



International Journal of Advanced Chemistry Research

ISSN Print: 2664-6781
 ISSN Online: 2664-679X
 NAAS Rating (2026): 4.77
 IJACR 2026; 8(6): 22-26
www.chemistryjournals.net
 Received: 06-03-2026
 Accepted: 09-04-2026

Satish Singh Chandra
 Gaya College, Gaya, Bihar,
 India

Phytochemical Profile and Therapeutic Relevance of Medicinal Plants of the Magadh Region, Bihar: A Natural Product Chemistry Perspective

Satish Singh Chandra

DOI: <https://www.doi.org/10.33545/26646781.2026.v8.i6a.684>

Abstract

The Magadh region of Bihar harbours a rich diversity of medicinal plants that serve as an important source of structurally diverse natural products. Current study focuses on the phytochemical and chemical profile of selected medicinal species, emphasizing their major secondary metabolites and corresponding chemical classes. The documented plants contain a wide range of bioactive compounds including alkaloids, phenolics, flavonoids, terpenoids, glycosides, saponins, lignans and anthraquinones. Structurally significant molecules such as indole alkaloids, quinazoline alkaloids, curcuminoids, withanolides, triterpenoids and hydrolysable tannins highlight the chemical complexity present within these species. These compounds are known for their varied physicochemical properties, functional groups and biosynthetic origins, which contribute to their biological relevance. This article connects traditional medicinal usage with underlying chemical constituents, providing a framework for understanding plant-based natural products from a chemical perspective. Further, the application of modern analytical techniques such as HPLC, GC-MS, LC-MS and NMR spectroscopy is also proposed for accurate identification, structural elucidation and profiling of these metabolites. Medicinal flora of Magadh represents a significant natural reservoir for phytochemical investigation and future natural product-based drug discovery.

Keywords: Magadh region, medicinal plants, phytochemistry, secondary metabolites, natural product chemistry

Introduction

The relationship between chemistry and medicine has developed through the continuous exploration of natural substances and their effects on living systems. Many therapeutic compounds used in healthcare have originated from natural sources, particularly plants, where chemical constituents are produced as part of their survival and defence mechanisms. Medicinal plants are therefore important reservoirs of natural products containing a wide range of secondary metabolites, including alkaloids, terpenoids, phenolic compounds, flavonoids, tannins, glycosides and saponins. These molecules differ in their structures and chemical properties, which influence their biological activities and medicinal importance (Elshafie *et al.*, 2023) ^[10]. Natural products from medicinal plants are biosynthetically derived secondary metabolites whose structural diversity governs their pharmacological potential. The therapeutic potential of medicinal plants is largely associated with the nature and arrangement of their chemical constituents. The presence of specific functional groups, molecular structures and reactive sites determines how these compounds interact with biological molecules. Phenolic compounds and flavonoids are among the most studied groups because their hydroxyl groups and aromatic structures contribute to antioxidant behaviour and their ability to influence various biochemical processes (Sun & Shahrajabian, 2023) ^[23]. Alkaloids, another major group of plant metabolites, contain nitrogen-based structures that often show strong biological activity through interactions with enzymes, receptors and cellular pathways. Their structural diversity has made them important molecules in natural product research and pharmaceutical development (Faisal *et al.*, 2023) ^[11].

Corresponding Author:
 Satish Singh Chandra
 Gaya College, Gaya, Bihar,
 India

Terpenoids represent another chemically diverse group of plant compounds derived from isoprenoid pathways. Their structures vary from simple volatile molecules to complex triterpenes, creating a wide range of biological properties. Many terpenoid compounds have been investigated for antimicrobial, antioxidant and anti-inflammatory activities, demonstrating the close connection between plant chemistry and medicinal applications (Masyita *et al.*, 2022)^[16].

Traditional healthcare practices developed from the long-term association between humans and their surrounding environment. The preparation of herbal remedies involved several processes, including drying, grinding, extraction, boiling and fermentation. Such practices influenced the chemical composition of plant materials by affecting the release and concentration of active compounds. Modern phytochemical studies have helped explain these traditional approaches by identifying the molecules responsible for their biological effects.

