

# MUNICIPAL SOLID WASTE MANAGEMENT



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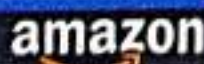
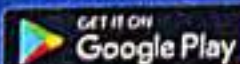


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# **BIG DATA ANALYTICS**

**Dr. S. SELVAKANI  
Mrs. K. VASUMATHI  
Mrs. M. SILAMBARASI  
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# BIG DATA ANALYTICS

FIRST EDITION

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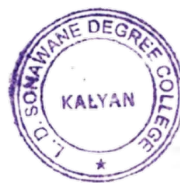
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# BIG DATA ANALYTICS

## OBJECTIVES

- To optimize business decisions and create competitive advantage with big data analytics
- To explore the fundamental concepts of big data analytics
- To learn to analyze the big data using intelligent techniques
- To understand the various search methods and visualization techniques
- To learn to use various techniques for mining data stream
- To understand the applications using Map reduce concepts
- To introduce programming tools PIG & HIVE in Hadoop ecosystem

## CHAPTER 1 : INTRODUCTION TO BIG DATA

Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Analytic Processes and Tools – Reporting – Analytics - Analysis vs Reporting.

## CHAPTER 2: MINING DATA STREAMS

Introduction To Streams Concepts – Data Streaming - Stream Data Model and Architecture - Stream Computing – bloom filter – Counting Distinct Elements in a Stream – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

## CHAPTER 3 : HADOOP:

History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-Runs on Map Reduce -Anatomy of a Map Reduce Job run- Failures in Hadoop-Job Scheduling-Shuffle and Sort – mapreduce execution - Map Reduce Types and Formats- Map Reduce Features- Hadoop ecosystem

## CHAPTER 4: FRAMEWORKS:

Applications on Big Data Using Pig and Hive – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase - fundamentals of ZooKeeper - IBM InfoSphere BigInsights and Streams.



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## CHAPTER 5: PREDICTIVE ANALYTICS

Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Data Visualizations - Visual data analysis techniques- interactive data visualization.

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# **Recent Techniques in Life Sciences**

**Editors**

**Dr. Sandeep Garg  
Dr. Lal Sahab Yadav  
Dr. Ashish Jain**



### **Dr. Sandeep Garg**

Dr. Sandeep Garg is an enthusiastic teacher and researcher in Zoology, working as an assistant professor in Department of Zoology in Smt. Chandibai Himathmal Mansukhani College, Ulhasnagar, affiliated to Mumbai University.

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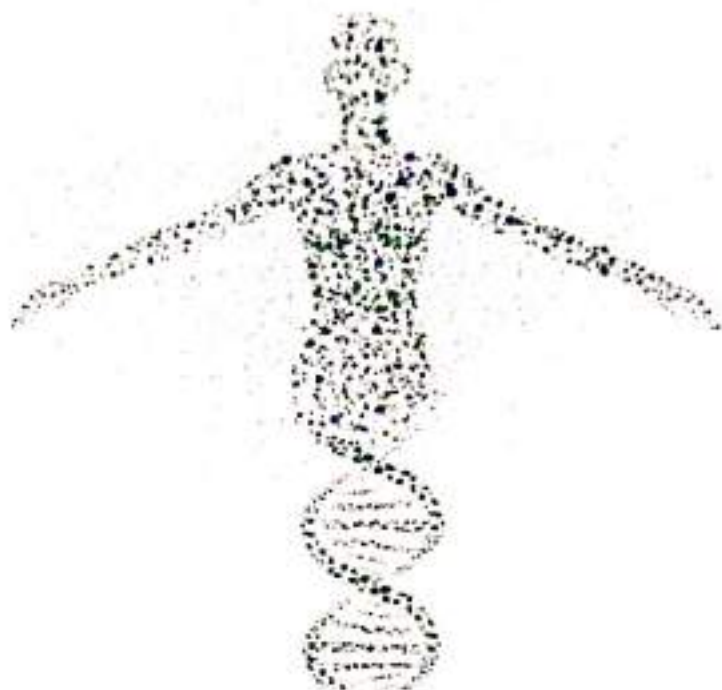
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# Recent Techniques in Life Sciences



**Editors**

**Dr. Sandeep Garg**  
**Dr. Lal Sahab Yadav**  
**Dr. Ashish Jain**



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# Preface to the First Edition

