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Study of phytochemicals source of drugs and biological activities

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Abstract

The purpose of this study was to investigate the stress physiology of medicinal plants by assessing a number of physiological characteristics. Primary and secondary metabolites are the traditional labels given to phytochemicals according to their function in plant metabolism. the results of the current study may aid in the fight against inflammation. Pharmacological activities of different phytochemicals They found that the tested plants contained medicinally important bioactive compounds in both crude aqueous and organic solvent extracts, and that using different methods of extraction resulted in significantly different yields and extraction times. Vincristine and vinblastine, two anticancer principles developed from the plant Catharanthus roseus (Apocynaceae), have been a boon to medicinal plant research.

Keywords: Phytochemicals, drugs, medicinal plants, herbal and biological, medicinal plants

Introduction

The use of herbal remedies and other plant-based items as a substitute for conventional medicine has grown in popularity across the world. It is impossible to overstate the importance of traditional herbal remedies in the development of contemporary pharmaceuticals, despite the fact that their usage dates back many decades. Herbal remedies had a bad reputation in bygone days due to their association with poverty and witchcraft, and they were reserved for the poor who could not afford synthetic medications.

Historically, there has been less scientific investigation into the purported therapeutic characteristics of plants and their potential for healing or prevention. In light of the rising worries about the negative side effects linked to the majority of synthetic pharmaceuticals, herbal medication is being increasingly considered as a viable option by health professionals and researchers throughout the world due to its proven efficacy. Most individuals, particularly in underdeveloped nations, cannot afford synthetic medication. A huge weight would be lifted off their shoulders if they were adequately educated on the safe and effective usage of commonly accessible medicinal herbs.

We are well-aware of the significance of plants. More and more people are starting to realise the significance of medicinal plants, and the plant world is a veritable treasure trove of possible pharmaceuticals. There are very few negative effects reported for drugs derived from plants, and they are readily accessible, inexpensive, safe, and effective. The most logical place to start looking for novel therapeutically effective medications, such anticancer, antibacterial, and antihepatotoxic chemicals, is with plants that have been used medicinally for thousands of years. In order to get a wide range of medications, the World Health Organisation (WHO) suggests looking to medicinal plants.

Chemically and taxonomically varied molecules with unclear functions are known as secondary metabolites. They have many applications in fields as diverse as human medicine, agriculture, veterinary medicine, and scientific research. *In vitro* studies have shown that a wide variety of phytochemicals from various chemical classes suppress the growth of various bacteria. Phytomedicines have included plant-based ingredients since the beginning of recorded history. Plant materials such as bark, leaves, flowers, roots, fruits, and seeds may provide this. In order to synthesise complicated chemical compounds, it is useful to have knowledge of the chemical components of plants.

Materilas and Methods

Sylaja, A *et al*. (2023) [2]. Summary: This research set out to

learn more about the phytochemical components of native plants in the Hyderabad, Telangana area. *Nycanthes arbortristis*, Clitoriaternatea, Costusigneus, Menispermum candenese, *Moringa oleifera*, *Ocimum sanctum*, Cymbopogoncitratus, and *Phyllanthus niruri* were among the plants that were included. For the purpose of analysing the presence of different phytochemicals, leaf extracts were produced from these plants using methanol and water as solvents. The findings demonstrated that several plant extracts, both aqueous and methanolic, included a diverse array of phytochemicals, including steroids, flavonoids, saponins, quinones, terpenoids, cardiac glycosides, phenols, and tannins.

Mulay, J *et al*. (2020) [3]. The screening of phytochemicals is an important step in the process of discovering new drugs by identifying the bioactive components in medicinal plants. For the purpose of correlating their existence with the bioactivities of the plants, the primary phyto components of 25 traditional medicinal herbs were determined in this research. Tannins, flavonoids, phenolics, saponins, steroids, cardiac glycosides, and alkaloids were detected in the plants by established techniques of screening. Of the 25 plants tested, 19 contained flavonoids and 16 had alkaloids. It is possible to link the existence of these phytochemicals to the therapeutic potential of these plants. To fully understand the medical and pharmacological uses of these plants, more research is required to identify, isolate, and characterize the bioactive chemicals that give them their unique properties.

