

# Herbal Medicines: A Potent Approach to Human Diseases, Their Chief Compounds, Formulations, Present Status, and Future Aspects

Somnath Ghosh<sup>1</sup>, Amlan Bishal<sup>2\*</sup>, Shirsa Kumar Ghosh<sup>3</sup>, Koushik Jana<sup>4</sup>, Bikash Gayen<sup>5</sup>, Suman Sahu<sup>6</sup>, Biplab Debnath<sup>7\*</sup>

<sup>1,3,4,5,6</sup> Department of Pharmaceutical Technology, Bharat Technology, Jadurberia, Uluberia, Howrah, West Bengal, India

<sup>2</sup> Department of Pharmaceutical Technology, Bharat Technology, Jadurberia, Uluberia, Howrah, West Bengal, India. [bishalamlan31@gmail.com](mailto:bishalamlan31@gmail.com)

<sup>7</sup> Department of Pharmaceutical Technology, Bharat Technology, Jadurberia, Uluberia, Howrah, West Bengal, India. [biplab.d86@gmail.com](mailto:biplab.d86@gmail.com)

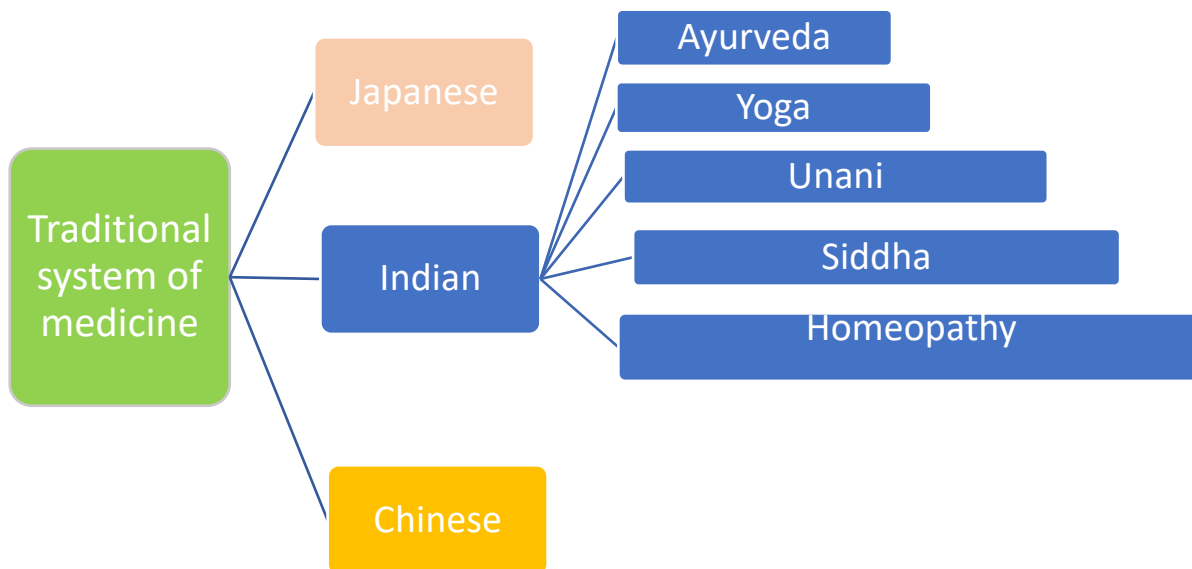
**Abstract:** Humans have relied on herbal medicines in health care and the treatment of numerous diseases since the very early stages of civilization. Herbal medicines or phytomedicines not only treat sickness but also guard against its complications simultaneously. The continuous use of synthetic medications is not safe for health because of their extreme negative impacts. So now a days, we can estimate that in some developing countries, such as the USA and England, herbal drugs make up to 25% of all consumption; on the other hand, in a few nations that are rapidly developing, like India and China, it comprises up to 80%. All over the world, more than ten thousand medicinal species are present. India is a well known producer of herbal plants that have a history of being used medicinally. As per the data of the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF), there are 50000-80000 types of flowering plants that have medicinal value globally. Because they are less expensive, more acceptable in society and culture, better compatible with the human body, and cause less adverse effects, herbal medicines are currently in considerable need for primary healthcare in developing countries. Scientific understanding of plants advanced over the 19th and 20th centuries, and active chemicals that are utilized to create new medicines were isolated. However, there are other issues with using phytomedicines that need to be resolved. This time period also saw the rise of herbal pharmacopoeias, standardized herbal preparations, and larger-scale production of herbal medicines for the future development of not only this field but also for the 80% of the world's population that belongs to the extreme limit of poverty. This study attempts to review different potent approach of herbal medicines, their current status and their future aspects.

Keywords: Active compound, Herbal plants, Herbal treatments, Human diseases, Phytomedicines.

## 1. INTRODUCTION

For thousands of years, nature has provided a significant source of therapeutic substances in the form of plants. Many of the modern medications that were originally isolated from nature have been used in conventional treatment; an astounding number of these isolations. The botanical-based healing process continue in their fundamental role in the healthcare system, as nearly 80% of the world population primarily depend on conventional treatment for their healthcare system primarily [1,2].The World Health Organization (WHO) claims that phytomedicines encloses the cumulative wisdom, expertise, and customs rooted in various cultures. It concerned beliefs, theories, and personal experiences that were used to support health and address physical and mental diseases through prevention, diagnosis, improvement, or therapy, whether or not they had been supported by science [3]. Herbal medicine, also known as herbalism, phytomedicine, or phototherapy, involves the exploration of Pharmacognosy and the uses of herbal plants, which serve as the foundation of traditional medicine [4]. From the beginning of history, different cultures and peoples have developed their own systems of herbal medicine based on native plants and traditional knowledge. Examples include Native American healing modalities, Indian Ayurveda, and Traditional Chinese Medicine (TCM).

These systems often highlighted the approach to health, aimed to restore the balance and polyphony within the body. However, when the industrial revolution got underway, we saw how allopathic medicine came to dominate. Due to its environmental origins and lack of negative side effects, conventional herbal medicine and its preparations have been utilized for thousands of years in both developed and developing nations. Herbal medicine, though an efficacious healing modality, was regarded with less fervour in regenerating responses [5].



**Figure-1:** Classification of traditional system of herbal medicines.

Herbal medicine involves making use of various plant components such as roots, stems, flowers, leaves and seeds, to create remedies that promote health, treat illnesses, and alleviate symptoms. These plant-based medicaments can be prepared in various forms, including teas, tinctures, capsules, powders, creams, and ointments [6]. India is thought to contain close to 8% biodiversity of the world and is home to about 126,000 species. More than 315 of the 400 different families of flowering herbs are found in India [7]. More than 700 of the 2600 plant species in the middle east are renowned for their therapeutic benefits or use as natural pesticides [8]. Herbal product excluded from medical utilization in the mid of 20<sup>th</sup> century, not important because to their inabilities, but rather because they have economic viability compared to the newly developed synthetic drugs [9]. One of the world's oldest medical disciplines is traditional Indian medicine. In traditional medicine system Ayush is the most impotent factor. Ayush stands for Ayurveda, Yoga, Unani, Siddha and Homeopathy. The most often used form of traditional Indian medicine, Ayurveda, places a strong emphasis on holistic treatments that treat the mind, spirit, and body as a whole [10]. In recent times, traditional herbal medicine has gained increasing recognition and interest from the scientific community and mainstream healthcare institutions [11]. Researchers are studying the specific chemical components of medicinal plants, their pharmacological properties, and potential applications in modern medicine. Integrative medicine, which combines conventional medical practices with traditional approaches, is becoming more prevalent, acknowledging the value of traditional herbal medicine alongside evidence-based treatments [12]. 129 herbal remedies are used in Israel to cure a variety of illnesses, including excessive cholesterol, obesity, digestive tract disorders, skin conditions, respiratory conditions, and various malignancies [13]. That's why herbal treatments have become a reliable matter for us now.

**2. HERBAL MEDICINES AND THEIR USEFULNESS**

The medicinal application of plants or their extracts is referred to as using herbal remedies, often known as herbalism or phototherapy. It is a traditional medical treatment that has been used for countless years by numerous cultures around the world [14]. In order to improve health and treat a variety of disorders, herbal medicine makes use of the therapeutic characteristics of numerous plant components, including leaves, blossoms, stems, roots, and seeds. The practice of herbal medicine based on that plant contains natural substances that are highly useful to treat our body

by itself these natural substances. In the human body, phytochemicals have a wide variety of biological effects. Many different ailments have been treated with herbal medicine, including common disorders like colds, boosting the immune system, improving our digestive system, enhancing sleep quality, reducing stress, and promoting relaxation [15]. There are many reasons why patients choose herbal treatments. Patients typically turn to natural treatments when they have an acute, frequently self-limiting ailment like a cold, throat infection, or bee sting because accessing medical care is difficult, uncomfortable, expensive, or time consuming [16]. People believe that natural plant items are healthier than synthetic drugs [17]. The natural world is home to a variety of plants and traditional remedies that are used to cure liver disorders, kidney diseases, skin diseases, diabetes etc [18]. There are numerous synthetic medications available on the market today that are quite expensive and have a lot of negative side effects. On the other hand, synthetic medications are exceedingly expensive, making them unaffordable for a substantial portion of the population. Around the world, research on therapeutic plants has increased recently. Because vitamins and minerals are combined with therapeutic components, natural pharmaceuticals are gaining remarkable relevance and appeal as safe, effective, and affordable medicines with extraordinary benefits [19]. Herbal medications can be used to treat cardiovascular disorders, which are now the leading cause of death worldwide [20]. One such area is cancer, where researchers anticipate novel chemicals from plants that could be an effective weapon in the fight against this dreadful illness [21]. On the other hand, if we notice that herbal products such as herbal tea, essential oil, herbal medicine etc are conveniently obtained from any medical store or food store, you can buy them easily without any type of prescription from any doctor. This procedure substantially reduces the complexity of acquiring herbal products and saves on additional medical expenses [22]. The herbal medicine has many importance in current time like, i) It can enhance availability of primary health care. ii) It improves the economic stability. iii) Potential for long term and sustainable for biodiversity. iv) Medicinal plants are the vital source of compound that might be utilized to create novel medication or drug molecules [23].