The advancement of analytical techniques has greatly improved the study of medicinal plant chemistry. Methods such as chromatography, mass spectrometry and nuclear magnetic resonance spectroscopy allow researchers to separate, identify and characterise complex natural compounds with greater accuracy. These approaches have strengthened the scientific evaluation of medicinal plants and provided a link between traditional medicine and modern pharmaceutical research (Wolfender *et al.*, 2019)^[26]. The Magadh region of Bihar provides an important setting for studying the connection between biodiversity and medicinal chemistry. The forests, hills and natural vegetation of the region support a variety of medicinal plants that produce chemically diverse compounds. These plants represent natural sources of organic molecules belonging to different chemical groups, including phenolics, alkaloids, terpenoids and glycosides. Investigation of medicinal plants from Magadh is important not only for understanding traditional uses but also for exploring their chemical potential. Identification and characterisation of plant constituents help establish relationships between molecular structure and biological activity. Such studies contribute towards the documentation of traditional knowledge and may provide valuable leads for natural product-based drug research. The medicinal plant diversity of Magadh can therefore be viewed as an important chemical resource. Understanding the phytochemical composition of these plants provides insight into the

relationship between natural compounds, biological activity and therapeutic applications. The present review article discusses medicinal plants of the Magadh region with emphasis on their chemical constituents and their significance in the field of medicinal chemistry. Further, the application of modern analytical techniques such as HPLC, GC-MS, LC-MS and NMR spectroscopy is also proposed for accurate identification, structural elucidation and profiling of these metabolites.

Methodology

This review was prepared by collecting and examining published scientific information related to medicinal plants, their chemical constituents and traditional uses in the Magadh region of Bihar. Relevant research articles, review papers and scientific reports dealing with ethnobotany, phytochemistry and natural product chemistry were consulted to understand the relationship between medicinal plants and their bioactive compounds.

The available information was compiled with special emphasis on plant species that have been traditionally used for healthcare purposes. For each species, data related to botanical identity, medicinal applications and important chemical constituents were collected from published literature. The major groups of phytochemicals, including alkaloids, flavonoids, phenolic compounds, terpenoids, tannins, glycosides and saponins, were considered because of their importance in explaining the medicinal properties of plants. The selected plant species were further reviewed from a chemical perspective by examining the reported bioactive molecules and their structural characteristics. Published studies involving phytochemical screening and analytical techniques such as chromatography, mass spectrometry and spectroscopy were considered to understand the identification and characterisation of natural compounds.

Results

The present review compiled information on medicinal plants (n=40) reported from the Magadh region and nearby areas, with particular emphasis on their chemical constituents and traditional medicinal importance. The collected information revealed that medicinal plants of the region represent a wide range of species belonging to different families, including trees, shrubs and herbs (Table 1).

Table 1: Chemical profile of selected 40 medicinal plant species of Magadh region highlighting important natural products, their structural classes and therapeutic significance

S. No.	Species	Family	Important chemical constituents	Major chemical class	Reported traditional therapeutic significance
1	<i>Achyranthes aspera</i>	Amaranthaceae	Oleanolic acid, ecdysterone	Triterpenoids	Inflammation and traditional remedies
2	<i>Andrographis paniculata</i>	Acanthaceae	Andrographolide	Diterpenoids	Fever and inflammatory conditions
3	<i>Adhatoda vasica</i>	Acanthaceae	Vasicine, vasicinone	Quinazoline alkaloids	Cough and respiratory disorders
4	<i>Justicia adhatoda</i>	Acanthaceae	Vasicine	Alkaloids	Traditional respiratory medicine
5	<i>Catharanthus roseus</i>	Apocynaceae	Vincristine, vinblastine	Indole alkaloids	Source of important medicinal alkaloids
6	<i>Gymnema sylvestre</i>	Apocynaceae	Gymnemic acids	Triterpenoid saponins	Traditional metabolic health use
7	<i>Rauvolfia serpentina</i>	Apocynaceae	Reserpine, ajmaline	Indole alkaloids	Blood pressure regulation
8	<i>Calotropis gigantea</i>	Apocynaceae	Cardiac glycosides	Cardenolides	Traditional external remedies
9	<i>Asparagus racemosus</i>	Asparagaceae	Shatavarins	Steroidal saponins	Traditional reproductive health use
10	<i>Centella asiatica</i>	Apiaceae	Asiaticoside, madecassoside	Triterpenoid saponins	Wound healing and cognitive applications
11	<i>Bacopa monnieri</i>	Plantaginaceae	Bacosides	Saponins	Memory and cognitive support

