

GC-MS Analysis of Bioactive Compounds from Selected Wild Edible Plants of Raigad District

Mrs. Salama Zeiruddin Tamboli¹, Dr. Shivprasad D. Mahadkar²

¹ Vasantrao Naik College of Arts, Commerce and Barrister A. R. Antulay Science College, Mhasala, Maharashtra, India.

² Sonopant Dandekar Arts, V. S. Apte Commerce and M. H. Mehta Science College, Palghar – 401404, Maharashtra, India..

Cite this paper as: Mrs. Salama Zeiruddin Tamboli, Dr. Shivprasad D. Mahadkar (2025) GC-MS Analysis of Bioactive Compounds from Selected Wild Edible Plants of Raigad District. Journal of Neonatal Surgery, 14, (32s) 11209-11216

ABSTRACT

Wild edible plants are important components of traditional food systems and represent potential sources of nutrients, phytochemicals and biologically active compounds. Raigad District of Maharashtra, situated in the Konkan region, possesses considerable plant diversity and traditional knowledge associated with the use of wild plants as food. Previous ethnobotanical documentation from Raigad has reported 30 wild edible plant species with different edible parts, including leaves, fruits, tubers, bulbils and other plant tissues. The present study focuses on selected wild edible plants of Raigad District and evaluates their potential for bioactive compound profiling using gas chromatography–mass spectrometry (GC-MS). Eight plants were selected for the study: *Amaranthus spinosus* L., *Basella alba* L., *Dioscorea alata* L., *Asparagus racemosus* Willd., *Momordica dioica* Roxb., *Ficus racemosa* L., *Aegle marmelos* (L.) Corr. and *Garcinia indica* (Thouars) Choisy. The study integrates ethnobotanical documentation with published phytochemical and GC-MS evidence. Literature indicates the presence of diverse chemical groups in these plants, including fatty-acid derivatives, terpenoids, sterols, phenolic compounds and other secondary metabolites. GC-MS is particularly useful for the qualitative investigation of volatile and semi-volatile compounds and can provide chemical fingerprints of plant extracts. The findings indicate that the selected wild edible plants represent promising candidates for systematic phytochemical investigation and future nutraceutical and functional-food research. However, the present assessment should not be interpreted as a substitute for laboratory-generated GC-MS data. Experimental validation using authenticated plant material, standardized extraction procedures, chromatographic analysis, spectral library matching and biological assays is required to establish the actual chemical composition and biological significance of the selected plants.

Keywords: GC-MS; Wild Edible Plants; Bioactive Compounds; Phytochemical Profiling; Raigad District; Maharashtra; Ethnobotany; Plant Extracts; Functional Foods; Nutraceuticals...

INTRODUCTION

Wild edible plants constitute an important component of food biodiversity. In many rural and forest-dependent communities, naturally occurring plants are traditionally collected and consumed as vegetables, fruits, tubers, seeds, flowers and other food materials. These plants may supplement cultivated crops and contribute to seasonal food availability and dietary diversity.

In addition to their nutritional importance, wild edible plants have attracted increasing scientific attention because many species contain secondary metabolites with potential antioxidant, antimicrobial, anti-inflammatory and other biological properties. The traditional use of plants as food and medicine has therefore created considerable interest in their phytochemical investigation.

Maharashtra is a biologically diverse region with extensive traditional knowledge concerning the use of wild plants. A recent review documented 314 wild edible plant species belonging to 84 families in western peninsular and Deccan Plateau regions of India and highlighted their nutritional and functional-food potential. (ACS Publications)

Raigad District is particularly suitable for research on wild edible plants because of its diverse forest, agricultural, hill and coastal ecosystems. An ethnobotanical survey conducted in the district documented 30 wild edible plant species and recorded different edible plant parts and traditional uses.

Among the documented species are *Amaranthus spinosus*, *Basella alba*, *Dioscorea alata*, *Asparagus racemosus*, *Momordica dioica*, *Ficus racemosa*, *Aegle marmelos* and *Garcinia indica*. These plants represent different taxonomic groups and edible plant parts, making them useful candidates for comparative phytochemical investigation..

. :

Gas chromatography–mass spectrometry is one of the important analytical techniques used for the investigation of volatile and semi-volatile organic compounds. Gas chromatography separates compounds according to their interaction with the chromatographic column, while mass spectrometry provides mass spectral information that can assist in compound identification.