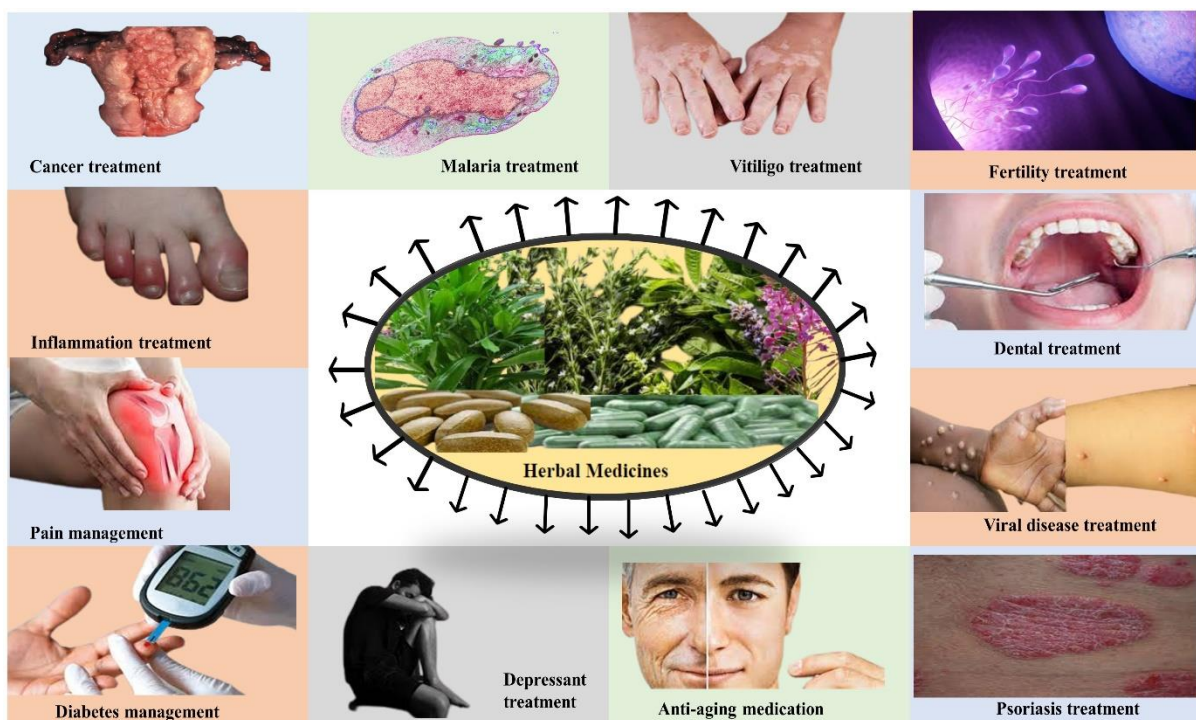


Figure-2: Use of herbal medicines in several human diseases.

### 3. HERBAL MEDICINES AND THEIR ACTIVITY IN HUMAN DISEASES.

#### 3.1 Anti-Cancer Phytomedicines:

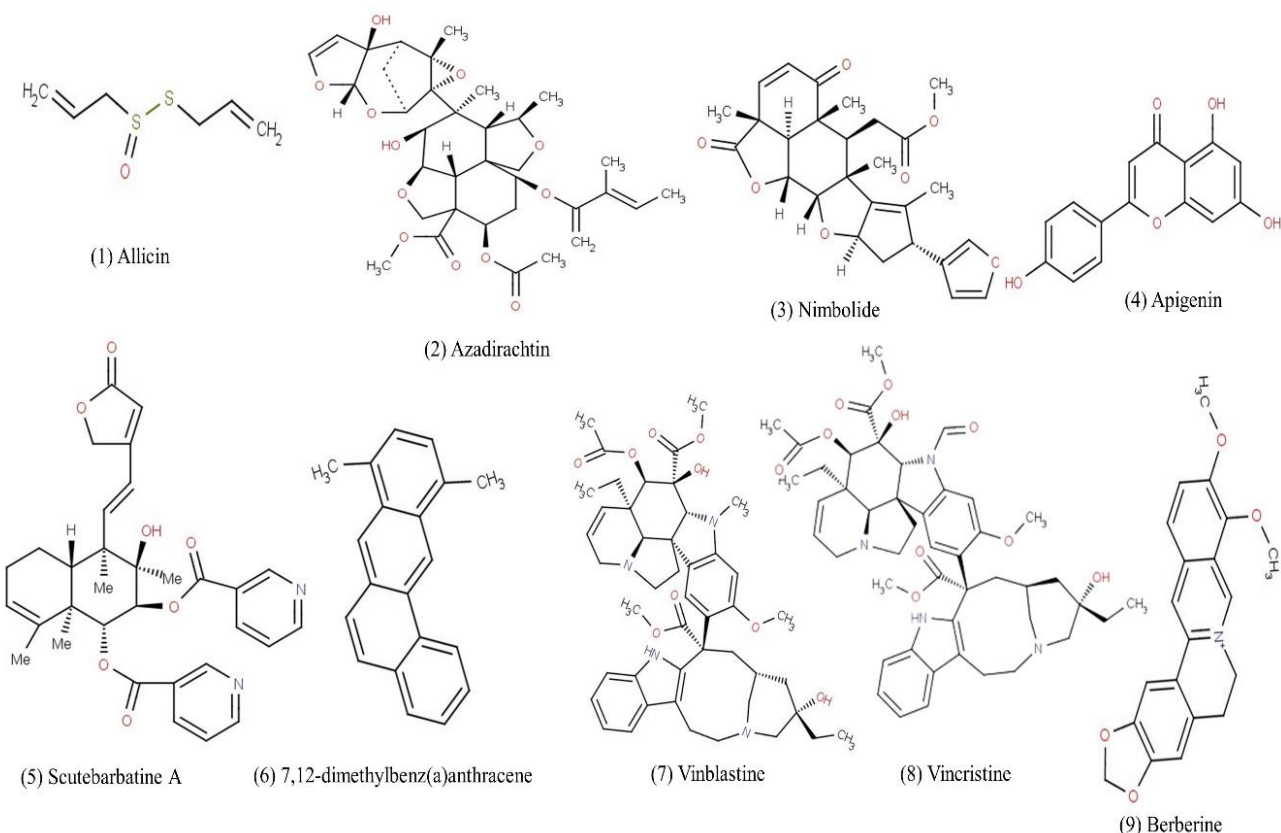
The practice of using natural plant components to treat cancer is known as anticancer phytomedicine, commonly referred to as phytotherapy or herbal medicine. In order to prevent, treat, or manage malignant growths, this discipline of medicine investigates the medicinal potential of numerous plants and their extracts. Anticancer phytomedicine, which has a long history anchored in conventional medical practices from around the world, presents promising

options for both complementary and alternative cancer therapy modalities. The effectiveness of these herbal treatments in the fight against cancer is a topic of ongoing research. Below is a list of several anticancer herbal remedies-

