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PHYTOCHEMICAL STUDY OF MEDICINAL PLANTS

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Abstract:

Medicinal plants are known to contain a variety of bioactive compounds that are significant in treating human illnesses and promoting agricultural health. Their inherent antimicrobial characteristics assist in reducing plant pathogens, enabling farmers to decrease the reliance on chemical pesticides. Numerous medicinal species feature antifungal and antibacterial elements that safeguard crops and help boost yields.

Phytochemicals derived from plants are generally divided into primary metabolites—such as proteins, sugars, chlorophyll, and amino acids—and secondary metabolites, which include flavonoids, terpenoids, and alkaloids. The secondary compounds are primarily responsible for the therapeutic properties associated with medicinal plants, which encompass antimicrobial and anti-inflammatory actions.

In this study, fourteen medicinal plant species that are frequently found in the Osmanabad and Beed districts of Maharashtra were chosen. After collection, the plant materials underwent washing, air drying, powdering, and extraction using water for qualitative phytochemical analysis. The objective of the research was to identify the presence of significant phytochemical groups in the selected plants.

The assessment identified terpenoids, reducing sugars, flavonoids, and alkaloids in multiple species. Gaining insights into the phytochemical composition of these plants is important for both agricultural and pharmaceutical uses. The bioactive compounds identified may aid in the creation of natural antimicrobial solutions for crop protection and may play a role in future drug development.

Keywords: *Antibacterial, Antifungal, Anti-inflammatory activity, Medicinal plants, Phytochemicaz*

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INTRODUCTION [1-14]

Medicinal plants are rich sources of biologically active compounds that have long been used to manage various human and plant diseases. In agricultural systems, these plants act as natural disease-control agents, offering farmers eco-friendly alternatives to synthetic pesticides. Their antimicrobial properties especially antifungal and antibacterial activities—make them effective in suppressing plant pathogens and improving crop productivity.

Phytochemicals are naturally occurring chemicals found in plant tissues such as leaves, roots, bark, fruits, and seeds. They play protective roles against environmental stress and biological threats. These compounds are broadly classified into primary metabolites, which include essential molecules like chlorophyll, proteins, sugars, and amino acids, and secondary metabolites such as alkaloids, terpenoids, phenolics, and flavonoids. Secondary metabolites are chemically diverse and widely utilized in medicine, veterinary science, agriculture, and pharmaceutical research due to their broad therapeutic potential.

For centuries, plant products have been central to traditional medicine systems around the world. The presence of characteristic phytochemicals enables plants to exhibit antimicrobial, antioxidant, anti-inflammatory, anti-diabetic, anticancer, and other biological effects. The chemical composition of plants is therefore of great interest, as it assists in the discovery of new drugs and provides insight into the pharmacological potential of traditional remedies.

Although synthetic medicines overshadowed herbal preparations during the early twentieth century, the limitations and side effects of many synthetic drugs have renewed global interest in natural plant-based treatments. Numerous studies now highlight the effectiveness of phytochemicals in long-term management of chronic diseases, often with fewer adverse effects compared to synthetic pharmaceuticals.

Phytochemicals are not essential nutrients; however, they contribute significantly to disease prevention and health improvement. With more than 4,000 phytochemicals identified and around 150 studied in depth, plants remain a rich source of bioactive molecules. They occur widely in fruits, vegetables, legumes, grains, nuts, herbs, and spices, and their concentrations vary depending on plant species, growing conditions, and processing methods. Collectively, these compounds offer antioxidant protection, immune support, detoxification, and other biological functions that benefit human health. When consumed in meaningful amounts, phytochemicals play important roles in supporting health. More than 4,000 phytochemicals have been identified so far, and around 150 of them have been thoroughly investigated for their biological functions. These compounds occur widely in everyday foods such as fruits, vegetables, legumes, whole grains, nuts, seeds, mushrooms, herbs, and spices. Common dietary sources include broccoli, cabbage, carrots, onions, garlic, tomatoes, grapes, cherries, berries, beans, and soy-based foods. Within plants, phytochemicals may be concentrated in specific tissues such as roots, stems, leaves, flowers, fruits, or seeds.