GC-MS has been applied to numerous medicinal, nutritional and wild edible plants for the identification of hydrocarbons, fatty-acid derivatives, esters, alcohols, aldehydes, ketones, terpenoids and other compounds. For example, GC-MS studies have demonstrated diverse phytochemical constituents in *Dioscorea alata*, *Asparagus racemosus*, *Aegle marmelos* and *Basella alba*. ([Wiley Online Library](#))

The objective of the present study is therefore to examine the phytochemical potential of selected wild edible plants of Raigad District and to establish a basic framework for their GC-MS-based chemical investigation.

Objectives

The major objectives of the study were:

To identify selected wild edible plants traditionally consumed in Raigad District.

To document their botanical families and edible plant parts.

To assess the reported phytochemical potential of the selected plants.

To develop a basic methodology for GC-MS-based phytochemical profiling.

To identify major chemical classes reported or expected in the selected plant materials.

To evaluate their potential importance for future functional-food and nutraceutical research.

2. Literature Review

2.1 Wild Edible Plants and Traditional Knowledge

Wild edible plants have historically contributed to food security and dietary diversity. Their use is particularly important in rural communities where local populations possess detailed knowledge regarding plant identification, harvesting seasons, edible parts and traditional processing methods.

The ethnobotanical survey of Raigad District documented 30 wild edible plant species. The edible parts included leaves, fruits, tubers, bulbils, seeds, flowers and other plant structures. Such documentation provides an important baseline for selecting species for further chemical and nutritional investigations.

2.2 *Amaranthus spinosus*

Amaranthus spinosus L. belongs to the family Amaranthaceae and is traditionally used as a leafy vegetable. Species belonging to the genus *Amaranthus* have attracted considerable interest because of their nutritional and phytochemical properties.

Recent research on wild edible plants has reported polyphenols, terpenoids, amino acids and fatty-acid derivatives in *A. spinosus* and other wild edible plants. ([ACS Publications](#))

A recent GC-MS investigation of *A. spinosus* leaf extract reported compounds belonging to esters, lactones, fatty-acid derivatives, terpenoids and aromatic compounds. ([AJAC Research](#))

2.3 *Basella alba*

Basella alba L., commonly known as Malabar spinach, belongs to the family Basellaceae. The leaves are commonly consumed as a vegetable.

GC-MS investigations of *B. alba* have demonstrated the presence of diverse phytochemical constituents. Recent research has reported compounds belonging to several chemical groups, including triterpenoids and other potentially bioactive constituents. ([Taylor & Francis Online](#))

The available literature supports further investigation of *B. alba* as a nutritional and phytochemical resource.

2.4 *Dioscorea alata*

Dioscorea alata L. belongs to the family Dioscoreaceae and is an important tuber-producing plant. Tubers and bulbils are used as food in different traditional food systems.

GC-MS analysis following chemical derivatization has been used to investigate phytochemical constituents of *D. alata*. The study demonstrated the usefulness of GC-MS for identifying compounds in plant tissues and relating chemical composition to nutritional and biological properties. ([Wiley Online Library](#))

The presence of carbohydrates, fibre and other nutritional components further supports the relevance of *Dioscorea* species in food research.

2.5 *Asparagus racemosus*

Asparagus racemosus Willd. belongs to the family Asparagaceae and is traditionally known as Shatavari. The roots are used in traditional systems of medicine and are also associated with nutritional and functional applications.

GC-MS studies of *A. racemosus* have identified several phytochemical constituents, including fatty-acid-related compounds and other secondary metabolites. One study reported approximately 13 major and 5 minor active constituents in root-tuber extracts. ([ScienceDirect](#))

More recent research has further demonstrated the nutritional and phytochemical complexity of *A. racemosus* roots, identifying phenolics, saponins, flavonoids and other compounds using mass-spectrometric approaches. ([ScienceDirect](#))

2.6 *Momordica dioica*

Momordica dioica Roxb. is a cucurbitaceous plant producing edible fruits. The plant is traditionally consumed in several parts of India.

Recent metabolomic research on wild edible plants including *M. dioica* identified diverse polyphenols, terpenoids, amino acids and fatty-acid derivatives. The same study also reported biological activities such as reducing and enzyme-inhibition potential in selected wild edible plants. ([ACS Publications](#))

These findings support further chemical investigation of *M. dioica* and related wild edible cucurbits.

2.7 *Ficus racemosa*

Ficus racemosa L. belongs to the family Moraceae and produces edible fruits. Different parts of *Ficus* species have been investigated for their nutritional and phytochemical properties.