Osuwat, Lawrence. (2016) [5]. Phytochemicals are the driving force behind the therapeutic characteristics shown by different medicinal plants. Finding out what phytochemicals were in six different Rwandan medicinal plants was the driving force for this research. To determine if certain phytochemicals were present, we used established protocols for phytochemical screening. It was discovered that all of the therapeutic plants that were chosen included tannins, flavanoids, saponnis, and phenols. Every one of the plants that were chosen had alkaloids, with the exception of two: Aloe myriacantha and Eucalyptus camaldulensis. Researchers in Rwanda found that medicinal plants have a wide range of phytochemicals that contributed to their healing effects.

Bansode, Twinkle *et al*. (2015) [7]. Traditional herbal therapy makes extensive use of phytochemicals, which are bioactive substances derived from plants. The locals treat a wide range of illnesses using these herbal remedies, including serious ones like diabetes, cancer, HIV, and more. This research set out to do just that by screening a subset of therapeutic plant extracts for these phytochemicals and mineral content. The four plants that were selected for the study were Salvadora persica, *Syzygium cumini*, *Terminalia chebula*, and Trigonella foenum-graecum. It was discovered that all species contain flavonoids in high concentrations. Additionally, almost every species that has been investigated has saponins and tannins. At last, we determined that the Salvadora persica plant had the greatest mineral content (19%) out of the four plant species that were tested. Researchers found that the plants they looked at had a wealth of phytochemicals that might have important medical and pharmacological uses.

Grace, Annalene *et al*. (2021) [8]. There are bioactive components in medicinal plants that help treat a wide range of human illnesses. Additionally, they are crucial in the healing process. The secondary plant metabolites were detected using a combination of qualitative analysis and a conventional solvent extraction methodology applied to fresh plant samples (leaves and fruits). A phytochemical study was conducted on the ethanolic extracts of eight medicinal plants native to Quirino Province, Cagayan Valley, Philippines. Specific extracts were found to include alkaloids, saponins, phytosterols, phenolic compounds, and flavonoids, according to the results. Given the importance of native plants to traditional medicine, we examine the implications of the results.

Phytochemistry

Phytochemicals are naturally occurring chemical compounds in plants that have biological activity and may be used as nutrition or therapeutic substances for humans. In addition to adding to the plant's colour, scent, and fragrance, they shield plants from harm and diseases. Pollution, stress, dehydration, ultraviolet radiation, and pathogenic assault are only a few examples of the environmental risks that plants can withstand via the use of phytochemicals (Gibson *et al*., 1998; Mathai, 2000) [16, 17]. More recently, it became abundantly obvious that they have a function in safeguarding human health when consumed in large quantities. More than 4,500 phytochemicals have been documented so far, with 350 of them having undergone extensive research into their chemical and physical properties and protective roles.

Plants store phytochemicals in several organs and tissues, including the stem, leaves, flowers, fruit, and seeds. The outer layers of many plant components, such as leaves and fruits of vegetables, tend to have a concentration of phytochemicals, especially colour compounds like anthocyanins and flavonoids. Nevertheless, the concentrations of these phytochemicals differ across plants as a result of factors such as diversity and environmental factors. The biological features of these substances include antioxidant activity, antibacterial action, immune system stimulation, modification of hormone metabolism, anticancer property, and modulation of detoxification enzymes.

The wide variety of phytochemical structures and shapes has prevented their precise categorization. Primary and secondary metabolites are the traditional labels given to phytochemicals according to their function in plant metabolism. Common sugars, proteins, amino acids, chlorophylls, nucleic acid purines and pyrimidines, and other compounds are examples of primary metabolites. The rest of the plant compounds, called secondary metabolites, include things like glucosides, phenolics, alkaloids, terpenes, flavonoids, lignans, plant steroids, curcumins, and saponins.