In many plants, especially those rich in pigments, these compounds are found in higher amounts in the outer layers of tissues. Their levels vary depending on genetic factors, environmental conditions, cultivation methods, processing, and cooking. Although phytochemicals are also marketed as supplements, research shows that they do not consistently provide the same benefits as those obtained from natural dietary sources.

Phytochemicals are classified as secondary metabolites and demonstrate a wide range of biological activities, including antioxidant, antimicrobial, immune-enhancing, anti-inflammatory, and anticancer effects. Thousands of these compounds have been discovered, and many more remain uncharacterized. While plants synthesize them primarily for protection against environmental stress and pathogens, growing evidence indicates that these same compounds can also contribute to disease prevention and health promotion in humans.

Although phytochemicals are not essential nutrients and the body does not require them for basic survival, they play valuable roles in reducing the risk of several common diseases. Because of their therapeutic potential, numerous studies have focused on understanding their beneficial properties. This review aims to summarize the diversity and significance of phytochemicals found in medicinal plants and highlight their importance in modern research.

This review aims to highlight the diversity, significance, and biological potential of phytochemicals found in medicinal plants, emphasizing their importance in modern research and therapeutic applications.

THE JOURNEY OF MEDICINAL PLANT RESEARCH[15-24]

For centuries, herbal preparations were used purely on empirical knowledge. A major turning point came in the early nineteenth century when

scientists first isolated active alkaloids such as morphine, strychnine, and quinine. These discoveries marked the beginning of modern scientific exploration of medicinal plants.

After 1945, the rapid rise of synthetic pharmaceutical chemistry and microbial fermentation shifted global attention away from plant-derived medicines. During this period, research on plant metabolites was largely focused on their phytochemical composition and their use in chemotaxonomy. However, in the last decade, interest in plant-based and even certain animal-derived therapeutic agents has steadily increased. In Western Europe, the use of medicinal plants nearly doubled, driven by growing ecological awareness, the proven effectiveness of phytopharmaceuticals such as ginkgo, garlic, and valerian, and renewed efforts by pharmaceutical companies to identify novel drug leads from higher plants.

As chemical sciences and pharmacognosy advanced, researchers became more capable of isolating and purifying bioactive molecules from medicinal plants. Notable developments include the extraction of quinine from Cinchona by Peletier and Caventou in 1820, and the derivation of aspirin from willow bark by the German chemist Hoffmann in the mid-nineteenth century. Once these active principles were isolated, plant-based remedies began to be replaced with pure chemical substances, which were easier to standardize, prescribe, and dose. This shift led to a significant decline in the use of traditional herbal medicine during the first half of the twentieth century, as synthetic drugs were considered more potent and reliable.

However, with time, the limitations and side effects associated with many synthetic drugs became apparent. As a result, medicinal plants have regained importance, especially because many exhibit therapeutic effects comparable to synthetic medications but with fewer adverse reactions. Although natural remedies may act more slowly, they often provide better long-term benefits, particularly in the management of chronic illnesses. These observations have contributed to renewed scientific interest in phytomedicine

REVIEW OF LITERATURE

1. **Kumar et al. (2020)** offered an extensive overview of the phytochemical constituents present in Indian medicinal plants, particularly emphasizing how alkaloids and terpenoids contribute to anti-inflammatory and antidiabetic activities.
2. **Ramesh et al. (2021)** carried out a detailed pharmacognostic and phytochemical investigation of *Costus speciosus*. Their findings highlighted significant levels of flavonoids, steroids, and terpenoids, which explain the plant's varied pharmacological effects.
3. **Sharma et al. (2021)** examined medicinal species belonging to the Combretaceae family and documented their rich phenolic and flavonoid profiles, which were closely associated with strong antioxidant potential.
4. **Tadesse et al. (2022)** assessed the phytochemical composition of several Ethiopian medicinal plants. Their review underscored the abundance of alkaloids, flavonoids, tannins, and saponins, all of which exhibit noteworthy antioxidant and antimicrobial activities.
5. **Singh and Bhatnagar (2022)** explored the ethnobotany and phytochemical makeup of various Himalayan plants, revealing that the type of solvent used during extraction significantly influences both the presence and concentration of phytochemicals.
6. **Brahmbhatt and Patel (2023)** outlined modern analytical approaches employed in phytochemical investigations, stressing the importance of GC–MS and HPLC techniques for accurately identifying bioactive molecules in traditional herbal species.
7. **Adhikari et al. (2023)** reviewed medicinal plants from Nepal, combining phytochemical findings with antimicrobial and antibiofilm research to scientifically validate several long- standing traditional therapeutic uses.
8. **Mwangi et al. (2023)** examined phytochemical studies on African medicinal plants, bringing attention to issues of sustainability and advocating for consistent, standardized extraction and quality-control practices.
9. **Alam et al. (2024)** provided an update on recent progress in chromatographic and spectroscopic technologies used for profiling plant phytochemicals, with a strong focus on metabolomics for precise compound characterization.