The occurrence of phenolics, flavonoids, terpenoids and other secondary metabolites in *Ficus* species suggests that the fruit and other edible plant parts may be suitable for further phytochemical investigation.

2.8 *Aegle marmelos*

Aegle marmelos (L.) Corr. belongs to the family Rutaceae and is traditionally valued for its edible fruit and medicinal applications.

GC-MS has been used for the investigation of *A. marmelos* extracts. Published analytical work has described the use of methanolic extracts, chromatographic separation and mass spectral comparison with reference libraries for compound identification. ([PubMed Central \(PMC\)](#))

The reported chemical diversity of *A. marmelos* makes it an appropriate candidate for further comparative GC-MS investigation.

2.9 *Garcinia indica*

Garcinia indica (Thouars) Choisy, commonly known as kokum, is an important fruit-bearing plant of western India. Its fruits are traditionally consumed and used in food preparations.

Recent studies have investigated *G. indica* using advanced mass-spectrometric approaches, particularly for anthocyanins and other phytochemicals. This demonstrates the increasing scientific interest in kokum as a potential nutraceutical resource.

The chemical profile of *G. indica* is likely to include compounds that are not all amenable to conventional GC-MS; therefore, complementary techniques such as LC-MS can be important for comprehensive characterization.

3. Methodology

3.1 Study Area

The study was focused on Raigad District of Maharashtra, India. The district forms part of the Konkan region and contains a combination of forest, agricultural, hill and coastal ecosystems.

Previous ethnobotanical work in the district documented wild edible plants through field observations and interactions with local communities and knowledgeable persons.

3.2 Selection of Plant Species

Eight wild edible plant species were selected based on their documentation as edible plants in Raigad and their reported phytochemical importance.

No.	Plant species	Family	Edible part
1	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Leaves
2	<i>Basella alba</i> L.	Basellaceae	Leaves
3	<i>Dioscorea alata</i> L.	Dioscoreaceae	Tubers, bulbils
4	<i>Asparagus racemosus</i> Willd.	Asparagaceae	Root/tuber
5	<i>Momordica dioica</i> Roxb.	Cucurbitaceae	Fruit
6	<i>Ficus racemosa</i> L.	Moraceae	Fruit
7	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Fruit pulp
8	<i>Garcinia indica</i> (Thouars) Choisy	Clusiaceae	Fruit

The selection represents leafy vegetables, tubers and fruits, allowing comparison among different plant tissues.

3.3 Collection and Authentication

Fresh plant material should be collected from selected locations within Raigad District during the appropriate harvesting season.

For each sample, the following information should be recorded:

Botanical name

Local name

Family

Collection location

Date of collection

Plant part collected

Maturity stage

Traditional edible use

Preliminary processing method

Plant materials should be authenticated by a qualified taxonomist. Voucher specimens should preferably be deposited in a recognized herbarium.

3.4 Sample Preparation

The collected plant materials should be cleaned carefully using distilled water to remove soil and other external contaminants.

The samples should then be:

Shade dried.

Cut into small pieces where necessary.

Ground into fine powder.

Stored in airtight containers.

Protected from excessive moisture, heat and direct sunlight.

Different plant parts should be processed separately.

3.5 Extraction

For GC-MS analysis, an appropriate solvent extraction procedure should be selected according to the plant material and analytical objective.

A basic approach may involve extraction of powdered plant material using methanol, ethanol, ethyl acetate or another validated solvent. The mixture may be subjected to maceration or Soxhlet extraction, followed by filtration and concentration.

The final extract should be appropriately diluted or derivatized before GC-MS analysis depending on the chemical characteristics of the target compounds.

3.6 GC-MS Analysis

The prepared extracts should be subjected to GC-MS analysis using a suitable capillary column and validated instrumental conditions.

The analysis should include:

Injection of prepared extract.

Chromatographic separation.

Mass spectral detection.

Recording of retention times.

Generation of total ion chromatograms.

Mass spectral comparison with reference databases.

Tentative identification of chemical constituents.

Calculation of relative peak abundance where appropriate.

Published GC-MS work on plant extracts demonstrates the use of mass spectral libraries such as NIST and comparison of spectral patterns for compound identification. ([PubMed Central \(PMC\)](#))

3.7 Identification of Compounds

Tentative compound identification should be based on comparison of observed mass spectra with authenticated reference libraries.

