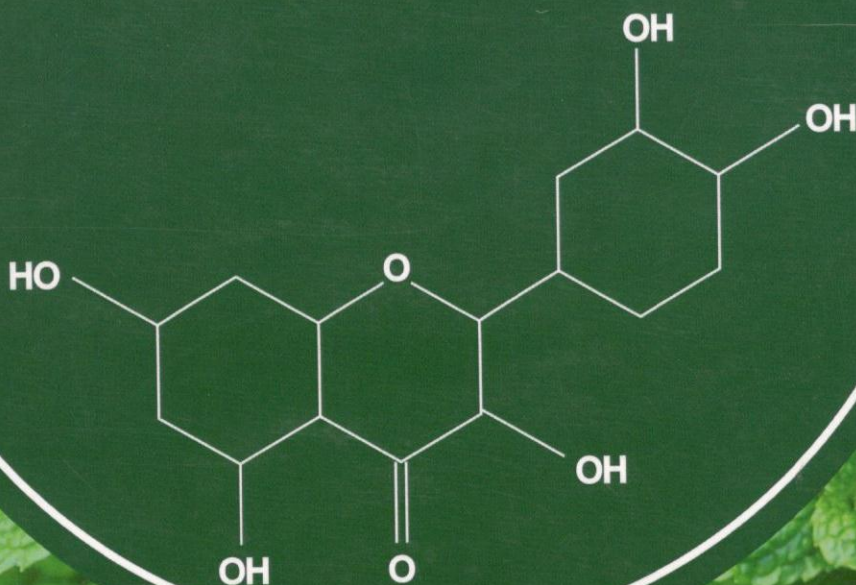


# Bioactive Compounds

Uzma Afaq  
Arshi Siddiqui

Applications and Significance



# Bioactive Compounds

## Applications and Significance

Uzma Afaq

Arshi Siddiqui

Department of Environmental Science  
Integral University, Lucknow (U.P) INDIA



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Uzma Afaq and Arshi Siddiqui

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## Chapter –01

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### *Mesua ferrea* L. (Nagakesara): A review on its botanical properties, bioactive components and medicinal uses

Mushfa Khatoon<sup>a</sup>, Durga Yadav<sup>a</sup>, Amita Dubey<sup>a\*</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

\*Corresponding address: Dr. Amita Dubey; email: amita@iul.ac.in

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#### Summary

There are various plants which have the qualities that are beneficial for the health and give the greatest results when used as therapeutic drugs. Almost every part of the plant is reported to contain therapeutic characteristics that might be utilized for the remedy of numerous ailments. Many plants of Callophylaceae family have various medicinal properties, among these *Mesua ferrea* L. is an important medicinal herb possessing various pharmacological properties. The plant is traditionally used in various Ayurvedic and Unani drug preparations. This chapter focuses on the traditional applications, main phytoconstituents and pharmacological properties of several parts of *M. ferrea*.

#### Keyword(s)

Nagakesara, Antioxidant, Medicinal plant, Antidiabetic, Mesuol

#### Introduction

Since ancient times, the components of plant have been employed as traditional medicinal remedy in the area of Ayurveda, Siddha and Unani for curing a variety of diseases<sup>[1]</sup>. Plants of the Callophylaceae family are extensively dispersed in tropical parts of the world, particularly in Asian continent, and have traditionally been utilized by the locals to cure variety of diseases varying from headache to cancer. *Mesua* is a vast genus of Callophylaceae family with over 48 species worldwide. Out of several species of *Mesua* genus, *M. ferrea* L. has been explored in detail by the researchers<sup>[1]</sup>. *M. ferrea* is commonly known as Ceylon iron wood in English Nagakesara in Hindi<sup>[2]</sup>. Trees of *M. ferrea* are raised for their flowers because they are visually appealing and decorative in nature<sup>[3]</sup>. *M. ferrea* is a resilient and drought adaptable plant

## Chapter – 02

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### Bioactive compounds in Phalsa (*Grewia asiatica* L.) and their pharmacological applications

Smita Rai<sup>a</sup>, Swati Sharma<sup>a\*</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

\*Corresponding address: Dr. Swati Sharma; email: ssharma@iul.ac.in

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#### Summary

Plants have been used throughout the world by human beings as drugs and remedies for various diseases since time immemorial. Phalsa or *Grewia asiatica* L. has exceptional nutritional and bioactive potential, hence the genus has attracted increasing attention in recent years. *G. asiatica* can be used for the treatment against many diseases, as it has been reported to possess a spectrum of antimicrobial, anticancer, antioxidant, radioprotective, hepatoprotective, and antihyperglycemic properties and avert the risk of many communicable and non-communicable diseases. Thus, this chapter reviews the nutritional composition, phytochemical profile, pharmacological properties of Phalsa plant.