- ***Allium sativum***; It is usually referred to as garlic and is a member of family Alliaceae. It is indigenous to the area between the Mediterranean and China [24]. Diallyl trisulfide, allicin(1), diallyl disulfide, diallyl sulfide, and allyl mercaptan are the chief compounds obtained from the methanolic, ethanolic and hydro-alcoholic extract. It exhibits anticancer efficacy against breast cancer, A549, MCF7 & DU145 as well as bladder cell carcinoma [25,26].
- ***Astragalus membranaceus***; It is often known as mongolian milkvetch and is belonging to the Fabaceae family. Parts of China are where the plant is frequently found. Astragalus polysaccharide is the chief compound responsible for inhibition of breast cancer cell growth [27]. It also guards against the damaging effects of chemotherapy on the liver [28].
- ***Azadirachta indica***; It is often known as neem tree and falls under Meliaceae family. It is indigenous to India and the Indian subcontinent. The ethanol extraction of the neem leaves contains the chief compounds like azadirachtin(2) and nimbolide(3), which cures cancers of the mouth, mammary glands, prostate, stomach, and prostate [29,30].
- ***Wedelia chinensis***; It is basically known as pilabhamgara or bhringraj and is a member of the Asteraceae family. It is indigenous to China, South-East Asia, and India. It contains active compound luteolin, and apigenin(4), which are beneficial against lung, prostate, breast, colon, pancreatic and glioblastoma cancer [31,32].
- ***Scutellaria barbata***; It is often known as the barbed skullcap, is an important member of the Lamiaceae family [33]. The methanolic and ethanolic extract of the whole plant contains scutebarbatine A(5), is effective to inhibit the proliferation and migration of breast cancer [34,35]. Skin cancer, hepatoma, lung cancer, and colon cancer can be treated [36].
- ***Camellia sinensis***; It is frequently referred to as green tea and is a member of the Theaceae family. It is primarily seen in Southeast Asia, East Asia, and the Indian Subcontinental area. The hydroalcoholic extract of the leaves contains, epicatechin-3-gallate, catechins, epigallocatechin-3-gallate, epicatechin, epigallocatechin and five major flavonoids. These flavonoids and polyphenolic compounds have anti-mutagenic and anti-carcinogenic properties. Additionally, it slows the spread of cancerous cells by removing harmful free radicals of the body [36]. It is effective against the colon and stomach cancer also [37].
- ***Cannabis sativa***; It is also known as hemp, marihuana and marijuana and is a member of the Cannabinaceae family. It can be found in East Africa, South Africa, East Asia, Bangladesh, Pakistan, Iran, Central America, and the United States. It includes cannabinoids such as cannabinol, anandamide, pinene, and myrcene [38]. Cannabinoids cause cancer cells to undergo apoptosis, stop their ability to proliferate, migrate and angiogenesis in tumor cell [39].
- ***Glycine max***; It is generally referred to as a soy bean, belonging in Fabaceae family. It is native medicines of East Asia. The ethanolic extract of the plant contains the active compound 7,12-dimethylbenz(a)anthracene(6)[40]. It reduces necrosis and proliferation of cancer cell [36].
- ***Catharanthus roseus***; It is commonly known as vinca, nayantara, bright eyes, sadaphuli etc and is a member of the Apocynaceae family. Vinblastine(7) and vincristine(8), the vinca alkaloids are the chief bioactive substances it contains [41].Leukemia and lymphoma are frequently treated with these compounds [42].
- ***Vismia laurentii***; It is often known as vasmia and is a member of the Guttiferae family. Tropical and subtropical climates around the world are where it can be found. The fruit and seeds contain anthraquinones, xanthenes and naphthoquinones, as the chief anticancer compounds. Numerous cancer cell cultures have demonstrated the anticancer potential of Xanthone V1 [43].
- ***Berberis aristate***; It is commonly known as barberry and is a member of Berberidaceae family. It is thoroughly distributed in temperate and subtropical regions of Europe, America and Asia. The ethanolic extract contains

berberine(9) as an active anticancer compound. The human colon cancer cell cultures have been shown to be susceptible to the anticancer effects of *B. aristata*'s methanolic extract, in which HT29 cells are likewise inhibited in a concentration dependent manner [44].

- ***Tussilago farfara***; It is frequently called as coltsfoot, under the family Asteraceae. It is indigenous to Europe and other parts of western and central Asia. The flower buds contain an active compound tussilagone and other phenolic compounds, which can augment apoptosis in human carcinoma of the liver cells and inhibit colon cancer cell growth [45].



**Figure-3:** Structures of chief chemical compounds.

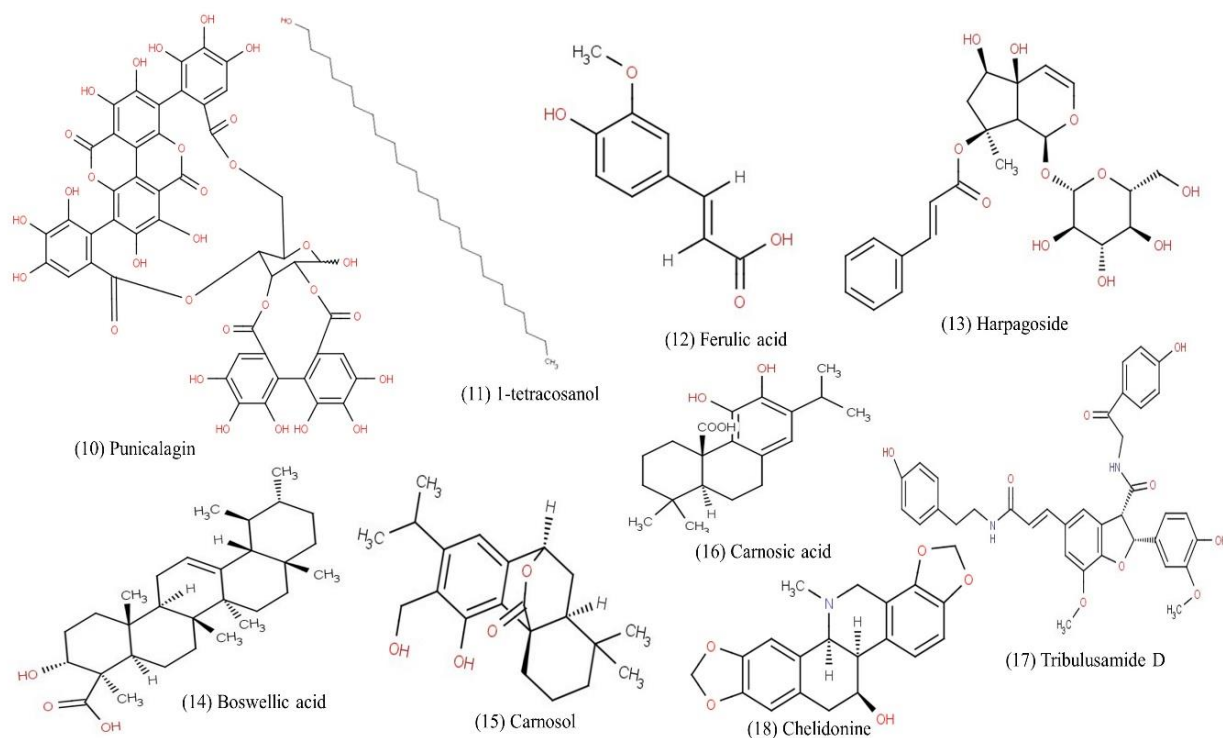
### 3.2 Anti-inflammatory Phytomedicines:

An area of alternative medicine called anti-inflammatory phytomedicine focuses on using plant-based substances to reduce inflammation in the body. By utilizing the therapeutic benefits of numerous botanical extracts, this discipline aims to reduce chronic inflammation, a major contributor to several medical problems. Anti-inflammatory phytomedicine, which has a long history of use in conjunction with conventional herbal treatments, provides a comprehensive and complementary strategy for treating conditions involving inflammation. The powerful anti-inflammatory properties of these natural therapies are being revealed by ongoing research, creating new opportunities for better health and wellbeing. The following is a list of several anti-inflammatory plant remedies-

- ***Punica granatum***; It is basically known as pomegranate and is a member of the family Lythraceae [46]. It is originated from Iran to the Himalayas in northern India. The anti-inflammatory properties of pomegranate assign for the existence of the phenolic compounds like punicalagin(10), anthocyanin and ellagic acid in concurrence with the occurrence of fatty acid in the seeds [47]. Punica acid is present in its seed oil which suppresses in biosynthesis of prostaglandin, and therefore it exhibits the anti-inflammatory activity [48].
- ***Oenothera biennis***; Evening Primrose is the common name for it and belongs to the Onagraceae family. It has a native range that extends from Newfoundland to Alberta in the west to Texas in the southwest. It has also been extensively naturalized in other temperate and subtropical regions. 1-tetracosanol(11) is an aliphatic alcoholic

compound and ferulic acid(12) is a phenolic compound which are present in this plant extract and responsible for anti-inflammatory activity [49].

- ***Nigella sativa***; It is widely known as black cumin under the family Ranunculaceae. It is indigenous to Southwest Asia, North Africa, and Southern Europe. The oil and seeds are said to have anti-inflammatory effects because of the existence of its main phytochemical compound thymoquinone [50]. It shows covenant a potential in the treatment of arthritis.
- ***Harpagophytum procumbens***; Its common name is devil's claw and is a member of the Pedaliaceae family. Harpagoside(13) is the major chemical constituents, regarded as an anti-inflammatory substance [51]. The root extract has been asserted to have the ability to inhibit PGE<sub>2</sub>, NO and inflammatory cytokines (IL-6, TNF- $\alpha$  and IL-1 $\beta$ ), and it hinder metabolism of arachidonic acid and biosynthesis of eicosanoid, resulting in COX-2 inhibition and mitigating inflammation [52,53].
- ***Boswellia serrata***; In Ayurveda it is also formally as shallaki. The plant is a member of the Burseraceae family and grows throughout the Middle East, Northern Africa, and dry mountain regions of India [54]. Some bioactive chemicals are found in *B. serrata* specially, acetyl-11-keto-boswellic acid, boswellic acid(14) and its derivative have been identified as particularly effective inhibitors of the formation of 5-LOX. Given the significance of 5-LOX in biosynthesis of leukotriene and its substantial expression in OA synovium and RA, LOX pathways play a critical role in inflammation. Thus, 5-LOX is inhibited by boswellic acid which may offer relief from arthritic symptoms [55].
- ***Ribes nigrum***; The formal name of it is black current and it belongs to Grossulariaceae family. It originates from temperate northern Eurasia. Black current oil is a substantial source of n-6 polyunsaturated fatty acids (PUFA), linoleic acid, and linoleic acid. Due to its anti-inflammatory effects, it is used to treat gout and arthritis [56].
- ***Commiphora wightii***; It is widely known as Guggulu in Ayurveda, a member of the Buseraceae family and thrives well in tropical India's dry, sandy, and rocky regions [57]. The main chemical constituents are rone, E-guggulsterone, Z-guggulsterol and guggulsterol I-V, the resins which can be used to treat a wide range of illnesses, such as arthritis and inflammation [58].
- ***Piper longum***; In Ayurveda it is being known as pippali under the family Piperaceae and grows naturally in Vietnam, Sri Lanka, Malaysia, Nepal, and India. Piperine, piperlonguminine and piperlongumine are the main Phyto- chemical constituents of *Piper longum* fruit oil, responsible for reducing edema and muscular pain [59].
- ***Rosa canina***; The common name of it is dog rose and belongs to the Rosaceae family. It is native to Northwestern Africa, Western Asia, and Europe. The hydroalcoholic extract of the fruits plays potential role as a therapeutic adjuvant when treating inflammatory diseases [60].
- ***Salvia officinalis***; Sage is the common name of it and belongs to the Lamiaceae family. It is indigenous to the Mediterranean and Middle East regions. The chloroform and the n-hexane extract of the leaves contain phenolic diterpenes, carnosol(15) and carnosic acid(16), which is having anti-inflammatory properties [61].
- ***Tribulus terrestris***; It is widely known as gokharu, belonging to the Zygophyllaceae family. It can be found all throughout Africa, New Zealand, Australia, and warm temperate and tropical parts of southern Europe and southern Asia. Tribulusamide D(17) has been isolated as the active phytocompound, which is used to treat a variety of illnesses including edema, high blood pressure and inflammatory disorders in several countries [62].