The following information should preferably be recorded:

Peak number

Retention time

Tentative compound name

Molecular formula

Molecular weight

Similarity/library match

Chemical class

Relative peak area

Where possible, retention indices and authentic standards should be used to strengthen identification.

3.8 Analytical Limitation

GC-MS is primarily suitable for volatile and semi-volatile compounds. Several important phytochemicals, including large saponins, proteins, polysaccharides and some polar or thermally unstable compounds, may not be adequately detected by conventional GC-MS.

Therefore, GC-MS results should not be considered a complete representation of the phytochemical composition of the plants. Complementary methods such as HPLC, LC-MS/MS, NMR and FTIR may be required for comprehensive chemical characterization.

4. Results

4.1 Ethnobotanical Selection

The literature-based assessment confirmed that the selected plants are documented as wild edible resources in Raigad District. The original ethnobotanical survey documented 30 wild edible species, from which the present study selected eight representative species.

The selected plants included:

Two leafy vegetables: *Amaranthus spinosus* and *Basella alba*

Two tuber/root resources: *Dioscorea alata* and *Asparagus racemosus*

Four fruit resources: *Momordica dioica*, *Ficus racemosa*, *Aegle marmelos* and *Garcinia indica*

This diversity provides an appropriate basis for comparative phytochemical investigation.

4.2 Reported Phytochemical Potential

Available literature demonstrates that the selected plants possess considerable phytochemical diversity.

Amaranthus spinosus has been associated with polyphenols, fatty-acid derivatives and other secondary metabolites. Recent GC-MS work on its leaf extract identified compounds from several chemical classes, including esters, lactones, terpenoids and fatty-acid derivatives. ([AJAC Research](#))

Basella alba has also demonstrated considerable chemical diversity. GC-MS-based investigations have reported compounds including triterpenoid and other potentially bioactive constituents. ([Wiley Online Library](#))

Dioscorea alata has been examined by GC-MS following derivatization, with several phytochemical constituents identified from plant tissues. ([Wiley Online Library](#))

Asparagus racemosus has demonstrated the presence of multiple phytochemical constituents, with GC-MS studies reporting both major and minor compounds. ([ScienceDirect](#))

These observations indicate that the selected plants represent chemically diverse resources rather than a single homogeneous group.

4.3 Major Chemical Classes of Interest

Based on available literature, the principal chemical classes that may be investigated through GC-MS include:

Fatty-Acid Derivatives

Fatty acids and their derivatives are frequently reported in plant extracts. They may contribute to nutritional value and other biological properties.

Terpenoids

Terpenoids are an important class of plant secondary metabolites. Monoterpenes and sesquiterpenes are particularly amenable to GC-MS analysis because of their volatility.

Sterols

Phytosterols can occur in different plant tissues and are of interest in nutritional and functional-food research.

Phenolic-Related Compounds

Phenolic compounds are important plant metabolites associated with antioxidant properties. However, many phenolic compounds are polar and may require derivatization or complementary analytical methods for appropriate detection.

Other Secondary Metabolites

Depending on extraction and analytical conditions, GC-MS may also provide information concerning aldehydes, ketones, esters, hydrocarbons, alcohols and other organic compounds.

4.4 Comparative Assessment

The selected plants can be broadly categorized according to their edible parts and expected phytochemical characteristics.

Plant	Main edible part	Major research interest
<i>A. spinosus</i>	Leaves	Phenolics, fatty-acid derivatives, antioxidant-associated compounds
<i>B. alba</i>	Leaves	Nutritional compounds, triterpenoids and other phytochemicals
<i>D. alata</i>	Tubers/bulbils	Nutritional constituents and phytochemicals
<i>A. racemosus</i>	Root/tuber	Steroidal saponins, fatty-acid-related compounds and phenolics
<i>M. dioica</i>	Fruit	Polyphenols, terpenoids and nutritional compounds
<i>F. racemosa</i>	Fruit	Phenolics and secondary metabolites
<i>A. marmelos</i>	Fruit pulp	Volatile compounds, terpenoids and other phytochemicals

Plant	Main edible part	Major research interest
<i>G. indica</i>	Fruit	Anthocyanins and other fruit-associated phytochemicals

This table represents a **literature-based research framework**, not experimentally measured GC-MS results.

4.5 Research Gap

The available Raigad ethnobotanical literature establishes the diversity and traditional edible use of wild plants, but it does not provide a comprehensive experimental GC-MS dataset for all eight selected species.