We are delighted to publish our book entitled "**Recent Techniques in Life Science**". This book is an assemblage of articles of significant life science techniques penned by acknowledged experts in the field of life science. These articles will provide an adequate acquaintance of the subject and will satisfy the need of budding scientists and students at all academic levels. This book is a bound of diversity of information about advances and developments in life science. With its application oriented and interdisciplinary approach, we hope that the students, teachers, researchers, scientists and policy makers will find this book more useful. The articles in the book have been contributed by eminent scientists, academicians. Our special thanks and appreciation goes to experts and research workers whose contributions have enriched this book. We thank our publisher Vyusta Publishing, India for compilation of such nice data in the form of this book. Finally, we will always remain a debtor to all our well-wishers for their blessings, without which this book would not have come into existence.

**Editors**

**Recent Techniques in Life Science**



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# An overview on ethnobotanical uses and bioactive phytochemicals of genus *Gymnosporia* family Celastraceae.

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## KEY POINTS

- The genus *Gymnosporia* is a native of South Pacific spread in tropical & subtropical regions of the old world. Several species of *Gymnosporia* are also found in Indian sub-continent and have been used as folk medicine since a long time in history.
- The ethnobotanical uses of whole plant parts to cure various kinds of serious disorders have been reported from different parts of India. Genus *Gymnosporia* is well studied in the majority of the world because of its high potential medicinal value and several new phytochemical compounds have been discovered.
- This chapter aims to compile the various phytochemicals found in different species of the *Gymnosporia* and the portions of the plant that have therapeutic potential for treating various ailments. It will be useful to improve the scientific investigation of health care research on Indian *Gymnosporia* species.

## KEY WORDS

Plants, folk medicine, phytochemicals.

## 4.1. INTRODUCTION

Traditional Folk medicines play a crucial role in treating numerous ailments in a wide variety of population, ranging from tribal area to city (Anywar *et al.*, 2021). Some plant-based folk medicines have been tested over the years for curing cancer, inflammation, diabetes and other such disorders (Jain *et al.*, 2022). The therapeutic properties of these plants/ plant parts have also been studied for centuries because of certain bioactive compounds present in selective plant parts (roots, stem, leaves and flowers) as insect repellents, fever, arthritis and stomach pain (Khickar *et al.*



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2019). There are many ethnobotanical plants that remain unexplored scientifically or less studied. One such example of such obscured plants, Indian species of genus *Gymnosporia*, family *Celastraceae*.

There are a total of 200 species of *Gymnosporia* currently classified worldwide, out of those around 16 species are found in India. The phytochemical screening of genus *Gymnosporia* studied in India are very meagre and presently known to contain secondary metabolites such as steroids, mucilage, sesquiterpenes, tannins, phenols, and polyphenols occurring in leaf, stem, and bark. These derived phytochemicals have been used in *diarrhoea*, wounds, dyspepsia, eye infection, malaria, dysmenorrhoea, rheumatism, chronic pain, chronic pain illness and chest pain. (Divya Jain *et al.*, 2022).

#### 4.2. SYSTEMATIC TAXONOMIC POSITION OF GYMNOSPORIA ROTHIANA

Kingdom	: Plantae
Division	: Spermatophyta
Sub-division	: Angiospermae
Class	: Dicotyledoneae
Sub Class	: Polypetalae
Group	: Disciflorae
Order	: Celastrales
Family	: Celastraceae
Genus	: <i>Gymnosporia</i> (Wt. & Arn.) Benth & Hook. f.
Species	: <i>rothiana</i>
Plant's Name: <i>Gymnosporia rothiana</i> (Walp.) M.A. Lawson Syn.: <i>Maytenus rothiana</i> (Wild.) W&A.(subrata.et.al)	

#### 4.3. HABITAT AND GEOGRAPHIC DISTRIBUTION

The plants belonging to genus *Gymnosporia* are typically found in arid, mountainous and forest regions around the globe. In India, *Gymnosporia* species found in Western Ghat regions and in deciduous scrub forests range of Madhya Pradesh, Uttar Pradesh, Punjab, Delhi, Bihar, Rajasthan, Maharashtra and Tamil Nadu of India (Khickar *et al.*, 2019). This genus is also known to occur in Afghanistan, tropical Africa, Australia and Arabia as well (Bhavita *et al.*, 2017).