- **INCREASING TRADITIONAL MEDICINES AND NATURAL PLANT**[25-33]

The major bioactive compounds found in medicinal plants include tannins, alkaloids, saponins, cardiac glycosides, steroids, terpenoids, flavonoids, phlobatannins, anthraquinones, and various reducing sugars. According to the World Health Organization, a large proportion of people in developing nations rely primarily on traditional remedies, most of

which are derived from natural plant sources. Similar to many other countries, Ethiopia makes extensive use of traditional medicine in both rural and urban regions, where herbal knowledge has been passed down through generations.

The cultural diversity of Ethiopia—reflected in its numerous ethnic groups, languages, and belief systems—has helped preserve a wide range of traditional healing practices. Several studies have documented the ethnobotanical and ethnopharmacological uses of Ethiopian medicinal plants, especially those traditionally employed to manage conditions such as cancer, skin infections, leprosy, parasitic infestations, the "evil eye," and wound-related ailments. Despite these extensive traditional applications, there is still a lack of comprehensive research outlining the phytochemical components and expanded pharmacological potential of many of these plants.

Understanding both the known and unexplored phytochemical profiles of Ethiopian medicinal species is crucial, as it provides foundational information for future scientific investigations. The therapeutic value of these plants stems from their phytochemical constituents, which exert specific biological and pharmacological effects on the human body. Based on their role in plant metabolism, phytochemicals are classified into two main categories:

- **Primary metabolites**, including sugars, amino acids, proteins, and chlorophyll.
- **Secondary metabolites**, which encompass alkaloids, flavonoids, saponins, tannins, phenolics, and various other compounds.

CLASSIFICATION OF PHYTOCHEMICALS[34-47]

These compounds are commonly grouped into primary metabolites and Because plants produce an enormous variety of chemical compounds, establishing a single universal classification secondary metabolites based on their biological roles. such as sugars, amino acids, proteins, nucleic acids (purines and pyrimidines), and pigments like chlorophyll.

Secondary metabolites consist of a wide range of specialized compounds such as alkaloids, terpenes, flavonoids, lignans, steroids, curcuminoids, saponins, phenolics, and glycosides. According to several scientific surveys, phenolic compounds are among the most abundant and structurally diverse groups within this category.

Phenolics

Phenolic phytochemicals represent the largest and most widespread class of secondary metabolites in the plant kingdom. The major dietary phenolics include flavonoids**,** phenolic acids**,** and polyphenols**.** These compounds share a common structural feature hydroxyl (-OH) group attached to an aromatic ring. The simplest molecule in this class is phenol (C_6H_5OH).

Phenolics serve important protective roles in plants, helping them resist pathogens, herbivores, and environmental stress. For humans, their antioxidant potential makes them valuable in defending the body against damage caused by free radicals. Among the different subgroups, flavonoids are the most extensively researched due to their wide distribution and diverse biological activities.

- **Phenolic Acids**

Phenolic acids form a broad category consisting mainly of two groups—hydroxybenzoic acids and hydroxycinnamic acids. High-molecular-weight phenolic polymers, known as tannins, also belong to this group and are classified as either hydrolyzable or condensed tannins. Phenolic acids typically contain a carboxylic acid group attached to an aromatic ring. In plants, many hydroxycinnamic acids occur as esters bound to glucose or organic acids. These compounds differ widely in structure but share antioxidant characteristics, which contribute to reducing the risk of degenerative diseases such as cardiovascular disorders, inflammation, and cancer.