Consequently, a laboratory-based study would provide valuable additional information through:

GC-MS chromatographic fingerprints.

Identification of individual compounds.

Relative abundance of detected constituents.

Comparison between plant species.

Classification of compounds according to chemical groups.

Correlation with antioxidant or antimicrobial assays.

Identification of major compounds for further quantitative analysis.

The major research gap is therefore the lack of a systematic, experimentally validated GC-MS profile for selected wild edible plants specifically collected from Raigad District.

5. Conclusion

The present study highlights the phytochemical potential of selected wild edible plants of Raigad District, Maharashtra. Eight species, namely *Amaranthus spinosus*, *Basella alba*, *Dioscorea alata*, *Asparagus racemosus*, *Momordica dioica*, *Ficus racemosa*, *Aegle marmelos* and *Garcinia indica*, were selected based on their documented edible use and scientific interest.

The available literature indicates that these plants contain diverse groups of phytochemicals, including fatty-acid derivatives, terpenoids, sterols, phenolic compounds and other secondary metabolites. Previous GC-MS investigations of several selected species demonstrate that GC-MS can be effectively used as an initial analytical technique for phytochemical screening.

The study also demonstrates the importance of connecting ethnobotanical knowledge with modern analytical chemistry. Wild edible plants can potentially contribute to functional-food development, nutraceutical research and sustainable utilization of local plant resources.

However, the present work does not claim experimentally measured GC-MS values. Actual retention times, chromatographic peaks, peak-area percentages and compound identifications should be generated through laboratory analysis. GC-MS should also be combined with complementary analytical techniques and biological assays where required.

Future research should therefore focus on authenticated sample collection from Raigad District, standardized extraction, GC-MS profiling, compound confirmation using standards or complementary analytical methods, quantitative analysis and biological evaluation. Such an integrated approach may provide stronger scientific evidence for the nutritional and functional potential of wild edible plants..

REFERENCES

- [1] Kharade SS, Mali S. Ethnobotanical survey of wild edible plants from Raigad District, Maharashtra. *International Journal for Research Trends and Innovation*. 2022;7(6):159–161.
- [2] Aswani MA, Khyade M, Kasote DM, et al. Wild edible plants from western peninsular and Deccan Plateau regions of India: valued nutritional and functional foods. *Discover Plants*. 2024;1:62. (ACS Publications)
- [3] Dey P, et al. Phytochemical characterization of *Dioscorea alata* leaf and stem by silylation followed by GC-MS analysis. *Journal of Food Biochemistry*. 2016. (Wiley Online Library)
- [4] Phytochemical, purification and spectral analysis of compounds from root tuber extract of *Asparagus racemosus* (Willd). *Journal of King Saud University – Science*. (ScienceDirect)
- [5] Chemoprofiling and in vitro evaluation of anticancer, antioxidant and antibacterial activities of *Asparagus racemosus* (Willd). *Pharmacological Research – Natural Products*. 2024;2:100015. (ScienceDirect)
- [6] Comprehensive assessment of the nutritional, phytochemical, and volatile components present in the roots of *Asparagus racemosus*, an underutilized plant for food applications. *Food Bioscience*. 2025;68:106677. (ScienceDirect)
- [7] Bioactive composition and antioxidant and glycemic-regulating properties of *Basella alba* L. leaf, fruit, and stem: GC-MS, FTIR, in vitro and in silico insights. *Food Science & Nutrition*. 2026. (Wiley Online Library)

- [8] Determination of biological activities of Malabar spinach (*Basella alba*) fruit extracts and molecular docking against COX-II enzyme. PMC. 2023. (PubMed Central (PMC))
- [9] Phytochemical evaluation, antimicrobial activity, and determination of bioactive components from leaves of *Aegle marmelos*. Journal of Traditional and Complementary Medicine. (PubMed Central (PMC))
- [10] Bioactive compounds from wild edible plants of Western Himalayas: nutritional profile, UHPLC-QTOF-IMS-based phytochemical characterization, and their in vitro gastrointestinal digestibility. ACS Food Science & Technology. 2024. (ACS Publications)
- [11] GC-MS analysis of bioactive components of aqueous leaf extract of *Amaranthus spinosus*. Asian Journal of Applied Chemistry Research. 2026;17(2):1–9. (AJAC Research)
- [12] Relevant literature on phytochemical characterization and nutritional properties of *Garcinia indica* and other wild edible plants may be incorporated following experimental GC-MS/LC-MS confirmation.

.

..

.

.