**Figure-4:** Structures of chief chemical compounds.

### 3.3 Analgesic Phytomedicines:

Herbal analgesics use the medicinal potential of diverse plant-based substances to reduce pain and discomfort naturally. This method, which is based on age-old, cross-cultural traditional healing methods, strives to reduce pain without the use of artificial drugs. A growing number of studies is demonstrating the effectiveness of analgesic herbal medicines for pain relief, which range from calming teas to topical applications. Analgesic herbal medicine keeps rising in recognition and acceptance as people look for more sustainable and natural healthcare choices. The medicinal plants, which shows analgesic activities are discussed in below-

- ***Bougainvillea spectabilis***; It is also known as paper flower and belongs to the Nyctaginaceae family. It is indigenous to the Chubut Province of Argentina, Bolivia, Peru, and Brazil. The methanolic extract of its leaves contain carrageenan, which is the chief active compound, responsible for anti-analgesic activity [63].
- ***Chelidonium majus***; It is also known as killwort, tetterwort and falls under the Papaveraceae family. It is originated in Europe and western Asia and was widely imported to North America. The aqueous extract of the plant contains berberine(fig-9) and chelidonine(**18**), which are responsible for the analgesic activity [64].
- ***Ficus glomerata***; It is commonly known as audumbar tree in India and falls under Moraceae family. This plant is indigenous to Australia, Malaysia, Southwest Asia and Indian subcontinent. The ethanolic extract of leaves are chemically rich in tannins and polyphenols, which have been shown to have analgesic and anti-inflammatory effects in various types of pain and inflammation.
- ***Dalbergia lanceolaria***; The herb is basically known as goraksh in Sanskrit and belongs to the Fabaceae family. It is native to Indo-China, India, Sri Lanka, Nepal, and Burma. The ethanolic extract of the bark is having potent analgesic action.
- ***Glaucium grandiflorum***; It commonly known as great flowered horned poppy and belongs to family papaveraceae. Its range extends from Iran to the Eastern Mediterranean. The methanolic extract of total alkaloid mainly isoquinone alkaloid show anti-analgesic activity.

- ***Polyalthia longifolia***; It is commonly known as mast tree and false Ashoka, belonging from the Annonaceae family. It can be found in tropical and subtropical areas including Australia, South Asia, and South East Asia. Quercetin, [rutin](#), [spinasterol](#),  $\alpha$ -spinasterol these are the main chemical compound which responsible for anti-analgesic activity.
- ***Toona ciliata***; Its common name is red cedar. It falls under the Meliaceae family. As one moves east from Burma, India, Thailand, China, Malaysia, Nepal, and Java to Europe, they are widely dispersed at higher altitudes [65]. It contains bergapten(**19**) which may be responsible for the narcotic analgesic activity and helpful in pain management [66].
- ***Papaver somniferum***; It is also called as opium poppy or breadseed poppy and falls under family Papaveraceae. It is native range is east of the Mediterranean Sea. Morphine is the chief compound, present in a huge amount in the dried latex of the fruit, is responsible for analgesic activity. It is a centrally active agent and used in severe cases only. It falls under narcotic drug.
- ***Aloe vera***; It is commonly known as ghrit kumari and is a member of Liliaceae family. They can be found all throughout India, Africa and other dry regions. The aerial parts and dried juice of leaves contains active compounds like aloe-emodin, aloesin(**20**), aloin(**21**), emodin, and acemannan which are responsible for analgesic activity.

### 3.4 Antidiabetic Phytomedicines:

Antidiabetic herbal medicines are a branch of traditional and complementary medicine that utilizes the healing properties of various plant-based compounds to manage and control diabetes. These remedies draw upon a rich history of herbal treatments from diverse cultures, offering natural alternatives to synthetic drugs. As diabetes continues to be a global health concern, antidiabetic herbal medicines have garnered attention for their potential in regulating blood sugar levels and improving overall well-being. Ongoing research aims to further validate the effectivity and safety of these herbal interventions in managing diabetes. Below is a list of several antidiabetic herbal remedies-

- ***Capsicum frutescens***; In Ayurveda it is commonly known as katuviraa but in our Indian traditional culture we commonly know it as gachmirch or mirchi. It is an American native and is grown in tropical areas such as India, Japan, southern Europe, Mexico, and Africa. The primary active component is capsaicin(**22**), a phenylpropanoid compound present in it which is responsible for anti-diabetic activity [67].
- ***Momordica charantia***; The commonly known as karela, bittermelon etc. It lies under the Cucurbitaceae family and is now pantropical but originally from the old-world tropics. The fruit and seeds extracts contain main chemical element Charantin(**23**) which have anti-diabetic activity [68].
- ***Azadirachta indica***; Neem, margosa or Indian lilac are the popular name of it and belongs to the family Meliaceae. It is indigenous to the majority of the African nations as well as the Indian subcontinent. There are some bitter compounds present in it these are nimbin, nimbinin and nimbidin. The leaf extract, seed oil, nimbidin(**24**) shows the anti-diabetic activity or hypoglycaemia [69].
- ***Gymnema sylvestre***; It is also known miracle fruit and sometimes also called as australian cow plant, gymnema and cowplant. It belongs to the family Apocynaceae [70]. Gymnemic acids, a class of oleanane-type triterpenoid saponins, is the primary bioactive component. From the extract of leave we find gymnemic acids(**25**) which exhibit anti-sweet activity [71]. It also helps to prevent adrenal hormone secretion by stimulating liver to synthesize glucose for that reduce blood sugar level [72].
- ***Gymnema sylvestre***; It is also known as gudmar. Asclepiadaceae is the family where it is belonging. It is a native of Australia, tropical Africa, and central and western India. Gymnemic acids, gymnema saponin these are two main active ingredients present in the leaf, callus, steam, which is used for Anti-diabetic activity [73].
- ***Holostemma creper***; It is also known as holostemma or chhirvel and belongs to the Asclepiadaceae family. It is native to southern Asia. The roots contain some flavonoids, tannins, terpenoids as active compound. It is specifically used for Anti-diuretic agent [74].



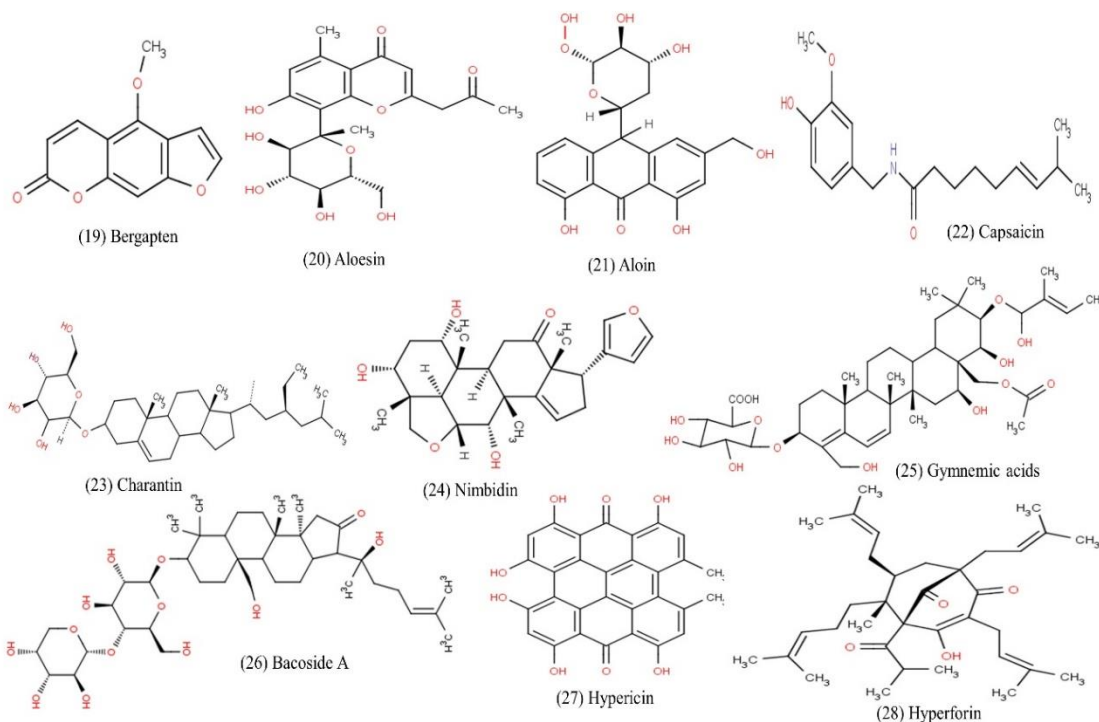
- ***Aegle marmelos***; It is commonly known as bael and belongs to the Rutaceae family. It is grown in Sri Lanka, Tamil Nadu, Thailand, and Malesia and is native to the Indian subcontinent and Southeast Asia. Methanolic leaf extract showed potent effectivity to reduce the oxidative stress induced by alloxan and produced a reduction in blood sugar [75].
- ***Ginkgo biloba***; It is also known as maidenhair tree. Ginkgoaceae is the family where the plant belongs to. It is indigenous to China. The leaves contain bioactive compounds like terpenoids and flavonoids which works in diabetes by promoting insulin receptor substrate 2 transcription and reducing insulin resistance, it primarily increased insulin sensitivity [76].
- ***Teucrium polium***; It is commonly known as felty germander and falls under Lamiaceae family. It is widely spread in practically all Mediterranean nations, southern Asia, Europe, and North Africa, as well as the arid, stony areas of the hills and deserts. The crude drug's extract can boost pancreatic insulin production, which in turn can increase insulin secretion [77]. Its anti-diabetic benefits are due to the presence of apigenin, which is only present in the methanol fraction and absent from the aqueous fraction [78].