Cancer cells—including leukemia cells—often maintain higher levels of reactive oxygen species (ROS), making them particularly vulnerable to antioxidants like phenolic acids. Numerous studies describe not only their health benefits but also their bioavailability**,** influenced by digestion and metabolism in the stomach, intestines, and liver. Because of their strong antioxidant capacity, phenolic acids are increasingly used as natural preservatives in food products and continue to be a major research focus in agriculture, biology, chemistry, and medicine.

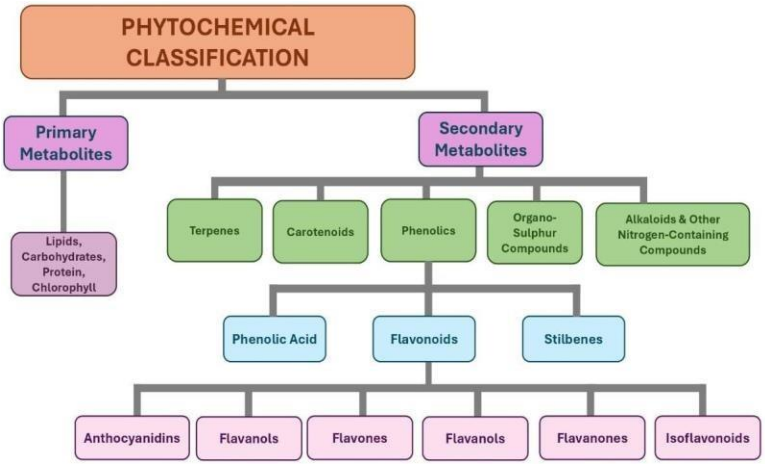

Fig no.1 Classification of Phytochemicals

STUDY OF MEDICINAL PLANTS [48-63]

The medicinal plants included in this study were selected for their traditional importance and documented therapeutic potential. Each species contains unique phytochemicals that contribute to various biological activities.

1. Aegle marmelos

Biological source :- Aegle marmelos are also known as bael. Various part of plant are used in traditional medicine such as leaves, flowers, fruits, etc. It is cultivated in Southeast Asia, Sri Lanka, Thailand, Malesia.

Family :- Rutaceae.

Chemical constituents :- The main chemical constituent are alkaloids, coumarins ,terpenoids present in plant. Other constituents is flavonoids, tannins, saponins, fatty acids and essential oil ,etc.

Uses :-

- It is used in fever, nausea, vomiting, swelling.
- It is also used in treatment of urinary problems, abdominal pain, diabetes, and high cholesterol.

Fig no. 2 Aegle marmelos

2. Aloe vera

Biological source :- Aloevera is the dried juice collected by incision from the bases of leaves of various species of aloe. Aloe vera Linn, Aloe barbadensis . It is cultivated in United States, Mexico, Australia, and India like Rajasthan, Gujarat, Andhra Pradesh and Maharashtra.

Family :- Liliaceae

Chemical constituents :- The main chemical constituents of aloe plant are three isomer of Aloins, Barbaloin, Isobarbaloin. Other chemical constituents are polysaccharide, vitamins, amino acids, anthraquinone, resin, emodin, socotrine, zanzibar.

Uses :-

- It is used in treatment of skin infection, psoriasis, eczema.
- It is also used in treatment of digestive disorder, constipation, laxative.
- It is used as modulate the immume system, anti-inflammatory, anti-oxidant.

Fig no. 3 Aloe (Aloe vera)

3. Eclipta alba (L.)

Biologocal source :- Eclipata alba are also known as Bhringraj. This plant are found in India, Brazil, Thailand, and China.

Family : Asteraceae

Chemical constituents :- The main chemical constituents heptacosanol , wedololactone, stigmasterol. Other chemical constituents are flavonoids,steroids, polypeptides, triterpenes.

Uses :-

- It is used in treatment of skin diseases.
- It is also used as analgesic, anti bacterial, anti hepatoxic, antioxidant, anti hyperglycemic.

Fig no. 4 Eclipata alba

4. Punica granatum

Biological source :- It is a deciduous shrub or small tree . It is cultivated in Maharashtra, Gujarat, Rajasthan.

Family: Lythraceae

Chemical constituents :- The main chemical constituents polyphenols like punicalagins, ellagitannins, and anthocyanins. Other chemical constituents are flavonoids, punicic acid, organic acids.