#### Keyword(s)

Phalsa, *Grewia asiatica*, bioactive potential, disease

#### Introduction

India has a diverse variety of medicinally important plants which have been claimed with beneficial therapeutic effects along with better tolerability in terms of side effects. *G. asiatica* also known as phalsa, a member of tiliaceae family is a small fruit crop cultivated in warmer season and is known to contain cyanidin 3- glucoside, vitamin C, minerals. A brief review of work so far carried out is compiled in the present study showing radioprotective, antioxidant, antimalarial, antihyperglycemic, antipyretic, analgesic, antifungal, antiviral, antiplatelet, anticancer and immunomodulatory effect of plant. Plant of genus *Grewia* consists of shrubs and trees and majorly distributed in the warmer regions. Numerous species around 40 are found in India to name a few are *G. tenax*, *G. hirsuta*, and *G. damine*, *G. Lasiodiscus*, *G. optiva*, *G.*

## Chapter – 03

### Bioactive compounds and health effects of *Psidium guajava* Linnaeus

Madeeha Zaidi<sup>a</sup>, Syed Khalida Izhar<sup>a</sup>, Shahida Hamid<sup>a</sup>, Jahanarah

Khatoon<sup>a</sup>, Uzma Afaq<sup>a\*</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

\*Corresponding address: Dr. Uzma Afaq; email: uzmaafaq89@gmail.com

#### Summary

*Psidium guajava* Linnaeus, popularly known as guava, is a small tree belonging to the myrtle family (Myrtaceae) is widely cultivated in tropical and subtropical countries. It is well-known for its culinary and nutritional qualities all over the world. The plant is known to have high content of organic and inorganic compounds such as secondary metabolites e.g. antioxidants, polyphenols, antiviral compounds, anti-inflammatory compounds. Quercetin, guaijaverin, gallic acid, iso-flavonoids, catechin, epicatechin, naringenin, rutin, kaempferol flavonoids and galactose-specific lecithins are only a few of the compounds extracted from plants that have shown promising activity. *P. guajava* is a popular fruit that is high in vitamin C and minerals and has been shown to have antibacterial activity against bacteria that cause diarrhoea and bacteria that cause food spoilage.

#### Keyword(s)

*Psidium guajava*, Antibacterial, Biochemical, Chlorophyll

#### Introduction

*Psidium guajava* Linnaeus native to tropical areas from southern Mexico to northern South America, have been grown by many other countries having tropical and subtropical climates, thus allowing production around the world. It is a drought-resistant fruit that grows naturally in areas with high mean annual rainfall. India, Pakistan, Mexico, and Brazil are the top producers of guava fruit. It is a food crop as well as has medicinal value, possessing sweet-sour flavour and a lovely scent. Fresh-cut salads, puree, paste, nectar, juice, paste, concentrates, candy, jelly, jam, candy bars and other items made from it are the most popular. There are two

## Chapter – 04

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### Elucidating therapeutical potential of methanolic extract of *Moringa oleifera* on rodent glioblastoma cells

Arshi Siddiqui<sup>a</sup>, Shaizee<sup>a</sup>, Shabroz Alam<sup>a</sup>, Shahida Hamid<sup>a</sup>, Preeti Bajpai<sup>b\*</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

<sup>b</sup>Department of Zoology, Mahatma Gandhi Central University, Belisarai, Motihari-845401 (Bihar), India