### 3.5 Antidepressant Phytomedicines:

Antidepressant phytomedicine is a therapeutic approach that harnesses the power of natural plant compounds to alleviate symptoms of depression and improve mental well-being. This field of alternative medicine draws inspiration from traditional herbal remedies and seeks to offer holistic solutions for individuals facing mood disorders. With a growing interest in mental health and well-being, antidepressant phytomedicine is gaining recognition as a complementary and sustainable option for those seeking relief from depressive symptoms. Ongoing research explores the efficacy and safety of these natural interventions in promoting mental health. Numerous plants may be used to treat depression, and their effects include [79]-

- ***Bacopa monniera***; It is commonly known as brahmi, falls under Plantaginaceae family. It is found in the wetlands of southern and eastern India, Australia, Africa, Asia, Europe, North and South America. Methanolic extract of leaves contain bacoside A(**26**), which is used in the treatment of depressant, anxiety and insomnia.
- ***Piper methysticum***; It is commonly known as kava or kava kava, under the family Piperaceae. It is native to Melanesia, Micronesia and Polynesia. Kavalactones compound have been found in this plant. Used in the treatment of depressant, and to reduce anxiety via modulation of GABA.
- ***Panax quinquefolius***; It is also called as American ginseng, falls under family Araliaceae and is native to China and eastern North America. Ginsenosides have been found to show antidepressant-like impact on depression brought on by CRS by suppressing the hypothalamo-pituitary-adrenal axis and engaging in anti-inflammatory and antioxidant actions.
- ***Rhodiola rosea***; It is commonly known as rose root and falls under the family Crassulaceae. They are indigenous to Europe, North America, Asia. It contains active compounds like tyrosol, rhodioloside and rosavin, responsible for antidepressant activity. It is fantastic for increasing energy levels, moods and mental performance. But pregnant, breastfeeding women and children should avoid it.
- ***Hypericum perforatum***; It is commonly known as St. John's wort of the Hypericaceae family. It was introduced to East Asia, Australia, New Zealand, and some portions of North and South America from temperate regions in Eurasia and North Africa. Hypericin(**27**) and hyperforin(**28**) exerts the potential antidepressant effect.
- ***Valeriana officinalis***; It is also known as valerian and is a perennial flowering plant under Honeysuckle family. It is indigenous to Asia and Europe. The hydro-alcoholic extract of the root contains valerenic acid(**29**) as an active compound and has been found potent antidepressant activity in ovalbumin sensitized rats. It is used for not only the treatment of depression but also include headaches, premenstrual syndrome (PMS), anxiety, and insomnia.
- ***Crocus sativus***; It is basically known as saffron, under Lridaceae family. It is native to Asia Minor, Greece and Persia. It possesses different active antidepressive phytochemicals like crocin, crocetin and safranal. 30 mg/ day dose of saffron TDS and BD has been proven to be successful in treating mild to moderate depression.

- ***Clitoria ternatea***; It is commonly known as bluebellvine, blue pea, Asian pigeonwings etc and falls under Fabaceae family. It is abundantly found in the tropical areas. The methanolic extract of the flower possess antidepressant activity via serotonergic system.
- ***Magnolia officinalis***; It is commonly known as magnolia-bark under the family Magnoliaceae. It is distributed in central and eastern Himalayas, Malaya peninsula and Burma. The aqueous extract of the bark contains magnolol(30) and dihydroxydihydromagnolol as the active constituents against the experimental depression in mice.



**Figure-5:** Structures of chief chemical compounds.

### 3.6 Antiaging Phytochemicals:

Antiaging herbal medicine is a branch of holistic healthcare that taps into the rejuvenating properties of various plant-based compounds to slow down the aging process and promote overall longevity. Rooted in traditional healing practices from around the world, this approach seeks to address age-related concerns naturally. With a growing emphasis on healthy aging and youthful vitality, antiaging herbal medicine offers a compelling alternative to synthetic products and invasive procedures. Ongoing research continues to unveil the potential of these herbal remedies in supporting both physical and cognitive health as individuals strive to age gracefully. The name of some plants are listed below [80] –

- ***Pinus roxburghii***; It is also known as pine tree and falls under the family Pinaceae. It is indigenous to northern India, Tibet, Afghanistan, Pakistan, Nepal, Bhutan, and Myanmar. The pine bark extracts contain some phenolic compounds like catechins, taxifolin and phenolic acids. They are having antiaging effects along with other effects.
- ***Ficus benghalensis***; It is commonly known as banyan, Indian banyan and banyan fig, under Moraceae family. It is originated on the Indian Subcontinent. It's leaf and bark are full of flavonoids, terpenoids, phenols etc. Root is full of amino acids, fatty acids and sterols, which give the antiaging property.
- ***Vitis vinifera***; It is commonly known as grape under Vitaceae family. It is native to the Mediterranean region, Central Europe, and southwest Asia. In the north and east, it can be found from Morocco and Portugal to southern Germany and northern Iran. The ethanolic extract of seed and leaf is having the antioxidant property and effective against oxidative damage, free radical damage and age related diseases [81].

- ***Vaccinium corymbosum***; It is commonly known as blueberry, also called jamun in India. It belongs to Ericaceae family. From Ontario in the east to Nova Scotia in the south, and as far south as eastern Texas and Florida in the north, it is endemic to eastern Canada and eastern and southern America. Myricetin seems to slow down UVB-induced rapidly accelerated fibrosarcoma (Raf) kinase activity in order to have its anti-aging benefits.
- ***Arnica montana***; It is also called leopard's bane wolf's bane etc. It is a species of Asteraceae family. It can be found to grow in the highlands of central and northern Europe. By including this adipose enhancer in skincare products, lips, face, and breast volume are increased, reversing age-related loss at any age. Many face masks and eye creams contain the active component arnica, which can be used on face at night or even in the morning.
- ***Triticum aestivum***; It is commonly known as wheat under poaceae family. They are broadly cultivated in southern United States, southern, eastern, and western Mexico, Paraguay, Colombia, and other regions are anticipated to experience them. The extract contains ferulic acid(12), a phenol and several polar lipids which gives important moisturizing action, raising the skin's moisture level and enhancing several anti-aging properties, including skin elasticity, smoothness, and anti-redness.
- ***Thymus vulgaris***; It is popularly called thyme and falls under Lamiaceae family. It is originated in southern Europe. Thymol-2-isopropyl-5-methylphenol(31) is the phenolic compound considerably diminished facial lines and wrinkles, encouraging remodelling of the face oval and antiaging problems.

### 3.7 Antipsoriasis Phytomedicines:

Antipsoriasis phytomedicines are a branch of natural medicine dedicated to utilizing plant-derived compounds to alleviate and manage the symptoms of psoriasis. This field draws from a rich history of herbal remedies and botanical therapies, aiming to provide relief from the chronic skin condition characterized by red, scaly patches. With psoriasis affecting millions worldwide, antipsoriasis phytomedicines offer a holistic and potentially effective approach to mitigate its impact on patients' lives. Ongoing research explores the diverse botanical solutions that hold promise in addressing this challenging dermatological condition. List of antipsoriasis phytomedicines [82,83] are-