Uses :-

- It is used as antioxidant, anti-inflammatory, and anticancer effects.
- It used to treat diarrhea, ulcers, and infections, lowering blood pressure and cholesterol

Fig no. 5 Punica granatum

5. Psoralea corylifolia

Biological source :- It is dried ripe fruits and seeds . It is cultivated in its native areas of China and South Africa, as well as across the Indian subcontinent.

Family: Leguminosae

Chemical constituents :- The main chemical constituents are flavones, coumarins, monoterpenes, chalcones, lipids, resins, stigmasteroids, and flavonoids.

Uses :-

- It is used as treating skin disorders such as psoriasis, vitiligo, and leprosy.
- It is also used as diuretics, laxatives, and wound-healing agents. antitumor, antioxidant, antidepressant, antihyperglycemic, and antibacterial properties.

Fig no.6 Psoralea corylifolia

6. Bauhinia variegate

Biological source :-This plant is a species of flowering plant in the legume. It is found in India and the Himalayan region.

Family: Caesalpiniaceae

Chemical constituents :- The main chemical constituents are kaempferol, apigenin, steroids such as triterpene, saponins. Other compounds identified include tannins, glycosides, and amino acids.

Uses :-

- It is used as antidiabetic, anti-ulcerogenic, antioxidant, antimicrobial, anti- inflammatory, hepatoprotective, nephroprotective, and antitumor activities.

Fig.no.7. Bauhinia variegata

7. Tinospora cordifolia

Biological source :- It is also known as Giloy .It is a large climbing shrub. It is cultivated in tropical and subtropical climates, especially in India, Sri Lanka, and Myanmar.

Family: Menispermaceae

Chemical constituents :- The main chemical constituents are alkaloids, diterpenoid lactones, glycosides, and steroids. Other components include sesquiterpenoids, phenolics, lignans, and polysaccharides.

Uses :-

- It is used as for managing infections, metabolic disorders, arthritis, cancer, inflammation, oxidative stress, and toxin accumulation.
- It is also used in treatment of fever.

Fig no. 8 Tinospora cordifolia

8. Moringa oleifera

Biological source :- It consist of dried long slender,triangular seeds-pods. It is found in Asia and Africa.

Family: Moringaceae

Chemical constituents :- The main chemical constituents isothiocyanates, nitrate, quercetin, kaempferol. The other constituents are vitamins, minerals, amino acids, flavonoids, saponins, etc.

Uses :-

- It is used in treatment of rheumatism, venomous bites, digestive disorders, and circulatory problems.
- It is used as antibacterial, antimalarial, and anti-inflammatory properties. Flowers are used as tonics and diuretics.

Fig no. 9 Moringa oleifera

9. Azadirachta indica (Neem)

Biological source :- It is commonly known as Neem. All parts of the plant are used in medicinal properties. It is cultivated in tropical and subtropical regions worldwide, including most of Africa, Southeast Asia, and parts of South America and Australia.

Family: Meliaceae

Chemical constituents :- The main chemical constituents are triterpenoids like azadirachtin and gedunin, polyphenols. Other constituents are nimbin, nimbidin, nimbolide, salannin, and nimandiol, along with amino acids, fatty acids, and n-hexacosanol.

Uses :-

- Neem is used as treating skin infections, promoting hair health, supporting digestion. It is used to treat stomach ulcer, and improve digestion.
- It is used as antiviral , anti bacterial, antielmintic, anti cancer, it also help the reduce acne.

Fig no. 10 Azadirachta indica (Neem)

10. **Withania somnifera**

Biological source :- It is also known as Ashwagandha or Indian ginseng. This plant are used dried roots and stem. It is found in India, Sri Lanka, Afghanistan, and Sindh

Family: Solanaceae

Chemical constituents :- The main chemical constituents are steroidal lactones known as withanolides such as withaferin A and withanolide D. Other constituents are alkaloids, flavonoids, tannins, saponins, and phenolic acids.

Uses :-

- It is used for treating the nervous system, skin disorder and rheumatism, it also reduce the stress.
- It used as analgesic, anti inflammatory, antibacterial agent.
- It is also used as antimicrobial, anti-inflammatory, antistress, antitumor, cardioprotective, and immune-supportive activities.

Fig no.11 Withania somnifera

11. **Cassia tora Linn.**

Biological source :- It is also known as Senna. Cassia tora is a common weed found in India and tropical regions.