\* Corresponding address: Dr. Preeti Bajpai; email: preeti2874@gmail.com

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#### Summary

*Moringa oleifera* also is known as Drumstick tree or Horseradish tree. It is an angiospermic plant in the Moringaceae family. This plant is native to sub-Himalayan Northern India, Pakistan, Bangladesh, and Afghanistan. *M. oleifera* has already been investigated for its medical benefits, which are due to the multiple phytochemical constituents found in the plant, such as vitamins, phenolic acids, flavonoids, isothiocyanates, tannins, and saponins. It is known as "The Miracle Tree" because of its numerous practical and nutritious advantages, including its ability to treat a variety of fatal ailments. *M. oleifera* is also an excellent source of vital amino acids, minerals, and proteins. Moringin generated in situ by myrosinase-hydrolysis of GMG inhibited Tumor growth in CCF-STTG1 human astrocytoma grade IV cells by inducing suicidal programme and oxidative stress, as well as partially by disrupting ribosome assembly. Methanolic extract of *M. oleifera* has many anti-glioblastoma effects. It caused reactive oxygen species to be produced in glioblastoma C6 cells. Methanolic extract of *M. oleifera* extract increased the production of reactive oxygen species in C6 glioblastoma cells. *M. oleifera* methanolic extract causes nuclear condensation in glioblastoma C6 cells. It demonstrates caspase-3 and caspase-9 activity in glioblastoma C6 cells. Caspase inhibitors enhanced apoptosis in *M. oleifera* methanolic extract-treated C6 glioblastoma cells. Because previous studies have revealed that *M. oleifera* has anticancer activity, it has the possibility for further development as a successful feasible therapy versus glioblastoma. The researchers attempted to investigate the

## Chapter – 05

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### Evaluation of free radicals scavenging activity of different extracts of *Grewia asiatica* L.

Shahida Hamid<sup>a</sup>, Uzma Afaq<sup>a</sup>, Arshi Siddiqui<sup>a</sup>, Jahanarah Khatoon<sup>a</sup>,  
Farina Mujeeb<sup>a</sup>, Tabrez Faruqui<sup>a</sup>, Preeti Bajpai<sup>b\*</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

<sup>b</sup>Department of Zoology, Mahatma Gandhi Central University, Belisarai, Motihari-845401  
(Bihar), India

\* Corresponding address: Dr. Preeti Bajpai; email: preeti2874@gmail.com

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#### Summary

*Grewia asiatica* L. is a mainly found in southern Asia from Pakistan, east to Cambodia and cultivated in other tropical countries. This plant is used as a medicinal plant. Fruits are a rich many source of nutrients such as amino acids, vitamins, proteins, and minerals and also contain bioactive compounds, like anthocyanins, tannins, phenolics and flavonoids. Different parts of this plant have shown different pharmacological properties. Leaves have also anticancer, antimicrobial, antiemetic, and antiplatelet activities. A fruit possess antioxidant, anticancer, radio protective, Immunomodulatory, and antihyperglycemic activities, while stem bark show analgesic and anti-inflammatory activities. This plant possess nutritional studies and pharmacological properties.

#### Keyword(s)

*Grewia asiatica*, Phytochemicals, Nutrients, Antioxidant, Pharmacological properties

#### Introduction

*Grewia asiatica* L. is also known as phalsa. *G. asiatica* belongs to family Malvaceae. The *Grewia* genus name was given by Nehemiah Grew (1641-1712). He was anatomist and physiologist and famously known as the “Father of plant physiology”<sup>[1]</sup>. *Grewia* consists of shrubs and trees and also majorly distributed in the warmer regions of the world. It consists near about 150 species scattered in the world and around 40 species are found in India namely *G.*

## Chapter – 06

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### Isolation and characterization of secondary metabolites of endophytic fungi from leaves of *Irvingia gabonensis* (Bush Mango)

Jahanarah Khatoon<sup>a\*</sup>, Mohd. Sadiq<sup>a</sup>, Farina Mujeeb<sup>a</sup>, Shahida Hamid<sup>a</sup>,  
Swati Saxena<sup>a</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