- ***Azadirachta indica***; It is also known as neem and is a member of the Meliaceae family. It is believed to have organically spread throughout the Indian subcontinent from its origin in the Assam-Burma (Myanmar) region. Neem oil is effective to treat the symptoms of psoriasis, eczema and other disorder of skin. Azadirachtin is the main active compound which show anti-psoriasis activity.
- ***Cassia tora***; It is also known as sickle senna and belongs to the Fabaceae family. It is native to south Asia. O- $\beta$ -glucopyranoside, formononetin-7-O- $\beta$ -D-glucoside and quercetin-3-O- $\beta$ -D- glucuronide are the chief compounds. In rat models of ultraviolet-B-induced psoriasis, crude extracts including methanolic extract of leaves exhibit strong antipsoriatic action.
- ***Calendula officinalis***; It also known as the common marigold or pot marigold, belonging to the Asteraceae family. It is most likely native to southern Europe and may have garden beginnings, despite the fact that its long history of cultivation makes its precise origin unclear. The leaves contain carotenoids such as lutein(32) (80%), zeaxanthin(33) (5%), and beta carotene which shows antipsoriasis activity. To treat burns, bruises, and cuts as well as the small infections, it is used in tincture form, ointments, and washes.
- ***Wrightia tinctoria***; Common names for it include dyer's oleander, sweet indrajao, and pala indigo Plant and falls under the family Apocynaceae. It is primarily found in Myanmar, Nepal, and India. With the exception of the northern and north-eastern states, it is present over most of the peninsula and central India. The primary active ingredient, responsible for its antipsoriasis activity is isotretinoin(34), which is found in a purely alcoholic extract of the plant's leaves.
- ***Nigella sativa***; It is commonly known as black cumin and falls under the family Ranunculaceae. It is native to eastern Europe and western Asia. The seeds' 90% ethanolic extract has antipsoriatic effect, and external application of it helps treat psoriasis.
- ***Angelica dahurica***; It is also referred to as Chinese angelica, garden angelica, and Holy Ghost root, among other names. It falls under the Apiaceae family. It is only found there, as well as in Siberia, Mongolia, Japan,

Northeastern China, Taiwan, and Korea. It is also found in Far Eastern Russia. The aqueous extract of roots has the ability to normalize basal cell proliferation in psoriasis patients and accelerate the degeneration and breakdown of psoriatic cells.

- ***Centella asiatica***; It is also known as Indian pennywort, belonging to Apiaceae family. It is indigenous to islands in the western Pacific Ocean and tropical areas of Africa, Asia, and Australia. The plant contains madecassoside and asiaticoside, which are helpful in inhibiting the keratinocyte replication.

### 3.8 Phytomedicines in Dentistry:

Dental disorders phytomedicines include the use of organic plant-based substances to prevent, treat, or manage a variety of conditions affecting the mouth. This method, which has its roots in conventional and herbal medicine, offers different remedies for typical dental problems such as cavities, gum disease, and tooth sensitivity. Dental problems phytomedicines have received recognition for their potential in enhancing oral hygiene and overall dental well-being as individuals look for holistic and sustainable healthcare solutions. The effectiveness and safety of these herbal therapies for preserving a healthy smile are still being investigated through ongoing research. There are so many plants which are having dental-care benefits include [84,85]-

- ***Acacia catechu***; It is called catechu, cachou and black and falls under the family Fabaceae. It is native to South Asia, Myanmar, China, India. Camphor(**35**) (76.40%) and phytol(**36**) (27.56%) are the active compounds found in it. Six types of pathogenic and non-pathogenic microorganisms have been discovered to be resistant to substances contained in the plant's methanolic extract.
- ***Anacyclus pyrethrum***; It is also called akarkara, falls under the family Asteraceae. It is indigenous to Morocco, Spain, and Algeria. Levulinic acid, palmitic acid malonic acid are some active compounds of the plant that might help in strengthening teeth and gums and relieves toothache as they possess antibacterial, analgesic, and anti-inflammatory properties.
- ***Eucalyptus globules***; It is commonly named as tasmanian blue gum, under family Myrtaceae [86]. The leaves contain eucalyptol as an active component. Eucalyptus oil is a component of products used in dentistry as solvents and sealers for root canal fillings. Additionally, it is utilized in toothpaste, cough drops, lozenges, liniments, ointments, antiseptics, and mouthwash.

***Vachellia nilotica***; It is commonly known as acacia nilotic and belongs to the Fabaceae family. It is indigenous to Egypt, the Maghreb, and the Sahel, as well as Kwa Zulu-Natal, South Africa, in the south and the Indian subcontinent and Burma, respectively, in the east through the Arabian Peninsula. Gallic acid(**37**) and methyl gallate these are two main compound which are useful in the treatment of dental disease.

- ***Symplocos racemose***; It is commonly known as lodh tree, falls under the family Symplocaceae. It contains loutrine (0.25%), Colloturine (0.02%) and Loturidine (0.06%). It is used to make Ayurvedic remedies for a range of illnesses, including dental conditions, gynecological issues such as female infertility, gastrointestinal difficulties, and skin conditions.

***Ocimum sanctum***; It is frequently called tulsi. It is belonging from the Lamiaceae family. It is indigenous to Australia, Malesia, Asia, and the western Pacific, all of which have tropical and subtropical climates. Eugenol and methyl eugenol is the main active phytochemical which helps in the treatment of dental disease. It can be used as a tooth paste, to treat halitosis (poor breath), and to treat a variety of gingival and periodontal problems when combined with mustard oil [87].

- ***Juglans regia***; Common names for it include Persian walnut, English walnut, Carpathian walnut and so on and it falls under Juglandaceae family. It is widely cultivated across Europe and the Caucasus. organic polyphenols Important substances found in walnuts with beneficial qualities that have been researched for the management of dental inflammation are pedunculagin and ellagitannin. It functions well in dentistry as a tooth-whitening, antiplaque, antifungal, anti-bacterial, and anticariogenic material [88].

### 3.9 Antifertility Phytomedicines:

Antifertility phytomedicines refer to the use of natural plant-based compounds to regulate or inhibit fertility and prevent unwanted pregnancies. This area of herbal medicine draws inspiration from traditional contraceptive practices and aims to offer alternative, non-hormonal methods of family planning. As the demand for safe and natural birth control options grows, antifertility phytomedicines gain importance for individuals seeking reproductive control with fewer side effects. Ongoing research explores the effectiveness and reliability of these herbal remedies in providing responsible family planning choices. The following plants [89] are-

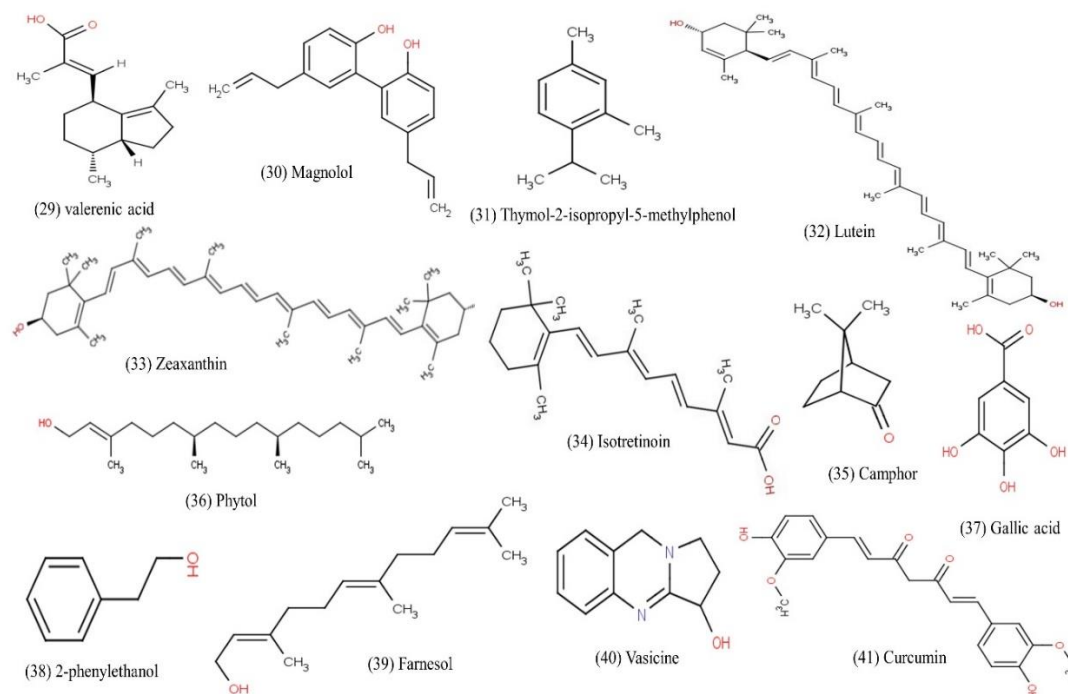
- ***Amaranthus spinosus***; It is also referred to as thorny amaranth, prickly amaranth, spiny amaranth, and spiny pigweed. It belongs to the Amaranthaceae family. It might be indigenous native to tropical America and is found throughout India. The ethanolic and the aqueous extract of the root contains phytosterols and polyphenol, which can be responsible for antifertility activity.
- ***Artabotrys odoratissimus***; It is commonly known as ylang-ylang vine and falls under Annonaceae family. It is a shrub found in India through to Burma, southern China and Taiwan. The oil is rich in terpinene-4-O1, linalol and caryophyllene oxide. Ethanol and water extracts of leaf showed anti-implantation effect. Ethanolic extract of bark and all the extracts of its flower reduced the number of implantations.
- ***Carcica papaya***; It is frequently referred to as pawpaw and falls under the Caricaceae family. It was first cultivated in Central America and is now spread throughout the world's tropical and subtropical climates. The aqueous extract of root contains different photoactive compounds, which is having the potent antifertility activity in male and female both.
- ***Evodia rutacapra***; It is frequently referred as bee tree or evodia and belongs to the Rutaceae family. In China, it is a well-known herbal remedy. Methanolic and ethanolic extract of the plant is having the antifertility activity.
- ***Hibiscus rosasinensis***; It is often known to as red hibiscus and belongs to the Malvaceae family. It can be found in tropics and subtropics. The root's ethanol and aqueous extract have antifertility, anti-implantation, uterotropic activity and estrogenic activity [90].
- ***Magnolia virginiana***; It is commonly called as swampbay and belongs to the Magnoliaceae family. Its original range extends from Florida, New York, in the lowlands and wetlands of the Atlantic coastal plain of the eastern United States. 2-phenylethanol(38) and farnesol(39) these are two main active constituents extracted is responsible for antifertility activity [91].
- ***Adathoda vasica***; It is basically called as malabar nut and belongs to Acanthaceae family. It is a native of India and can be found in a variety of settings, from plains to mountains. Vasicine(40), isolated from the plant showed potent abortifacient and uterotonic effects in guinea pigs.