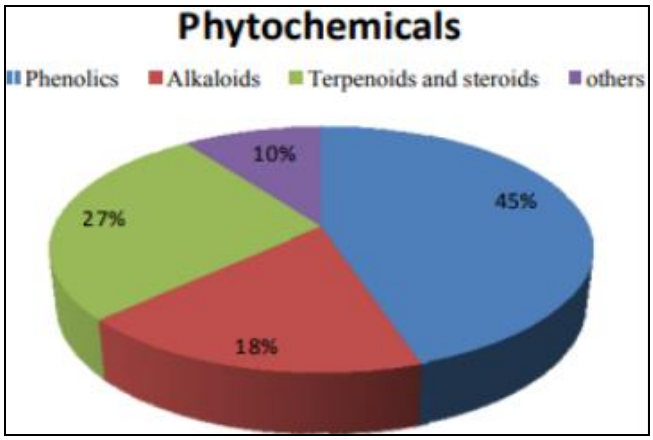


Fig 1: Pie chart representing phytochemicals (Thakur and Sharma, 2022) [4].

Classification of phytochemicals

The wide variety of phytochemical structures and shapes has prevented their precise categorization. Primary and secondary metabolites are the traditional labels given to phytochemicals according to their function in plant metabolism. Common sugars, proteins, amino acids, chlorophylls, nucleic acid purines and pyrimidines, and other compounds are examples of primary metabolites. According to Hahn (1998) [18] and Ramawat *et al*. (2009) [19], among the remaining plant compounds that are considered secondary metabolites include glucosides, alkaloids, terpenes, flavonoids, lignans, plant steroids, curcumines, saponins, phenolics, and glucosides (12,500). Because of these secondary metabolites, plants are effective therapeutics for a wide range of illnesses. Table 1 lists the phytochemicals along with their pharmacological actions.

Table 1: Pharmacological activities of different phytochemicals

Phytochemicals	Pharmacological activities
Flavonoids	Antioxidant, antimicrobial, cytotoxicity, anti-inflammatory, antitumor activity, enzyme inhibition, oestrogenic activity, anti-allergic activity, vascular activity.
Tannin	Anti-inflammatory, antiseptic, antioxidant and haemostatic pharmaceuticals
Alkaloids	Antimicrobial, antihypertensive effects, anti-arrhythmic effect, antimalarial activity, anticancer actions, antimalarial, antispasmodic analgesic, diuretic activities.
Terpenoids	Anti-carcinogenic, anti-malarial, anti-ulcer, hepaticidal, anti-microbial or diuretic activity, sesquiterpenoid, antiviral, anthelmintic, anti-inflammatory properties
Saponin	Anti-inflammatory, antiviral, plant defence activities, antimicrobial, antioxidant, immunostimulant, hypocholesterolaemic and anti-carcinogenic properties
Glycosides	Antifungal and antibacterial properties

Identifying characteristics of the investigated plant species the following are botanical descriptions of the nine species that were considered for this research.

1. ***Oldenlandia corymbosa*** **(Diamond flower/Bonjaluk):** This plant belongs to the Rubiaceae family and is a member of the Oldenlandia genus. It contains over 240 distinct species and is found all across the globe, in both the tropical and temperate zones. A plethora of 4-angled stems support the plant as it stands upright. The almost stalkless leaves have a width of 1.5-7 mm, a length of 1-3.5 cm, and an oblong or narrow elliptic shape. The delicate stalks that hold the white, slightly pinkish, or purple blossoms are only 3 to 9 millimetres long. The length of the four-petal flower tube ranges from 1.5 to 2 millimetres (Das, *et al*., 2012) [20]. The seeds are smooth and a deep brown colour, while the fruit is ovoid, subglobose, and covered in a cap.
2. **Ricinus communis (Castor oil plant/Eragoch):** The spurge family, which includes these perennial shrubs, is Euphorbiaceae. Stems are hollow, branching, herbaceous above and woody below. A hair-like growth covers the tips of young branches. Alternating with seven or more lobes, the petiolate leaves are exstipulate and strongly palmately lobed. The veins are divergent and palmately reticulate. The fruit develops three one-seeded cocci and is encased in spiny projections. However, humans, animals, and insects are all poisoned by the castor bean plant's seeds. The presence of the glycoprotein ricin is responsible for the toxicity. The only way to make the seed poisonous is to crack or gnaw on the shell. Along with neurological and ophthalmological abnormalities, it may trigger an acute and perhaps deadly gastroenteritis.
3. **Ipomea aquatic (swamp morning glory/kolmou):** Tender branches and leaves are harvested from this tropical, semi-aquatic plant for their culinary value. Despite its widespread distribution in the tropics and subtropics, its exact origin remains a mystery (Minakshi *et al*., 2016) [15]. Rooting at the nodes, its 2- to 3-meter-long stems are hollow and float. The leaves range in form from sagittate (like an arrowhead) to lanceolate, and are 5–15 cm in length and 2–8 cm in width. White with a mauve core, the trumpet-shaped blossoms typically measure three to five centimetres in diameter.
4. ***Xanthium strumarium*** **(cocklebur/chota dhatura/ogora kata):** belongs to the family Asteraceae and is an annual plant species. An annual plant, X. strumarium may reach a height of 1 to 1.2 metres. Stout and rugged, the stems might be green or brownish in colour and often have red spots and hairs. In addition to the hooked spines that cover the fruit, the plant has alternating, dull-green leaves that are lighter underneath and have small bristly hairs on both sides. The blooms are a yellowish-green colour. People who are sensitive to the plant might get contact dermatitis. Although the plant is thought to be dangerous in and of itself, the harmful compounds are rendered inert during the boiling and washing processes. Carboxyatractyloside is a glycoside that X. strumarium has in its seeds and seedlings, and it is very poisonous. Assamis use the young flowering tops and the two lower leaves as a pot herb by boiling them in water.
5. ***Terminalia bellerica*** **(Bahera/Bhumura):** Outside of arid regions, deciduous woods make up the majority of