\* Corresponding address: Dr. Jahanarah Khatoon, email: jahanarah@iul.ac.in

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#### Summary

Secondary metabolites are organic molecules, which are released from fungi, algae and bacteria. Secondary metabolites are characterized under three principal *i.e.*, terpenes (which includes plant volatiles, cardiac glycosides, carotenoids and sterols), phenolics (such as phenolic acids, coumarins, lignans, stilbenes, flavonoids, tannins and lignin) and nitrogen containing compounds (*e.g.*, includes alkaloids and glucosinolates). Various separation techniques with different solvent systems and spray reagents, are applied to separate and identify secondary metabolites. Studies support the theory that genes involved in secondary metabolism provide a “genetic playing field” that allows mutation and natural selection to fix new beneficial characters through evolution. Another view about the secondary metabolism is as a mandatory part of cellular metabolism and biology; it depends on primary metabolism for the supply of required enzymes, energy, substrates and cellular machinery and contributes to the long term survival of the producer. Here, we aimed to review the antimicrobial activity of secondary metabolites of fungi isolated from leaves of Bush mango against some selected microorganisms (*Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Penicillium chrysogenum* and *Aspergillus fumigates*). Recent research indicates that these kind of studies could also pave a way for new therapeutic agents which can be used as potential drugs against the selected microorganisms or its infections.

#### Keyword(s)

Endophytes, Ecology, Antioxidants, Microorganisms, Metabolites, Bush mango

## Chapter – 07

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### Anticancer efficacy of *Artemisia vulgaris* against non-small cell lung carcinoma: a review

Farina Mujeeb<sup>a\*</sup>, Ahamad Faiz Khan<sup>b</sup>, Areeba<sup>a</sup>, Rohit Kumar Tiwari<sup>a</sup>,  
Jahanarah Khatoon<sup>a</sup>, Swati Saxena<sup>a</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

<sup>b</sup>Department of Bioengineering, Integral University, Lucknow-226026 (U.P.), India

\*Corresponding address: Dr. Farina Mujeeb; email: farinam@iul.ac.in

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#### Summary

Lung cancer is a disease with high morbidity, mortality rates and speaks to one of the greatest health care issues for mankind. As a result, it is often associated with a considerable amount of suffering and a general decrease in the quality of life. Chemotherapy and radiation therapies are now and again effective and in much occasions harmful and deadly. Alternative and less toxic medicine is very considerably essential to this ailment. Herbal medicines are recognized as an attractive approach to lung cancer therapy with little side effects and are a major source of new drugs. This review aimed at highlighting the benefits of *Artemisia vulgaris*, a medicinally important plant in various therapeutic applications with special reference to the antitumor activity for the management and treatment of lung cancer. Medicinal plants are presently standing out as likely wellsprings of anticancer specialists and are broadly utilized because of accessibility of the materials, generally modest, little, or no side effects, wide pertinence, and helpful adequacy which thus have quickened the scientific exploration. In this review, we have summarized *A. vulgaris*, as an abundant wellspring of herbal remedies or bioactive composites against lung cancer.

#### Keyword(s)

Lung cancer, Anticancer, *Artemisia vulgaris*, herbal medicines

## Chapter – 08

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### Bioactive and antioxidant potential of *Tinospora cordifolia* stem extracts

Namrata Mittra<sup>a</sup>, Mir Nasir Ahmad<sup>a</sup>, Preeti Bajpai<sup>b\*</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

<sup>b</sup>Department of Zoology Mahatma Gandhi Central University, Belisarai, Motihari-845401 (Bihar), India

\* Corresponding address: Dr. Preeti Bajpai; email: preeti2874@gmail.com

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#### Summary

Plants produce active metabolites that provide therapeutic benefits against many diseases. These metabolites composed of antioxidant properties. Antioxidants are the compounds that scavenge the reactive oxygen species (ROS) that produce free radicals. Free radicals are generated in response to the biological oxidation of various biomolecules. Oxidative stress undergo lipid Peroxidation (LPO) via, oxidation of polyunsaturated fatty acids. 4-hydroxynonenal (4Hne) or malondialdehyde (MDA) contents are the end products of the lipid Peroxidation. Benefits of the *Tinospora cordifolia* can be used as a therapy against infectious diseases. The active metabolites of the plant possess large array of the anti-oxidant and anti-microbial property to fight against infectious diseases by combating free radical generation. The bioactive compounds of the stem extracts of *Tinospora* is the magical bullet to combat many of the infectious diseases due to its magical diversifying activity against inflammation, aberrant cell proliferation, skin allergy, microbial infection etc. Medicinal values of the bioactive compounds from stem extracts are the magical bullets in the disease world. As free radicals the devil of the disease progression that can be attenuated by the potentiality of the antioxidant capability of the bioactive plant metabolites. Hence, it is emerging era of the world where variety of bioactive metabolites can treat deadly diseases by lowering the disease progression. Thus, sustainability has greatly achieved to a level where diseases of neurological aspect, cancer, diabetes, microbial infections has been well treated to and extent with the diversifying therapeutic ability of the bioactive compounds.