### 3.10 Anti-vitiligo Phytomedicines:

Anti-vitiligo phytomedicines are a specialized branch of natural medicine focused on using plant-based compounds to manage and potentially treat vitiligo, a skin disorder characterized by depigmented patches. Rooted in traditional and herbal remedies, this approach offers hope to those seeking alternatives to conventional treatments. With the impact of vitiligo on individuals' self-esteem and quality of life, anti-vitiligo phytomedicines continue to garner interest as a complementary avenue for pigmentation restoration. Ongoing research explores the effectivity and safety of these herbal interventions in addressing this challenging dermatological condition. The following plants [92] can be used to cure vitiligo-

- ***Acorus calamus***; It is generally known as sweet flag. Vacha has been found to be the Sanskrit name of *Acorus calamus*. It belongs to the Acoraceae family and basically found in in Asia, North America, and Europe's subtropical and northern temperate zones. Camphene,  $\beta$ -pinene,  $\alpha$ -pinene, bornyl acetate, etc., are the major constituents present in the leaves and rhizomes of the plant. It possesses antivitaligo activity.
- ***Picrorhiza kurroa***; It commonly known as kutki under the Scrofulariaceae family. It is indigenous to Himalayan region from Kashmir to Sikkim. The drug was administered twice a day orally for three months to get the antivitaligo activity.

- ***Polypodium leucotomos***; It is also known as calaguala and falls under the Polypodiaceae family. It flourishes in Central and south America. vanillic, ferulic, caffeic acid, p-coumaric, Chlorogenic acids, 3,4-dihydroxybenzoic acid, 4-hydroxybenzoic acid, 4-hydroxycinnamic acid, and 4-hydroxycinnamoyl-quinic acid are the chief compounds to show adjuvant therapy for vitiligo patients.
- ***Chili peppers***; It is typically referred to as red pepper, long peppers, cayenne pepper, sweet peppers, bell peppers etc. and belongs to Solanaceae family. It is basically indigenous to Central or South America. The medication has been suggested as a therapeutic strategy for vitiligo treatments because of its anti-inflammatory and antioxidant qualities of its active constituent capsaicin.
- ***Curcuma longa***; It is commonly known as haldi, falls under the Lamiaceae family. It is native to southern India and Indonesia. Tetrahydrocurcumide cream has been used in association with nb - UVB for vitiligo treatments because of containing the active ingredient curcumin(41).
- ***Ginkgo biloba***; It is often known to as maidenhair tree and falls under Ginkgoaceae family. It is native to China. Numerous studies demonstrate the effectiveness of the herbal ingredient in reducing vitiligo activity and causing the white macules to repigment, especially when used in conjunction with other traditional treatments (such as corticosteroids and phototherapies).
- ***Cucumis melo***; It is commonly known as muskmelon and belongs to Cucurbitaceae family. They are basically found in Africa, Asia, and Australia. It contains active component *cucumis melo* superoxide dismutase, which is effective against vitiligo.



**Figure-6:** Structures of chief chemical compounds.

### 3.11 Anti-malarial Phytomedicines:

Artesunate (ART) and *Vernonia amygdalina* (VA) methanol leaf extract was studied recently in relation to how they interacted to remove parasitaemia in the treatment of malaria [93,94]. When paired with chloroquine (10 mg/kg), kaempferol, which is present in tea, beans, broccoli, and apples (20 mg/kg), has been reported to have a reasonable antimalarial effect [95]. *Gynostemma pentaphyllum* and *Moringa oleifera*'s extract demonstrated a promising future for development as an antimalarial combination therapy [96]. The effects of co-administration of *Balanites aegyptiaca* hydroalcoholic fruit extract and *Aloe camperi* leaf latex on the antimalarial action of chloroquine were examined [97]. *Uvaria chamae* methanol leaf extract, *Cryptolepis sanguinolenta*, *Azadirachta indica*, *Telfaria occidentalis*, *Carica papaya* with artesunic acid, *Khaya grandifolia*, *Ageratum conyzoides*, *Khaya grandifolia* etc have shown effectiveness

in the treatment of malaria. From 11 families such as *Toddalia asiatica*, *Albizia gummifera*, *Rhamnus prinoides*, *Rhamnus staddo*, *Ficus sur*, *Maytenus senegalensis*, *Caesalpinia volkensii*, *Withania somnifera*, *Vernonia lasiopos* and *Ekebergia capensis* the methanolic extracts of 15 medicinal plants is being used traditionally in Kenya for the treatment of malaria [98].

### 3.12 Antiviral Phytomedicines-

Antiviral phytomedicines fight against a variety of viruses, including AIDS (acquired immunodeficiency syndrome), HIV (human immunodeficiency virus), SARS (severe acute respiratory syndrome), herpes viruses, HSV (herpes simplex virus), measles virus, VZV (varicella zoster virus), influenza viruses, corona virus, ebola virus, hepatitis viruses etc. *Olea europaea*, *Eupatorium perfoliatum*, *Polygonum chinense*, *Thuja orientalis*, *Bletilla striata* etc fight against influenza virus. *Rosa centifolia*, *Ficus benghalensis*, *Daphne gnidium*, *Calendula officinalis* acts as anti-HIV phytomedicine. *Swertia angustifolia*, *Acanthus ilicifolius*, *Phyllanthus emblica* etc fight against hepatitis B virus. *Melanolepis multiglandulosa*, *Phyllanthus amarus*, *Limonium sinense*, *Rhizoma coptidis*, *Cinnamomi cortex* etc are helpful in HCV. *Peganum harmala*, *Pistacia vera*, *Terminalia chebula*, *Rhododendron ferrugineum* etc are helpful in HSV. *Bombax ceiba*, *Aegle marmelos*, *Citrus sinensis* etc are helpful in COVID-19.

### 4. FORMULATION OF PHYTOMEDICINES:

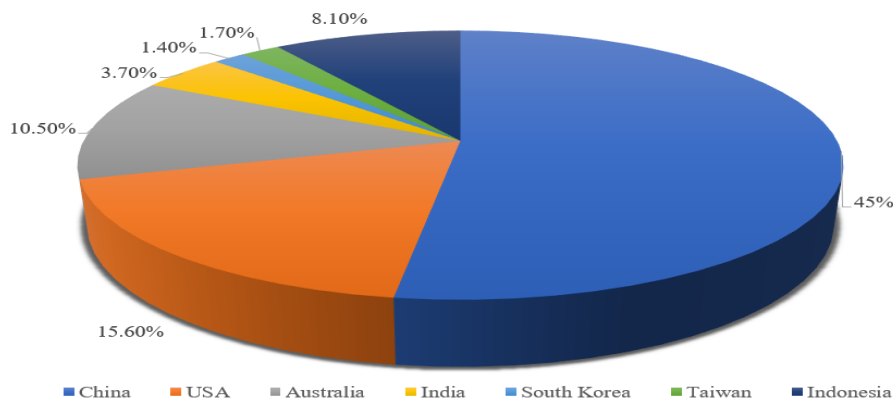
A dosage form that contains one or few herbs or processed herbs in a defined proportion to give certain nutritional or therapeutic effects to diagnose, treat, mitigate, and cure humans and animals, as well as change the structure or physiology of humans and animals, is referred to as herbal formulation. To formulate a finished herbal medicine or phytomedicines, we have to go through several steps to ensure the extraction of medicinal compounds from the plant material. The key points in the process includes the plant selection, more specifically the part of the plant selection, drying or the removal of moisture, grinding to increase the surface area aiding the better extraction of medicinal compounds. Then extraction of phytochemicals in several ways like infusion, maceration, tincture, decoction, oil infusion, soxhlet extraction, ultrasound assisted, high-performance liquid chromatography (HPLC), paper chromatography (PC) thin layer chromatography (TLC) and gas chromatography (GC). Filtration and making concentrate the filter. Sterilization and making formulation with or without using other ingredients. *In-vitro* or *in-vivo* studies on animal model. then, the drug's quality control and packaging to get ready for marketized. Then this formulated finished products are ready for use in need.



**Figure-7:** A depiction of the general methods used to prepare herbal medicines.

### 5. PRESENT STATUS OF HERBAL MEDICINES:

Due to their historic beliefs, lesser-known adverse effects, ease of accessibility, price, and other factors, herbal medicines are nearly universally regarded as the best option for treating a variety of common disorders. The demand for herbal or herbal remedies is still expanding significantly on a global scale. Many people are currently using phytomedicines to treat a range of health conditions in many national systems of healthcare [99]. Utilization of herbal medicine in wide level is not just seen in developing nations; in France and Germany, for example, it is believed that 70% of all doctors regularly prescribe herbal medicine [100]. In Africa more than 90% and India more than 70% of the population is using phytomedicines in primary health care. In China, conventional medicine makes up approximately 40% of all healthcare services delivered, and more over 90% of hospitals in general contain conventional medicine divisions [101,102]. So, the import and export business among these countries are very progressive like as the figure.