India's *Terminalia bellerica* Roxb.'s (Combretaceae) habitat. The tree reaches an elevation of 20 to 30 metres and is huge and deciduous, with wide leaves clustered at the terminals of the branches and a thick bark that is brownish-grey in colour. The petiolate leaves are 8–20 centimetres in length. Pale greenish yellow is the colour of the blossoms. According to Das *et al*. (2012) [20], the fruits are drupes that are 1.5-2.5 cm in diameter and contain ovioid seeds. Citation.

6. ***Bryophullum pinnatum* (air plant/dupor tenga):** It belongs to the Crassulaceae family and is a perennial succulent. In subtropical and tropical regions, it has become a naturalised species. The succulent leaves may grow to a height of 150 cm and are glabrous, thick, meaty, black, and have a crenate border. They are oval to elliptical in shape and have long petiolate segments. Having a swelling cup and a longer corolla than the cup, the inflorescences are hermaphrodites that are tubular, pendulous, monopetalas, and either light green or yellow-red in colour. According to many studies (Jessica, 2008; Moreira *et al*., 2014) [21, 22], the fruit takes the shape of hoods that eventually transform into scaly polispermos embryos.
7. ***Clerodendrum viscosum* (hill glory bower/ bhet-tita):** The Lamiaceae family counts this perennial plant among its members. Almost every state in India receives it. Bongaigaon is where most people in Assam observe it. According to Kannathasan K and Basu (2007) [23], this plant is identified by its oppositely arranged leaves, which may be whole or toothed, as well as by its terete stems, hypogynous bisexual flowers, cymose inflorescence (either terminally or axillary), and exalbumenous seeds. Bulky panicles of white flowers adorn the ends of the stems. The mature fruit is a drupe that, when contained in an accrescent calyx, becomes a bluish-black colour. Rosa/Tengamora Hibiscus sabdariffa: The Malvaceae family includes this plant or subshrub with woody stems and flowers; it is thought to have originated in Tropical Africa, East Asia (from India to Malaysia), or Asia. A deep-penetrating taproot supports the plant's 3.5-meter-tall stature. Its stems range in colour from dark green to scarlet and are linear in shape. Alternating between short and long petioles are green leaves with crimson veins. Yellow or buff blossoms with a rose or maroon eye may be seen borne singly in the axils of the leaves and can reach a width of up to 12.5 cm. A collar of 8–12 narrow, pointed bracts surrounds the five big sepals in the usually crimson calyx. described the seeds as kidney-shaped, light brown, and coated with minute stout and stellate hairs.
8. **Mentha piperita (Peppermint/Pudina):** Belonging to the Lamiaceae family, peppermint is a glabrous, perennial plant with a strong aroma. Another kind of mint is peppermint. It is a popular culinary herb, medicinal herb, ground cover, and rhizomatous erect perennial. The plant may reach a height and width of 1 to 2 feet, and its appealing ground cover can be expanded even further by means of rhizomes. It has dark green, serrated leaves that are either rounded or lance-shaped and are 1–2 inches long. In the summer, it produces spikes that terminate in tiny, pink–lavender flowers that almost never produce seeds.