Family: Leguminosae.

Chemical constituents :- The main chemical constituents are anthraquinone glycosides, naphthopyrone derivatives, and flavonoids. Other constituents are fatty acid, saponins, tannins, and palmitic acid.

Uses :-

- It is used as laxative, anti inflammatory, and skin healing properties.
- It is also used as constipation, ringworm, liver disorder.
- It also used anthelmintic, snakebites,and insect bites, antibacterial, antifungal, antioxidant, and anti-inflammatory properties. Extracts are known to inhibit fungi like Candida albicans, Aspergillus niger, and Trichophyton species.

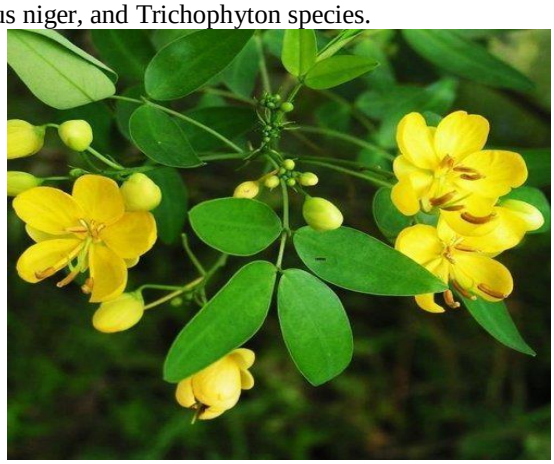

Fig.12 Cassia tora Linn.

12. **Curcuma amada (Mango Ginger)**

Biological source :- It is the rhizome of the mango ginger plant. It is cultivated in India and Southeast Asia.

Family: Zingiberaceae

Chemical constituents :- The main chemical constituents are volatile oils, phenolic compounds, curcuminoids. The major components are camphor, curzerenone. Other constituents are terpenoids, flavonoids, fatty acids, etc.

Uses :-

- It used in treatment of digestine issues, respiratory problems, skin disorders, and inflammation.
- It used as antioxidant, anti inflammatory, antibacterial, anti fungal etc.

Fig no.13 Curcuma amada (mango ginger)

13. **Cassia angustifolia (Senna)**

Biological source :- It is a small shrub. It is cultivated in India like Rajasthan, Gujarat.

Family: Fabaceae

Chemical constituents :- The main chemical contituents are hydroxyanthracene glycosides, especially sennosides like sennoside A and sennoside B. Other constituents are flavonoids, resins, tannins, mucilage, etc.

Uses :-

- It is used as constipation relief, laxative, skin disorder.
- It is used as purgative, fungal infection.

Fig no.14 Cassia angustifolia (Senna)

14. Emblica officinalis (Phyllanthus emblica / Amla)

Biological source :- It is fresh and dried mature fruits of the medium sized tree. It cultivated in India ,Pakistan, Sri Lanka.

Family: Euphorbiaceae

Chemical constituents :- The main chemical constituents are vitamin c, polyphenols, gallic acids, tannins. Other components are flavonoids, alkaloids, minerals, etc.

Uses :-

- It is used as digestive problems, diabetes, ulcers, infections, inflammation, and metabolic disorders.
- It is used as antibacterial, antiviral, antifungal, antioxidant, hepatoprotective, cardioprotective, anti-inflammatory, and neuroprotective effects

Fig.no.15 Emblica officinalis or Phyllanthus emblica

MATERIALS AND METHODS [62-70]:

Collection of plant materials fresh parts of fourteen medicinal plants were collected from different regions. The plant materials were shade dried until all the water molecules evaporated and plants became well dried for grinding. After drying, the plant materials were ground well using a mechanical blender into fine powder and transferred into airtight containers with proper labeling for future use.

Preparation of plant extracts

Solvent extraction crude plant extract was prepared by the Maceration extraction method. About 10gm of powdered plant material was placed in a stoppered container with 100ml Ethanol solvent and allowed to stand at room temperature. For a period of at least 3 days with frequent agitation until the soluble matter dissolved. The mixture was strained, the marc (the damp solid matter) was pressed, and the combined liquids were clarified by filtration. The filtrate was used for the phytochemical analysis.

Qualitative phytochemical analysis

The extract was tested for the presence of bioactive compounds by using following standard methods.