**Figure-8:** Percentage of herbal drug imported by various countries.

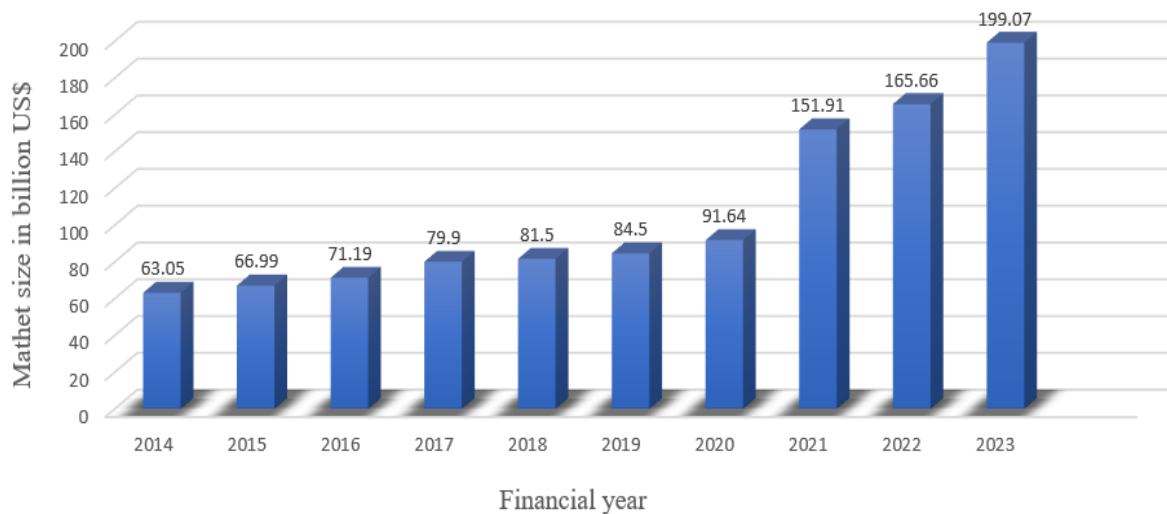
According to the figures that are now accessible, the market for herbal medicines in the European Union in 1991 was estimated to be worth \$6 billion (possibly now exceeds \$20 billion), with France accounting for \$1.6 billion, Italy \$0.6 billion and Germany \$3 billion. The US herbal medicine market was worth roughly \$4 billion in 1996; by the year 2000, it had doubled. Herbal medications are sold for roughly \$1 billion in India and herbal extract in its crude form is exported for about \$80 million [103]. According to a recent investigation [104], 39% of the 520 new pharmaceuticals approved between 1983 and 1994 were either developed from natural items or were derived from them, while 60-80% of antibiotic and anticancer therapies were made from natural substances [105]. As evidenced by Ayurveda, that could not have survived for over two thousand years without a scientific foundation, India has a long heritage of herbal treatment. India's traditional medical system is used by over 1.5 million people, and it includes about 25,000 effective plant-based treatments. There are 7800 pharmaceutical manufacturing facilities in India, and each year they use over 2000 tons of medicinal herbs [106]. Nature has given us many powerful pharmaceuticals, including dactinomycin, bleomycin and doxorubicin (for cancer), etoposide, vinblastine, topotecan, irinotecan and paclitaxel (for malaria), dihydroartemisinin, mefloquine chloroquine, artemether, and arteether (for diabetes), metformin amodiaquine artemisinin and eventually the other [107,108].



**Figure-9:** India's Ayurvedic and herbal exports from the financial years 2015 to 2023.



The herbal market in India is expanding at a rate of 14% yearly and is estimated to be valued close to 50 billion rupees. One billion rupees is thought to be the anticipated export value of herbal items. The worldwide herbal market is expected to increase from its present level of \$ 62 billion to \$ 5 trillion in 2050 as a result of the rising demand for therapeutic plants. More than 70% of the diversity in the globe is produced in India and China. The primary worldwide herbal export market is in Europe, the United States, Germany, China, France, Italy, Japan, Canada, Singapore, and Australia, while Brazil, Argentina, Mexico and Indonesia are emerging herbal markets [109]. After analysing all the information, we can conclude that herbal medicine is currently in a favourable state of development. Additionally, innovating with herbal treatments could help it become the market leader in the future.



**Figure-10:** Global market size of phytomedicine from the financial year 2014-2023.

## 6. FUTURE ASPECTS OF HERBAL MEDICINES

In future Several challenges must be addressed before herbal products with guaranteed quality and efficacy may be incorporated into standard medical care. Herbal medicines are sold without going through safety procedures or toxicity testing to determine their efficacy. Additionally, many of these countries lack the necessary tools to control the Production techniques and quality requirements for herbal medication. A quick way to find and isolate a pharmacologically active molecule is to employ folk beliefs and traditional healers' knowledge. The regulatory status, evaluation of safety and efficacy, quality assurance, safety tracking, and a lack of or insufficient knowledge about traditional, mutually beneficial, and alternative medicines are among the difficulties that are frequently faced and shared by many nations [110,111]. There might be problems with how herbal medications are regulated, how their safety and efficacy are evaluated, how their quality is controlled, and how their safety is observed. Applying the incorrect plant species, adulterating herbal products, contaminating them, overdosing, misusing herbal medicines by individuals or healthcare professionals, and combining herbal medicines with different drugs are just a few of the issues that can cause adverse effects from the consumption of herbal drugs and need to be addressed in the future. A hurdle is the prejudice of currently working healthcare professionals who, because they were not exposed to phytomedicines throughout their academic training, think they are all ineffectual [112]. Tribal and traditional knowledge should be protected by intellectual property laws in order to prevent "piracy" by both Indian and international pharmaceutical corporations [113]. The caliber of the literature in the field is a significant obstacle that needs to be surmounted before herbs may be used in conventional medicine. Misinformation is abundant in books, pamphlets, publications, and especially the Internet these days. Much of it is produced to sell products, and some of it is published to present an opinion or point of view on the basis of false information or on false optimism [114]. Because doctors take a herb's quality that was contaminated, misidentified, or should be resolved at face value, many false and unreproducible findings been documented in medical literature. Additionally, they frequently omit to include the actual dosage administered as well as the botanicals in the tested product by their scientific names. The demand for herbal medications and other natural healthcare products is increasing in both emerging and developed countries of the world [115]. Doctors, nurses, and pharmacists—healthcare professionals who prescribe medications—frequently lack

awareness about how using herbal medicines can affect their patients' health. This can be accomplished by having people who come across patients who are using these medications ask pertinent questions about the utilization of these herbal therapies. Health workers need to be knowledgeable about herbal medications if they work in poison control centres or health information services. Last but not least, it has become vital that phytomedicines be covered in every nation by a legal structure to guarantee that they adhere to the necessary criteria of efficacy, quality, and safety. So, in future some difficulties might arise and they will be solved by the intelligence of people.

**Table-1: Analysis of the adjacent herbal medicine market in comparison.**

Attributes	Herbal medicinal product market	Herbal drug formulation market	Herbal supplement market
<b>Compound annual growth rate (2023-2033)</b>	7.7%	5.6%	7.8%
<b>Value (2023)</b>	199.07 billion US\$	1.67 trillion US\$	97.88 billion US\$
<b>Value (2033)</b>	417.99billion US\$	2.88 trillion US\$	207.43 billion US\$
<b>Trends</b>	Increasing demand in health benefits, nutritional support and natural healing.	Rising populations, introducing novel technologies and cost-effective solutions.	Rising chronic diseases, growing populations and made from plants supplement.
<b>Opportunities</b>	Increased government initiatives, traditional knowledge, huge investment and research & developments.	Growing pharmaceutical sector, robotic and artificial intelligence adoption, huge investment and research & developments.	Seeking of people on alternative to synthetic drugs, turning of population towards natural therapy.

## 7. CONCLUSION

In the conclusion we can say the traditional herbal medicine represented a rich and diverse heritage of healing practices which have been refined over many centuries. It still has a big part to play in the global healthcare system. It can offer us natural remedies, holistic approaches and cultural insights into the traditional healthcare system. Herbal medicine has its roots in ancient civilization such as Mesopotamia, Egypt, China, and Greece. In the modern civilisation also, it has maintained strong roots in the realm of contemporary medicine. The herbal industry has a lot of promise, as is clear. Given the increasing acceptance of herbal products, future international labelling standards should adequately address quality issues. Issues related to side effects have additionally recently become more obvious, more widespread, and undeniable due to the antiquated notion that herbal medicinal products are "safe" since they originate from "natural" sources. The regulatory framework for herbal medicines has to be strengthened and standardized globally as a result. Chronic illness patients frequently use herbal treatments. Doctors with traditional training can no longer dismiss natural medicines. The fact that many patients take herbal drugs must be known to them. If a patient discloses that they use herbs, the doctor may have the chance to steer them toward efficient conventional medical treatment. Patients with chronic illnesses like AIDS or cancer have to be informed that some of the negative effects of herbal remedies frequently resemble symptoms of issues related to their condition or treatment, making it challenging to determine whether the sickness itself or the "remedy" is the issue. So, the responsibility for overseeing a controlled and high-quality flow of herbal products as well as facilitating their advancement to the level of clinical trials currently rests with the regulatory agencies. Herbal medicines will capture a huge marketplace in future if proper steps for development might be taken.

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### CONFLICT OF INTEREST:

The authors declare no conflict of interest.

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