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#### 4.4. BOTANICAL DESCRIPTION:

There are 800 species of the *Celastraceae* family, mostly predominant in the habits of trees and shrubs. *Maytenus* (*Gymnosporia*) is one of the important genera of this family. The plant species belonging to this genus are evergreen, sturdy and have moderate tolerance for dryness. These plants are able to thrive well in monsoon season; thus, as a result fresh flowers are expected to bloom between June to August. Whereas, the fruits emerge between March/April and leaves sprout between June to august in order to support reproductive activity (De & De, 2014). Weng branches and alternate leaves have a leathery feel, are fasciculate and spiky in character, and are dark green on the adaxial side and light green on the abaxial side. Some morphological variations are reported in the leaves size, shape and presence and absence of thorns as per geographical distribution.



**Figure 4.1:** Twig of *Gymnosporia rothiana*, W&A. (a)&(b)*Gymnosporia rothiana*, W&A twig and thorny branch (c)&(d) flowers (e) bark of the stem (f) aerial part back side of the twig.

#### 4.5. ACTIVE BIOLOGICAL COMPONENTS OF CELASTRACEAE

The *Celastraceae* family received a fresh leap in the 1970s thanks to the maytansinoids, compounds with outstanding antitumoral activity (Kupchan, *et al.*, 1972). Numerous bioactive substances with varying pharmacological activities have been discovered in a variety of *Celastraceae* species, including diterpene and triepoxides which are effective as antileukemic and anti-inflammatory; triterpenoid antibiotics and quinonemethides- also known as celastrols, sesquiterpene pyridine, as cytostatic properties, immunosuppressive or anti-inflammatory activities.



anticancer substances triterpene quinine with diterpenoid epoxide triptolide celastrol has been reported from this genus. Bhavita *et al.*, 2017, suggested that *M. emarginata* extract has a hepatoprotective action it can be used as a powerful hepatoprotective drug. Stem extract of *M. emarginata* reduces the hepatotoxicity caused by paracetamol

#### 4.6. INSECTICIDAL AND ANTIFEEDANT PROPERTIES:

*Celastrus angulatus* Max. commonly known as Chinese bittersweet, is widely distributed in the People's Republic of China and has long been used as a traditional insecticidal plant to protect other plants from insect damage. To protect the crop, powder of all plant parts is suspended in water, and sprayed over it. Gonzalez *et al.*, 2000 published the first scientific paper describing a non-alkaloid sesquiterpene polyol ester with insect antifeedant activity.

#### 4.7. ANTITUMOR-PROMOTION ACTIVITY

Some antitumor compounds like triptofordin & triptogelin and their derivatives were discovered to have powerful inhibitory activity. The active triptogelin A-1 has demonstrated exceptional inhibitory effects on the propagation of mouse skin tumours in an In- vivo two-stage carcinogenesis test, indicating that it is a promising new type of chemical for chemoprevention and chemotherapy against papilloma and carcinoma (Gonzalez *et al.*, 2000).

#### 4.8. THERAPEUTIC USE AND PHYTOCHEMISTRY

PLANT PART	METHODS AND USES	REFERENCE
<b>1. Leaves</b>		
<i>Maytenus emarginata</i>	Pulverised leaves + milk as a vermifuge, Decoction of leafy twig as mouth wash	(Kothari, 2000)
	Burnt leaves + ghee -To heal sores Tender leaves in jaundice Ash of leaves -wound heal	(T. Pullaiah, 2006)
	leaves powder is mixed with mustard oil and rubbed on the back- for treating Rickets	(Dixit & Pandey, 1984)
<i>Gymnosporia montana</i>	Decoction is drunk for gastrointestinal disorders, ulcers, dysentery, toothache	(Dixit & Pandey, 1984)