Phytochemical analysis

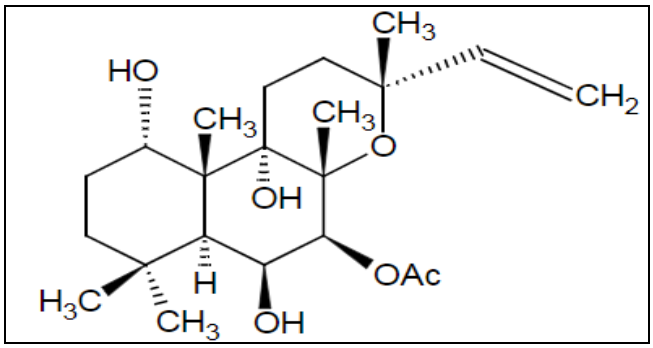
Several employees conducted phytochemical investigations of plants used for traditional medicine. Having said that, the papers cited were quite incomplete. Varieties of these species have been studied by different researchers. Concurrently, several researchers study various species; hence, it is crucial to consolidate these studies and reports into a single repository in order to get a holistic picture of the scientific research on traditional medicinal plants. In light of this, we conducted a case study of nine medicinal plants often found in the northeastern area. These plants have been the subject of reports on their therapeutic characteristics and the existence of biomolecules with major therapeutic applications.

Oldenlandia corymbosa, Ricinus communis, Ipomea aquatica, *Terminalia bellerica* (Bhumura), *Bryophyllum pinnatum*, *Clerodendrum viscosum*, Hibiscus sabdariffa, *Xanthium strumarium*, and Mentha piperita. The common components, such as flavonoids, tannins, and saponins, are present in almost all therapeutic plants, according to a comprehensive review of studies conducted by different researchers. But what the research did show was that various types of plants have differing amounts of phytochemicals. Among the plant species examined for this feature, it was found that *Terminalia bellerica* and Ipomea aquatic had almost all of the phytochemicals that were being considered. Seven plants-*Bryophyllum pinnatum*, Ipomea aquatica, *Oldenlandia corymbosa*, *Ricinus communis*, *Terminalia bellerica*, *Tinospora cordifolia*, and *Xanthium strumarium*-were subjected to qualitative and quantitative phytochemical investigation by Yadav and Agarwala (2014) [24].

They found that the tested plants contained medicinally important bioactive compounds in both crude aqueous and organic solvent extracts, and that using different methods of extraction resulted in significantly different yields and extraction times. This supports the use of these plants in traditional medicine for the treatment of various diseases. Preliminary phytochemical analysis for *Oldenlandia corymbosa*, Ricinus communis, Ipomea aquatica, *Xanthium strumarium*, and Mentha piperita was similarly investigated by Minakshi *et al*. (2016) [15]. The results indicated the presence of saponins, tannins, flavonoids, terpenoids, glycosides, alkaloids, carbohydrates, steroids, coumarin, and protein.

Recent progress in phytochemistry

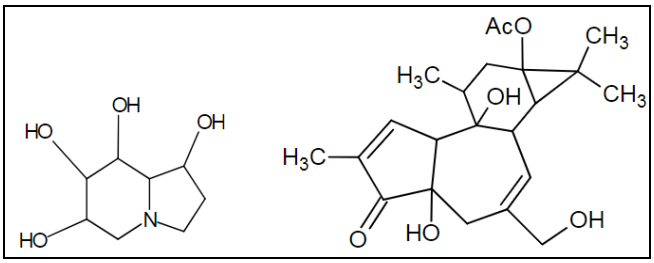
Vincristine and vinblastine, two anticancer principles developed from the plant Catharanthus roseus (Apocynaceae), have been a boon to medicinal plant research. Ammon and Muller (1985) [25] noted that forskolin, a diterpene isolated from Coleus forskohlii Brig. (Labiatae), stimulates the enzyme adenylate cyclase, which has led to its investigation into the physiological role of adenosine cyclic3',5'-(hydrogen) phosphate (cAMP).