12	<i>Terminalia arjuna</i>	Combretaceae	Arjunolic acid, arjunic acid	Triterpenoids	Traditional cardiovascular use
13	<i>Terminalia bellirica</i>	Combretaceae	Gallic acid, ellagic acid	Phenolics	Respiratory and digestive applications
14	<i>Terminalia chebula</i>	Combretaceae	Chebulagic acid, chebulinic acid	Hydrolysable tannins	Digestive disorders and rejuvenation
15	<i>Butea monosperma</i>	Fabaceae	Butein, flavonoids	Flavonoids	Inflammatory and traditional medicinal use
16	<i>Cassia fistula</i>	Fabaceae	Rhein, anthraquinones	Anthraquinones	Digestive traditional use
17	<i>Eclipta prostrata</i>	Asteraceae	Wedelolactone	Coumestans	Traditional hair and liver-related use
18	<i>Cissus quadrangularis</i>	Vitaceae	Ketosteroids, flavonoids	Steroids	Bone and healing applications
19	<i>Tinospora cordifolia</i>	Menispermaceae	Berberine, tinosporaside	Alkaloids, diterpenoids	Fever and immunity-related use
20	<i>Azadirachta indica</i>	Meliaceae	Azadirachtin, nimbin, salannin	Limonoids (terpenoids)	Antimicrobial, skin disorders
21	<i>Murraya koenigii</i>	Rutaceae	Carbazole alkaloids	Alkaloids	Digestive and metabolic applications
22	<i>Aegle marmelos</i>	Rutaceae	Marmelosin, aegeline	Coumarins, alkaloids	Digestive disorders
23	<i>Datura stramonium</i>	Solanaceae	Atropine, scopolamine	Tropane alkaloids	Traditional analgesic applications
24	<i>Withania somnifera</i>	Solanaceae	Withanolides	Steroidal lactones	Stress, strength and inflammation
25	<i>Emblica officinalis</i>	Phyllanthaceae	Emblicanins, gallic acid, tannins	Polyphenols	Antioxidant and digestive use
26	<i>Phyllanthus niruri</i>	Phyllanthaceae	Phyllanthin, hypophyllanthin	Lignans	Liver and digestive traditional use
27	<i>Piper longum</i>	Piperaceae	Piperine	Alkaloids	Digestive and respiratory use
28	<i>Piper nigrum</i>	Piperaceae	Piperine	Alkaloids	Digestive stimulant
29	<i>Ocimum sanctum</i>	Lamiaceae	Eugenol, ursolic acid, rosmarinic acid	Phenolics, terpenoids	Respiratory disorders and antioxidant use
30	<i>Clerodendrum infortunatum</i>	Lamiaceae	Clerodin, flavonoids	Terpenoids	Traditional inflammatory disorders
31	<i>Vitex negundo</i>	Lamiaceae	Casticin, iridoids	Flavonoids	Pain and inflammatory conditions
32	<i>Syzygium cumini</i>	Myrtaceae	Jamboline, anthocyanins	Polyphenols	Traditional metabolic health use
33	<i>Boerhavia diffusa</i>	Nyctaginaceae	Punarnavine, rotenoids	Alkaloids	Inflammation and traditional kidney-related use
34	<i>Nyctanthes arbor-tristis</i>	Oleaceae	Iridoid glycosides	Glycosides	Fever and inflammatory use
35	<i>Moringa oleifera</i>	Moringaceae	Isothiocyanates, quercetin	Phenolics	Nutritional and anti-inflammatory use
36	<i>Aloe vera</i>	Asphodelaceae	Aloin, anthraquinones	Anthraquinones	Skin and wound applications
37	<i>Curcuma longa</i>	Zingiberaceae	Curcumin, demethoxycurcumin	Curcuminoids	Inflammation and wound healing
38	<i>Zingiber officinale</i>	Zingiberaceae	Gingerol, shogaol	Phenolic ketones	Digestive and anti-inflammatory use
39	<i>Tribulus terrestris</i>	Zygophyllaceae	Protodioscin	Steroidal saponins	Traditional vitality-related use
40	<i>Acalypha indica</i>	Euphorbiaceae	Acalyphine, flavonoids	Alkaloids	Respiratory and skin-related use