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	to treat jaundice, hepato-protective.	
<i>Maytenus aquifolium Martius</i>	Leaves infusion is drunk for ulcers	(Pereira et al., 1996)
<i>Maytenus buxifolia Grise</i>	Decoction is drunk orally as medicine for cure of fever, extended menstruation.	(Gonzalez et al., 2000)
	Bark, leaves and twig powder soaked in water and drunk 1 quart/day for 5 days as abortifacient up to 3 months pregnant	(Gonzalez et al., 2000)
<i>Maytenus canariensis</i> (Loes.) Kunk. et Sund	Leaves hot water/ cutaneous abscesses, oral chewed antirheumatic to ward off fatigue	(Darias et al., 1989), (Gonzalez et al., 2000)
<i>Maytenus chuchuasca</i>	Leaves hot water/oral Aphrodisiac	(Gonzalez et al., 2000)
<i>Maytenus heterophylla</i> (Eckl. Zeyh.) N. Robs.	Not specified Dysmenorrhoea	(Hedberg et al., 1982)
<i>Maytenus ilicifolia Mart</i>	Leaves oral sialagogue, antiasthmatic, antiseptic, vulnerary emmenagogue	(Gonzalez et al., 2000), Martinez et al. 1981
<i>Maytenus obscura</i>	decoction mixed with soup and drunk for cancer.	(Gonzalez et al., 2000)
<i>Maytenus putterlickioides</i> (Loes.) Exell. & Mendopa	hot water/oral is used to cure hook worm infestation	(Gonzalez et al., 2000)
<i>Maytenus vitis idaea Grxst</i>	Leaves in powder form are taken with milk as Vermifuge and leave juice is drunk to cure female sterility	(Gonzalez et al., 2000)
<b>2. Stem</b>		
<i>Maytenus emarginata</i>	Treatment of mouth ulcers,	Spivey et al, 2002
	Tender shoots extract kills lice in hairs	(T. Pullaiah, 2006)
	Decoction of stem + black pepper	(Kapoor et al., 2013)



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	Stem bark + mustard oil In pneumonia and cold fever	
<b>3. Fruits</b>		
<i>Maytenus emarginata</i>	Fruit in powder form Used for purify blood	(Agarwal and Nag., 2010)
	Powder in hot water/oral for cancer	(Gonzalez et al., 2000)
<b>4. Roots</b>		
<i>Maytenus emarginata</i>	Root paste is applied externally for sprains and pulled muscles	(Gonzalez et al., 2000)
<i>Maytenus acuminata</i>	Decoction is drunk twice a day for stomach ups	(Bhat & Jacobs, 1995)
<i>Maytenus heterophylla</i> (Eckl. Zeyh.) N. Robs	Root decoction is drunk used as anthelmintic, epilepsy, hernia, syphilis	(Hedberg et al., 1982)
<i>Maytenus ilicifolia</i> Mart	Root bark decoction for fertility-regulation	(Alice et al., 1991)
<i>Maytenus peduncularis</i> (Sonder) Loes	Root decoction is drunk 4 times a day for backache (Males only 4 times a day	(Arnolda & Gulumianb, 1984)
<i>Maytenus putterlickioides</i> (Loes.) Exell. & Mendopa	Root decoction is taken orally for irregular menstruation, hernia, swollen testicles, aphrodisiac, dysmenorrhoea	(Hedberg et al., 1982)
<i>Maytenus senegalensis</i> (Lam.) Exell	Root decoction is drunk hot water/oral.	(Gonzalez et al., 2000) (Arnolda & Gulumianb, 1984)
	Irregular menstruation, hernia, swollen testicles, aphrodisiac, dysmenorrhoea	(Chhabra et al., 1993)
<b>5. FLOWERS</b>		
<i>Maytenus ilicifolia</i> Mart	Flower Decoction is drunk anti-inflammatory	(Alice et al., 1991)

## 4.9. PHYTOCHEMICAL CONSTITUENTS

Chemicals known as phytochemicals are those that plants make spontaneously for their own requirements which gives plants their colour, flavour, scent, and texture (Mukesh Kumar & Manoj, 2019) This term is often used to describe compounds specially phytocompounds. Numerous triterpenoids, including maytansinoids,



friedelane triterpenoids, lupane triterpenes, oleanane triterpenes, sesquiterpenes, and their alkaloids, have been isolated and discovered from the members of the genus *Maytenus*.

Many scientists have carefully studied the *Maytenus* species, and they have isolated a number of novel compounds with a wide range of structures that may be beneficial against a number of diseases. In addition to terpenes, plants also include flavonoids, saponins, terpenoids, carotenoids, anthocyanins, and xanthophylls. Mathur & Goswami, 2013, examined the phytosterol content of *Maytenus emarginata* fruit, leaves, flowers, stem and in unorganised tissues (callus of leaf). He discovered that leaves of *Maytenus* contain high concentrations of  $\beta$ -sitosterol, stigmasterol, and total sterols compared to fruits. Additionally, unorganised tissue contained relatively little sterol. Gonzalez et al., 2000, reported that *Maytenus emarginata*'s leaf contains stigmasterol, - sitosterol in larger percentage.