The sesquiterpene endoperoxide artemisinin, also known as qinghaosu, is a medicine that has been therapeutically successful in treating falciparum malaria that has developed resistance to many drugs. It is derived from the Chinese plant qinghao, which is part of the Asteraceae family. Artemether® and Sodium artesunate, two synthetic artemisinin derivatives, are also commercially available.

Isolation of various promising compounds has been achieved in the search for phytochemicals effective against the human immunodeficiency virus (HIV), the agent responsible for Acquired Immune Deficiency Syndrome (AIDS). These compounds include the tetrahydroxyindolizidine alkaloid castanospermine from *Castanospermum australe* (Leguminosae) and the phorbol ester prostratin from *Homalanthus nutans* (Euphorbiaceae).

Although prostaglandin was previously recognised, it has never been studied for its potential antiviral effects. Isolated from the Chinese medicinal plant Ginkgo biloba L. (family Ginkgoaceae), the ginkgolides are strong and selective inhibitors of the phospholipid mediator of inflammation and platelet activating factor (PAF). A number of studies have shown that ginkgolides, and ginkgolide B in particular (BN 52021, VII), are effective medicinal agents with a broad variety of biological effects (Braquet, 1987; Smith *et al*., 1996) [26, 27].



Last but not least, paclitaxel, a diterpenoid derived from some Taxus species, is a powerful anticancer agent. It has been authorised for the treatment of ovarian cancer and metastatic breast cancer that has not responded to other treatments (Cox and Balick, 1994) [28]. The semi-synthesis of 10-deacetylbaccatin from a certain plant is currently the main method for obtaining taxol, since its concentration in the bark of Taxus species is low and its high global demand almost led to the extinction of the Pacific yew.

1. When taxonomic evidence is lacking for the categorization of genera or species based on morphology alone, chemotaxonomic evidence may be provided by isolating bioactive chemicals.
2. You may conduct research on activities that are connected to structures because of it.
3. It also allows for the showing of the veracity of the stated physiological activity of the screening plant.

Forests, home to many medicinal plants, are rapidly losing their biodiversity, which presents a serious threat to the continuing use of these plants in medicine (Cox, 18994) [2]. The linked plant folklore is also vanishing as herbalists aren't passing on the wealth of information they've collected over the years. Cox and Balick (1994) [28], and Van Wyk *et al*. (2008) [29] all emphasise the critical need of conducting a comprehensive study of our medicinal plants in order to identify their active principles. This study is being conducted at a time when worldwide policies are being developed to ensure the sustainable use of bioresources (Bonati, 1988; Cunningham, 1988; Mander, 1998; Van Wyk, 2008) [30, 31, 29].

According to Cox and Balick (1994) [28], out of the 250,000-500,000 species of higher plants, only around 0.5% have received sufficient attention in terms of phytochemical or biological activity investigations. It is worth noting that out of the 119 plant-derived drugs currently in use, only 90 are commercially produced. This suggests that there is a significant untapped resource of phytochemicals that could be utilised for various purposes, such as developing new drugs, preparing for the semi-synthesis of natural products with complex chemical structures, or as powerful pharmacological tools.

Phytochemicals as a source of drugs

The tropics are home to around 155,000 of the more than 250,000 species of flowering plants that call Earth home. One of the world's twelve nations with the highest concentration of plant and animal species is Malaysia. Plants have long been recognised as a source of traditional medicine due to their abundance of diverse secondary metabolites, which they release in addition to their primary uses as fuel, fibre, and food. The variety of chemicals is one of the main reasons why people are still interested in studying natural goods. Numerous medications used today have their origins in plants, in some way or another, demonstrating the significant impact plants have had on contemporary medicine (Table 2).

Particularly plants found in tropical rainforests are thought to have a high level of chemical diversity, making them a possible resource for the development of novel medicinal compounds. Chemical substances derived from a wide variety of sources, including plants, animals, insects, and many more, are known as natural products. Investigating the molecular structure, biogenesis, biological activities, therapeutic uses, and other aspects of natural products is what scientific inquiry is all about. The discovery that plants contain valuable compounds that might be used either as-is or as building blocks for pharmaceuticals with defensive or protective properties against a wide range of ailments has increased the relevance of studies using natural products. They have further use as nutraceutricals, which are meals or supplements that boost health and development.