Test for Proteins:

Millon's test :-

Crude extract when mixed with 2ml of Millon's reagent, white precipitate appeared which turned red upon gentle heating that confirmed the presence of protein.

Ninhydrin test :-

Crude extract when boiled with 2ml of 0.2% solution of Ninhydrin, violet colour appeared suggesting the presence of amino acids and proteins.

Test for Carbohydrates:

Fehling's test equal volume of Fehling A and Fehling B reagents were mixed together and 2ml of it was added to crude extract and gently boiled. A brick red precipitate appeared at the bottom of the test tube indicated the presence of reducing sugars.

Benedict's test :-

Crude extract when mixed with 2ml of Benedict's reagent and boiled, a reddish brown precipitate

formed which indicated the presence of the carbohydrates.

Molisch's test :-
Crude extract was mixed with 2ml of Molisch's reagent and the mixture was shaken properly. After that, 2ml of concentrated H_2SO_4 was poured carefully along the side of the test tube. Appearance of a violet ring at the interphase indicated the presence of carbohydrate.

Iodine test :-
Crude extract was mixed with 2ml of Iodine solution. A dark blue or purple coloration indicated the presence of the carbohydrate.

Test for Phenols and Tannins
Crude extract was mixed with 2ml of 2% solution of FeCl3. A blue-green or black coloration indicated the presence of phenols and tannins.
Test for Flavonoids:
Shinoda test :-
Crude extract was mixed with few fragments of Magnesium ribbon and conc. HCL was added drop wise. Pink scarlet colour appeared after a few minutes which indicated the presence of flavonoids.
Alkaline reagent test:
Crude extract was mixed with 2ml of 2% solution of NaOH. An intense yellow colour was formed which turned colourless in addition to a few drops of diluted acid which indicated the presence of flavonoids.

Test for Saponins
Crude extract was mixed with 5ml of distilled water in a test tube and it was shaken vigorously. The formation of stable foam was taken as an indication for the presence of saponins.

Test for Glycosides
Liebermann's test : -
Crude extract was mixed with 2ml of chloroform and 2ml of acetic acid. The mixture was cooled in ice. Carefully concentrated H_2SO_4 was added. A colour change from violet to blue to green indicated the presence of steroidal nucleus. i.e., portion of glycoside.
Salkowski's test :-
Crude extract was mixed with 2ml of chloroform. Then 2ml of concentrated H_2SO_4 was added carefully and shaken gently. A reddish brown colour indicated the presence of steroidal ring, i.e., glycone portion of the glycoside.

Keller-kilani test :-
Crude extract was mixed with 2ml of glacial acetic acid containing 1-2 drops of 2% solution of FeCl3. The mixture was then poured into another test tube containing 2ml of conc. H_2SO_4. A brown ring at the interphase indicated the presence of cardiac glycosides (12 RNS Yadav and Munin).

Test for Steroid
Crude extract was mixed with 2ml of chloroform and conc. H_2SO_4 was added sidewise. A red colour produced in the lower chloroform layer indicated the presence of steroids. Another test was performed by mixing crude extract with 2ml of chloroform. Then 2ml of each of conc. H_2SO_4 and acetic acid were poured into the mixture. The development of a greenish coloration indicated the presence of steroids.

Test for Terpenoids
The presence of terpenoids, the crude extract was mixed with about 2 ml of chloroform, after which the solvent was allowed to evaporate completely. The dry residue was then combinedwith an equal volume of concentrated sulfuric acid and warmed for roughly two minutes. The appearance of a grayish coloration was taken as evidence of terpenoid compounds

CONCLUSION:

The fourteen medicinal plant species examined in this study were found to contain several important secondary metabolites, including alkaloids, flavonoids, terpenoids, and reducing sugars. These bioactive compounds contribute to the plants' ability to help prevent or manage a range of health conditions. Their known anti-inflammatory, anticancer, antiviral, antibacterial, and antifungal properties are largely attributed to the presence of these metabolites.

Medicinal plants continue to serve as valuable resources for identifying and evaluating phytochemical constituents that may lead to the development of novel therapeutic agents. Phytochemical investigations have growing significance and commercial value within research institutions and the pharmaceutical sector, where such compounds are explored for the creation of new drugs as well as biofertilizers aimed at managing plant diseases.

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