This diversity reflects the richness of plant resources and the variation in chemical compounds produced by different species. The compiled table (Table 1) included 40 medicinal plants representing diverse chemical groups, with individual species showing characteristic phytochemical profiles. Alkaloids were represented by plants such as *Rauvolfia serpentina* (reserpine), *Catharanthus roseus* (vincristine and vinblastine), *Adhatoda vasica* (vasicine), *Tinospora cordifolia* (berberine-related alkaloids), *Piper longum* (piperine), and *Datura stramonium* (tropine alkaloids). Phenolic and flavonoid-rich species included *Emblica officinalis* (tannins and emblicanins), *Terminalia chebula* (chebulagic acid), *Terminalia bellirica* (gallic and ellagic acids), *Syzygium cumini* (anthocyanins), and *Curcuma longa* (curcumin). Terpenoid and steroidal compounds were recorded from *Azadirachta indica* (azadirachtin and limonoids), *Withania somnifera* (withanolides), *Terminalia arjuna* (arjunolic acid), and *Centella asiatica* (asiaticosides). Saponin- and glycoside-containing plants included *Bacopa monnieri* (bacosides), *Asparagus racemosus* (shatavarins), and *Calotropis gigantea* (cardiac glycosides) etc.

Further, the analysis of the compiled information showed that medicinal plants contain a broad spectrum of secondary metabolites. The major chemical groups recorded from the reviewed plants included alkaloids, phenolic compounds, flavonoids, terpenoids, tannins, glycosides and saponins. The occurrence of these different classes of compounds

indicates the chemical diversity present among medicinal plants used in traditional healthcare practices (Table 1).

Alkaloids were among the important groups of bioactive compounds identified in several medicinal plants (Table 1). Species such as *Rauvolfia serpentina*, *Catharanthus roseus*, *Adhatoda vasica*, *Tinospora cordifolia*, *Piper longum* and *Datura stramonium* were reported to contain biologically active alkaloids. Compounds such as reserpine, vasicine, berberine-related alkaloids and piperine demonstrate the importance of nitrogen-containing natural products in medicinal chemistry. A large number of plants in the compiled list were associated with phenolic compounds and flavonoids (Table 1). Plants including *Emblica officinalis*, *Terminalia chebula*, *Terminalia bellirica*, *Syzygium cumini*, *Curcuma longa* and *Moringa oleifera* contain important phenolic constituents. Molecules such as gallic acid, ellagic acid, tannins and curcumin are chemically important because their aromatic structures and hydroxyl groups contribute to antioxidant activity and biological interactions. Terpenoid compounds were also widely represented among the reviewed medicinal plants (Table 1). Species such as *Azadirachta indica*, *Withania somnifera*, *Terminalia arjuna* and *Centella asiatica* contain structurally diverse terpenoid molecules, including limonoids, withanolides and triterpenoid derivatives. The variation in their chemical structures contributes to the different medicinal properties associated with these plants. The review further showed the

presence of glycosides and saponins in several important medicinal species (Table 1). Plants such as *Bacopa monnieri*, *Centella asiatica*, *Asparagus racemosus* and *Calotropis gigantea* contain compounds where sugar components are linked with biologically active molecules. Such structural features influence their solubility and interaction with biological systems. When traditional uses were compared with the reported chemical constituents, a clear association was observed between medicinal applications and phytochemical composition. Plants traditionally used for antioxidant and inflammatory conditions were frequently rich in phenolics and flavonoids, while those used in neurological, cardiovascular and respiratory disorders commonly contained alkaloids, terpenoids or glycosidic compounds. The medicinal plants documented from the Magadh region demonstrate diverse traditional therapeutic applications across multiple health conditions (Table 1). These include the management of digestive, respiratory, inflammatory, metabolic, neurological and skin-related disorders. Such therapeutic relevance is strongly associated with the presence of distinct phytochemical groups, particularly alkaloids, phenolics, flavonoids, terpenoids, glycosides and saponins. The variation in chemical composition among species explains their wide-ranging biological effects. Overall, the results highlight a clear link between phytochemical diversity and traditional medicinal practices in the region. It indicates that medicinal plants of Magadh seems to represent an important source of chemical diversity. Their varied phytochemical composition provides a scientific basis for traditional medicinal knowledge and highlights their potential value for further studies in phytochemistry and natural product-based medicine.