#### 4.10. SESQUITERPENES

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Sesquiterpene ester is widely available from the *Celastraceae* family. They are thought to be chemotaxonomic markers for the Family.

#### 4.11. MAYTANSINOIDS

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A second class of microtubulin polymerization inhibitors known as maytansinoids was developed from the naturally occurring benzoansamacrolide known as maytansine, which was obtained from the bark of the African plant *Maytenus ovatus*. Maytansine was found to have promising anti-tumor effects on lymphocytic leukaemia, lymphoma, ovarian cancer, breast cancer, and melanomas in a clinical investigation (Mukesh Kumar & Manoj, 2019). Albert T. Sneden & George L. Beemsterboer, 1980 extracted and purified some important compounds like maytansine, maytanprine, and maytanbutine from *M. buchananii*.

#### 4.12. ALKALOIDS

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The pyridine alkaloids are a significant category of naturally occurring chemicals that include nitrogen, and they are rather uncommon natural products. These molecules exhibit complex stereo-chemistries and a distinct form of chemical diversity. Additionally, they have a wide range of biological functions, including immunosuppressive and anti-tumor properties. Sesquiterpene pyridine is a pyridine alkaloid, which is widely distributed in the *Celastraceae* family of plants (Huang et al., 2021). Many sesquiterpene pyridine alkaloids and friedelane triterpenoids with their unique aromatized structures have been identified from the



genus *Maytenus*, and these have also demonstrated effective anti-tumor properties (Morita *et al.*, 2008; Gonzalez *et al.*, 2000).

**Table 4.2. Various Phytochemical constituents reported in species of *Gymnosporia* plant**

Sr. No	Nature of metabolite	Identified phytochemical
1	Flavonoids	Luteolin, Kaempferol, Quercetin, Phytosterol, $\beta$ -sitosterol, Stigmasterol, Cholesterol, $\alpha$ -Amyrin acetate
2	Phytosterol	$\beta$ -sitosterol, Stigmasterol, Cholesterol, $\alpha$ -Amyrin acetate
3	Triterpenoid	Lupeol, Valemol, Friedelane triterpenoids, pristimerin, Lupane Triterpenes, Oleanane, Triterpenes
4	Alkaloid	Evonine, Spermidine
5	Triterpene	Squalene, Betulin, Friedelin, Lupenyl acetate, $\alpha$ - Caryophyllene, Isovellerdial, Germacrene A
6	Triterpene glycoside	Methyl commate C, Methyl commate A
7	Alkane hydrocarbon	Tridecane, Dodecane
8	Alcohol	Glycerin
9	Aromatic compounds	Myoinositol
10	Fatty compounds	Myristic acid, Pentadecanoic acid, Palmitoleic acid, Eicosanoic acid, $\alpha$ Monostearin, n- Hexadecenoic acid, 9- Hexadecenoic acid, Octadecanoic acid, Linoleic acid

**Reference:** (Mukesh Kumar & Manoj, 2019)

### 4.13. CONCLUSION

Review of the literature on the *Maytenus* plant showed that it has a number of significant phytochemicals that are medicinally useful to treat a variety of ailments. The plant has also received extensive research for its wide range of antimicrobial, antioxidant, anticancer, hepatoprotective and antiulcerogenic pharmacological activities. The traditional ethnobotanical uses of these plants by tribal people have great significance to study and explore it scientifically for some novel bioactive phytochemical compounds. This review provides the phytochemical compounds



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isolated from various parts of *Gymnosporia* species and their uses, which may be helpful to develop novel drugs to cure some serious diseases. The scientific screening of these phytochemicals gives new insight to pharmacology. So, there is a need to screen indigenous Indian species of *Gymnosporia* for their phytochemicals. There is tremendous scope to investigate and characterise active phytoconstituents, their mode of action and the effective dose of plant extracts of Indian species of *Gymnosporia* for development of herbal formulation against several diseases.

Despite the fact that *Gymnosporia* species are a very important plant of great medicinal use the population of this plant is steadily declining, there are no scientific measures to save these plants. There is a need to spread the word about this plant. The information summarised in this review is intended to serve as reference to many researchers. Research on the diverse and different bioactivities of the phytochemicals from this priceless plant resource has continued because of the abundance of active substances found in *Maytenus*.

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