A new era in medicine began in 1928 when Fleming discovered penicillin from the fungus Penicillium notatum. It encouraged researchers to scour the natural world for potential new bioactive chemicals. From that point on, the pharmaceutical industry has benefited greatly from the

abundance of structurally varied and bioactive metabolites produced by microbial communities. Systematic studies including just 5–15% of the terrestrial flora, mostly higher plants, have led to this conclusion. Much of the remaining portion is unexplored and has not been studied yet. This biological resource offers a great amount of promise for discovery. Expanding the systematic investigation of these biological resources in search of novel bioactive compounds is urgently needed due to the ongoing danger to biodiversity caused by the deterioration of terrestrial and marine ecosystems.

Table 2: Drugs obtained or derived from natural products

Drug	Plant source	Therapeutic application
Morphine	*Papaver somniferum*	Pain relief
Quinine	*Cinchona succirubra*	Anti malarial
Tamil	*Taxus brevifolia*	Anti cancer
Lysergic acid diethylamide	*Claviceps purpurea*	Migraine and headaches
Vincristine	*Cathanunhus roseus*	Anti leukemic

Biological activities of phytochemicals

Extensive research has been conducted to determine the effectiveness and mechanism of action of the phytochemicals found in plants, which are responsible for disease prevention and health promotion. These investigations have included determining the chemical components, isolating them, and proving their biological efficacy *in vitro* and *in vivo* in experimental animals, as well as in humans via epidemiological and clinical-case control studies. According to research, phytochemicals have the potential to lower the risk of coronary heart disease by regulating blood pressure and clotting, increasing arterial flexibility, decreasing cholesterol production or absorption, and avoiding the oxidation of lowdensity lipoprotein (LDL) cholesterol.

Some toxins that cause cancer may be detoxified by phytochemicals. Based on what we can tell, they do things like activate enzymes that detoxify carcinogens, inhibit enzymes that activate carcinogens, and neutralise free radicals. Genistein, for instance, blocks the production of new capillaries-essential for tumour development and metastasis-as shown in data compiled by Meagher and Thomson.

Few phytochemicals have their physiological effects fully elucidated, with most studies concentrating on their potential to cure or prevent cancer and cardiovascular disease. Additionally, phytochemicals have been advocated for the treatment and prevention of diabetes, hypertension, and macular degeneration. Even though phytochemicals are categorised according to their biological functions, a single molecule may possess multiple roles, for example, as an antioxidant and an antibacterial agent. See Table 3 for a list of the plant's bioactive and disease-preventing phytochemicals.

Table 3: Bioactive Phytochemicals in Medicinal Plants

Classification	Main groups of compounds	Biological function
NSA(Non-starch polysaccharides.)	Cellulose, hemicellulose, gums, mucilages, pectins, lignins	Water holding capacity, delay in nutrient absorption, binding toxins and bile acids
Antibacterial & Antifungal	Terpenoids, alkaloids, phenolics	Inhibitors of micro-organisms, reduce the risk of fungal infection
Antioxidants	Polyphenolic compounds, flavonoids, carotenoids, tocopherols, ascorbic acid	Oxygen free radical quenching, inhibition of lipid peroxidation
Anticancer	Carotenoids, polyphenols, curcumine, Flavonoids	Inhibitors of tumor, inhibited development of lung cancer, anti-metastatic activity
Detoxifying Agents	Reductive acids, tocopherols, phenols, indoles, aromatic isothiocyanates, coumarins, flavones, carotenoids, retinoids, cyanates, phytosterols	Inhibitors of procarcinogen activation, inducers of drug binding of carcinogens, inhibitors of tumourogenesis
Other	Alkaloids, terpenoids, volatile flavor compounds, biogenic amines	Neuropharmacological agents, anti-oxidants, cancer chemoprevention

Conclusion

Despite their differences in habit, habitat, and reaction time, the two antiallergenic medicinal plants that were chosen for this study had the same biochemical and physiological processes in the parameters that were evaluated to combat the negative effects of seasonal stress. Phytochemicals are naturally occurring chemical compounds in plants that have biological activity and may be used as nutrition or therapeutic substances for humans. Improving stomatal control, decreasing leaf water content, and minimizing

osmotic potential of cell sap during summer allowed them to quickly adjust to water stress and have a high-water potential in the plant.

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