Discussion

The medicinal plants associated with the Magadh region represent an important source of chemically diverse natural compounds. The presence of different classes of secondary metabolites, including alkaloids, phenolic compounds, flavonoids, terpenoids, glycosides and saponins (Fahey 2007; Faisal *et al.*, 2017; Intharuksa *et al.*, 2024; Baliga *et al.*, 2011; Masyita *et al.*, 2022; Parekh *et al.*, 2024) ^[11, 12, 14, 15, 16, 19], provides a chemical basis for understanding the medicinal importance of these plants. These compounds are primarily involved in plant defence and adaptation, but their structural diversity has also made them valuable in phytochemical and pharmaceutical research (Atanasov *et al.*, 2021; Elshafie *et al.*, 2023) ^[2, 10]. The traditional use of medicinal plants in the Magadh region is connected with the broader heritage of Indian traditional medicine. Classical Ayurvedic literature such as *Charaka Samhita* and *Sushruta Samhita* documented the therapeutic use of numerous plant resources, while later works on Indian medicinal plants provided extensive records of their traditional applications (Agnivesha, 2003; Kirtikar & Basu, 1935; Nadkarni, 1976; Sharma, 2003; Sushruta, 1963) ^[1, 15, 18, 22, 24]. Modern phytochemical investigations have helped to explain these traditional observations by identifying specific molecules associated with biological activity. Alkaloids constitute one of the most significant chemical groups found among medicinal plants. Their nitrogen-containing structures allow interaction with biological molecules and make them important compounds in natural product chemistry. Plants such as *Rauvolfia serpentina*, *Adhatoda vasica*, *Tinospora cordifolia*, *Piper longum* and *Datura stramonium* (Elshafie

et al., 2023; Saha & Ghosh, 2010) ^[10, 21] contain alkaloids that have received considerable scientific attention. Compounds such as reserpine, vasicine and piperine demonstrate the importance of alkaloid chemistry in the development of pharmacologically active natural products (Faisal *et al.*, 2023) ^[12]. Phenolic compounds and flavonoids represent another major group observed in the reviewed medicinal plants. Species such as *Embolia officinalis*, *Terminalia chebula*, *Terminalia bellirica*, *Syzygium cumini*, *Curcuma longa* and *Ocimum sanctum* (Ayyanar *et al.*, 2009; Bag *et al.*, 2009; Ciucă *et al.*, 2023; Dwivedi, 2007; Pattanayak, 2010) ^[3, 4, 8, 9, 20] contain chemically important polyphenolic molecules. The presence of aromatic rings and hydroxyl groups influences their antioxidant properties and their interactions with biological systems. Curcumin from *Curcuma longa* and phenolic compounds from *Terminalia* (Bag *et al.*, 2013; Hewlings & Kalman, 2017) ^[4, 13] species are examples of plant-derived molecules that continue to be investigated for their medicinal potential (Ciucă & Racovita, 2023; Sun & Shahrajabian, 2023) ^[8, 23]. Terpenoids and related compounds contribute significantly to the chemical diversity of medicinal plants found in the region. Withanolides from *Withania somnifera* (Bashir *et al.*, 2023; Mirjalili *et al.*, 2009) ^[6, 17], limonoids from *Azadirachta indica* (Mirjalili *et al.*, 2009) ^[17] and triterpenoid compounds from *Centella asiatica* represent structurally diverse molecules belonging to this group. The variation in their chemical structures contributes to the wide range of biological activities reported for terpenoid-rich medicinal plants (Bashir *et al.*, 2023; Masyita *et al.*, 2022) ^[8, 23]. Glycosides and saponins further add to the chemical complexity of medicinal plants. Compounds such as bacosides from *Bacopa monnieri*, asiaticosides from *Centella asiatica* and cardiac glycosides from *Calotropis gigantea* contain sugar-linked structures that influence their chemical behaviour and biological interactions. These compounds demonstrate how differences in molecular structure contribute to the diversity of medicinal properties observed in plants (Atanasov, 2021; Elshafie *et al.*, 2023) ^[2, 10]. The medicinal plants of Magadh are valuable natural source of chemically diverse molecules for natural drugs. The connection between traditional medicinal knowledge and phytochemical composition suggests that many traditionally used plants possess chemical constituents worthy of further scientific investigation. This requires the application of modern analytical techniques to achieve reliable and detailed chemical understanding beyond traditional phytochemical screening. While preliminary tests are useful for confirming the presence of major classes of secondary metabolites such as alkaloids, flavonoids, terpenoids, and phenolics, they do not provide structural or molecular-level resolution of individual compounds. Therefore, advanced techniques such as High-Performance Liquid Chromatography (HPLC), Gas Chromatography–Mass Spectrometry (GC–MS), and Liquid Chromatography–Mass Spectrometry (LC–MS) are essential for accurate separation, identification, and quantification of bioactive constituents present in complex plant matrices (Wolfender *et al.*, 2019). Further, Nuclear Magnetic Resonance (NMR) Spectroscopy plays a key role in the precise structural elucidation of isolated compounds, while Fourier-Transform Infrared Spectroscopy (FTIR) spectroscopy supports rapid identification of functional groups. The integration of metabolomics and chemometric tools also helps in understanding phytochemical variation