#### Keyword(s)

Metabolites, Antioxidants, Biomolecules, Therapeutic

## Chapter – 09

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### Isolation and characterization of secondary metabolites from fungi Jahanarah Khatoon<sup>a\*</sup>, Seema Maurya<sup>a</sup>, Farina Mujeeb<sup>a</sup>, Uzma Afaq<sup>a</sup>, Shahida Hamid<sup>a</sup>, Swati Saxena<sup>a</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

\*Corresponding address: Dr. Jahanarah Khatoon; email: jahanarah@iul.ac.in

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#### Summary

Fungi harbours low-molecular weight compounds, known as secondary metabolites (SMs). The secondary metabolites of fungi are found to be associated with many potentially useful biologic activities related to mankind. Discovery of pharmaceutical lead compounds within the microbial metabolic pools depend on the selection and biochemical characterization of promising strains. Biotechnologically applicable fungal metabolites include penicillin ( $\beta$ -lactam antibiotic) and lovastatin (cholesterol-lowering drug). Secondary metabolites are usually small molecules that are not necessary for normal growth or development. Fungal secondary metabolites can be distinguished into four main chemical classes: polyketides, shikimic acid derived compounds, terpenoids and non-ribosomal peptides. These metabolites works as: (i) a competitive weapons used against other bacteria, fungi, amoebae, plants, insects, and large animals; (ii) as a metal transporting agents; (iii) as a agents of symbiosis among microbes and plants, nematodes, insects, and higher animals or other possible ecological functions. Hence, it is evident from studies that fungal secondary metabolites act as antibacterial agent, immunosuppressant agents, antimicrobial agent, anti-inflammatory, antipyretic, and analgesic.

Several scientific literatures reported that endophytic fungi are a rich source of secondary metabolites and have significant roles in novel drug discovery. Lichen-forming fungi also provide us knowledge about significant biological metabolites with great clinical relevance. Meroterpenoids are a different class of secondary metabolites obtained from the terpenoid biosynthetic pathway, and are enriched with mycophenolic acid, fumagillin and act as potent sources of drugs. Here, we aims to discuss about different phyla of kingdom fungi, which includes Basidiomycota, Glomeromycota, Blastocladiomycota, Neocallimastigomycota,

## Chapter – 10

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### Evaluation of anticancer potential of *Moringa oleifera* methanolic extract against lung cancer

Arshi Siddiqui<sup>a</sup>, Hira Moeed<sup>a</sup>, Shabroz Alam<sup>a</sup>, Preeti Bajpai<sup>b\*</sup>

<sup>a</sup>Department of Biosciences, Integral University, Lucknow-226026 (U.P.), India

<sup>b</sup>Department of Zoology, Mahatma Gandhi Central University, Belisarai, Motihari-845401 (Bihar), India

\* Corresponding address: Dr. Preeti Bajpai; email: preeti2874@gmail.com

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#### Summary

*Moringa oleifera* usually called “wonderful tree” has been scientifically proven to inhibit the proliferation of many cancer cell types by induction of apoptosis. Apoptosis is an energy-dependent process, whereby cells are due for death because of abnormal gene mutation. It is referred to as the hallmark of cancer. The proliferation of cancer cells is not unconnected to deficiency in their apoptotic processes such as loss of caspase activity, p53 gene mutation, and imbalanced regulation of proteins which leads to inactivation or reduction in cancer cell apoptosis, hence, agents that are capable of inducing apoptosis in cancer cells are potential sources of effective anticancer drug. We briefed about apoptotic cell death and its routes, apoptosis down-regulation in cancerous cells, most critically, *M. oleifera* tree-induced apoptosis in cancer cells.

#### Keyword(s)

*Moringa oleifera*, Carcinogens, Phytochemicals, Lung Cancer, Cell Proliferation

#### Introduction

In the last century, a significant development in biomedical science has conquered many diseases; however, cancer remains ambiguous especially from a therapeutic perspective. Cancer is still a growing health problem worldwide, and it is the second most common cause of death from disease after myocardial infarction. Tumor or neoplasm is usually defined as a growth of an abnormal mass of tissue due to uncontrolled cellular growth, while cancer is the term of all