among species and environmental conditions (Wolfender *et al.*, 2019). These modern approaches are important for scientifically validating traditional medicinal knowledge and for identifying potential lead molecules for future drug development. In the context of Magadh's rich medicinal plant diversity, such techniques provide a strong bridge between ethnobotanical knowledge and contemporary natural product chemistry.

Conclusion

The medicinal plant diversity of the Magadh region reflects the close relationship between biodiversity, traditional knowledge and natural product chemistry. The variety of plants used in traditional healthcare represents a valuable source of chemically diverse compounds, including alkaloids, phenolics, flavonoids, terpenoids, glycosides and saponins. These naturally occurring molecules provide a chemical basis for understanding the medicinal importance associated with many plant species used over generations. Future studies combining traditional knowledge with advanced phytochemical approaches can provide deeper insight into the chemical diversity of these plants. Techniques such as High-Performance Liquid Chromatography (HPLC), Gas Chromatography–Mass Spectrometry (GC–MS), Liquid Chromatography–Mass Spectrometry (LC–MS), Nuclear Magnetic Resonance (NMR) Spectroscopy and Fourier-Transform Infrared Spectroscopy (FTIR) can help in the identification, separation and structural characterisation of bioactive compounds. Such investigations may support the discovery of valuable natural products while contributing to the sustainable utilisation and conservation of medicinal plant resources in the Magadh region.

Acknowledgements

The author gratefully acknowledges the contributions of earlier researchers and traditional knowledge systems that supported this study. The available literature on medicinal plants and phytochemistry provided valuable guidance in understanding the chemical and medicinal importance of these resources.

Conflict of Interest

Author has no conflict of interest

References

1. Agnivesha. *Charaka Samhita: Text with English translation*. Sharma RK, Dash B, translators. Varanasi (India): Chowkhamba Sanskrit Series Office; 2003.
2. Atanasov AG, Zotchev SB, Dirsch VM, Supuran CT. Natural products in drug discovery: advances and opportunities. *Nat Rev Drug Discov*. 2021;20:200-216. doi:10.1038/s41573-020-00114-z.
3. Ayyanar M, Subash-Babu P. *Syzygium cumini*: a review of phytochemical constituents and medicinal uses. *Asian Pac J Trop Biomed*. 2012;2:240-246.
4. Bag A, Bhattacharyya SK, Chattopadhyay RR. *Terminalia chebula* in clinical research. *Asian Pac J Trop Biomed*. 2013;3:244-252.
5. Baliga MS, Bhat HP, Joseph N, Fazal F. *Aegle marmelos*: a potential medicinal tree. *Food Chem Toxicol*. 2011;49:1496-1501.
6. Bashir A, Nabi M, Tabassum N, Afzal S, Ayoub M. *Withania somnifera* phytochemistry and pharmacology. *Front Pharmacol*. 2023;14:1049334. doi:10.3389/fphar.2023.1049334.
7. Biswas K, Chattopadhyay I, Banerjee RK, Bandyopadhyay U. Biological activities of *Azadirachta indica*. *Curr Sci*. 2002;82:1336-1345.
8. Ciucă MD, Racoviță RC. Curcumin: extraction and biomedical applications. *Int J Mol Sci*. 2023;24:8874. doi:10.3390/ijms24108874.
9. Dwivedi S. *Terminalia arjuna* in cardiovascular disorders. *J Ethnopharmacol*. 2007;114:114-129.
10. Elshafie HS, Camele I, Mohamed AA. Secondary metabolites from plants. *Int J Mol Sci*. 2023;24:3266. doi:10.3390/ijms24043266.
11. Fahey JW. *Moringa oleifera*: medicinal evidence. *Trees Life J*. 2005;1:5.
12. Faisal S, Badshah SL, Kubra B, Emwas AH, Jaremko M, Jaremko Ł. Alkaloids as antivirals. *Nat Prod Bioprospect*. 2023;13:4. doi:10.1007/s13659-022-00366-9.
13. Hewlings SJ, Kalman DS. Curcumin: a review of its effects on human health. *Foods*. 2017;6:92. doi:10.3390/foods6100092.
14. Intharuxsa A, Kuljarusnont S, Sasaki Y, Tungmunthum D. Flavonoids and polyphenols in medicinal plants. *Molecules*. 2024;29:5760.
15. Kirtikar KR, Basu BD. *Indian medicinal plants*. Allahabad (India): Lalit Mohan Basu; 1935.
16. Masyita A, Sari RM, Astuti AD, Yasmin NN, Rahmawati D. Terpenes and terpenoids in medicine. *Food Chem X*. 2022;13:100217. doi:10.1016/j.fochx.2022.100217.
17. Mirjalili MH, Moyano E, Bonfill M, Cusidó RM, Palazón J. Steroidal lactones from *Withania somnifera*, an ancient plant for novel medicine. *Phytochemistry*. 2009;70:1245-1254. doi:10.1016/j.phytochem.2009.04.004.
18. Nadkarni KM. *Indian Materia Medica*. 3rd ed. Bombay (India): Popular Prakashan; 1976.
19. Parekh SS, Parmar GR, Kanojiya D, Baile SB, Trivedi R, Bhatt F. Therapeutic potential of terpenoids. *Pharmacogn Res*. 2024;16:698-705.
20. Pattanayak P, Behera P, Das D, Panda SK. *Ocimum sanctum* Linn: a reservoir plant for therapeutic applications. *Pharmacogn Rev*. 2010;4:95-105.
21. Saha S, Ghosh S. *Tinospora cordifolia*: one plant, many roles. *Int J Pharm Sci Res*. 2012;3:867-876.
22. Sharma PV. *Dravyaguna Vijnana*. Varanasi (India): Chaukhamba Bharati Academy; 2003.
23. Sun W, Shahrajabian MH. Phenolic compounds in medicinal plants and their biological activities. *Molecules*. 2023;28:1845. doi:10.3390/molecules28041845.
24. Sushruta. *Sushruta Samhita*. Bhishagratna KL, translator. Varanasi (India): Chowkhamba Sanskrit Series Office; 1963.
25. Variya BC, Bakrania AK, Patel SS. *Embllica officinalis* (Amla): a review for its phytochemistry, ethnomedicinal uses and medicinal potentials. *J Tradit Complement Med*. 2016;6:6-13.
26. Wolfender JL, Litaudon M, Touboul D, Queiroz EF. Innovative omics-based approaches for prioritisation and targeted isolation of natural products—new strategies for drug discovery. *Nat Prod Rep*. 2019;36:855-868. doi:10.1039/C9NP00004F.