Exploring The Phytochemical Diversity And Therapeutic Properties Of Rare Traditional Medicinal Plants: A Systematic Review

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Abstract **— The health advantages and environmental issues related to four traditional medicinal plants—Ashtavarga, Sarpgandha, Kali Haldi, and Shyonaki—are examined in this study. In Ayurvedic medicine, ashtavarga—which includes species like Kshirkakoli and Kakoli—is essential, but it is threatened because of habitat loss and increasing demand, which results in adulteration and decreased efficacy. To protect these species, conservation efforts including planting campaigns and agricultural projects are required. Since 1000 BC, sarpgandha (Rauwolfia serpentina) has been used to cure hypertension; nevertheless, overharvesting and habitat fragmentation pose a hazard. Its formulation, Sarpgandha Ghanvati, emphasises the necessity for habitat protection while treating anxiety and sleeplessness. With its analgesic and anti-inflammatory qualities, Kali Haldi (Curcuma caesia) has long been used to treat a variety of illnesses. However, overuse and particular growing circumstances are threatening this plant, thus urgent conservation measures such in vitro propagation are required. Although shyonaki (Oroxylum indicum) is prized for its antibacterial, anti-inflammatory, and antioxidant qualities, deforestation and unsustainable harvesting pose risks to the plant. In order to preserve these priceless plants' availability and the biodiversity that is essential for traditional medicine, this review highlights the necessity of sustainable practices. The study promotes more awareness and action towards the protection of these uncommon medicinal plants by analysing their phytochemical characteristics and therapeutic potentials.**

Index Terms — Ayurveda, **A**shtavarga, **S**arpgandha **(**Rauwolfia serpentina), **K**ali **H**aldi **(**Curcuma caesia), **S**hyonak **(**Oroxylum indicum), **H**erbal **M**edicine.

1. INTRODUCTION

A treasure trove of botanical wonders can be found in the enormous tapestry of nature. Traditional medicine practitioners have long been aware of the abundance of therapeutic potential that each of these plants holds within its leaves, roots, and stems [1]. By exploring the rich history and cultural significance of traditional medicinal plants, highlighting their crucial role in worldwide healthcare traditions, and underscoring the urgent need to conserve these botanical riches, we set the stage for this inquiry in this introduction [3]. Plants have been valued throughout human history for their potential to heal illnesses and bring the body back into equilibrium, in addition to their use as food [4]. For many years, traditional medical systems have depended on the complex understanding of botanical remedies to treat a wide range of medical ailments. These systems are based on old wisdom that has been passed down through the centuries [5].

Traditional healers have developed a profound awareness of the healing qualities inherent in the natural world, drawing from the ancient civilizations of India and China, as well as the indigenous cultures of the Americas and Africa [6]. Ayurveda, which has its roots in the Indian subcontinent and dates back more than 5,000 years, is one of the most well-known traditional medical systems [7]. Known as the "science of life," Ayurveda emphasises the interdependence of the mind, body, and spirit in its holistic approach to healthcare [8]. A huge pharmacopoeia of medicinal plants, each carefully categorised according to its therapeutic characteristics and employed in intricate formulations to restore health and vigour, is the foundation of Ayurvedic medicine [9]. The idea of "rasa," or a substance's flavour and energy quality, is fundamental to Ayurveda philosophy and serves as the foundation for comprehending the therapeutic qualities of plants [10]. Every plant has a distinct flavour and combination of properties that determine its therapeutic benefits on the body, according to Ayurvedic philosophy [11].

For instance, sweet-tasting herbs are valued for their nourishing and restorative qualities, but bitter-tasting herbs are frequently employed to cleanse the blood and detoxify the liver [12]. Ayurvedic medicine reveres a wide variety of plants, but among them are a few uncommon species referred to be "botanical treasures" [13]. These plants, which are frequently native to particular areas and habitats, are valued for their extraordinary therapeutic qualities and are essential components of conventional formulas [14]. Some examples of these botanical riches are Sarpgandha, which is well known for its effectiveness in treating hypertension and other cardiovascular diseases, and Ashtavarga, a set of eight uncommon medicinal plants found mostly in the Himalayan region [15]. Many of these uncommon medicinal plants are in danger of going extinct because of habitat loss, overharvesting, and climate change, despite their enormous therapeutic potential [16]. These botanical treasures run the risk of disappearing forever due to the rapid speed of urbanisation and modernization, which has resulted in the degradation of natural ecosystems and the decline of biodiversity [17]. A growing awareness of the need to conserve traditional medicinal plants and the environments in which they flourish has emerged in response to these conservation problems [18]. There are initiatives in place to support sustainable harvesting methods, grow uncommon medicinal plants in nurseries and botanical gardens, and increase public understanding of the value of biodiversity conservation [19].

This review study delves into the complex realm of uncommon traditional medicinal plants, examining their medicinal qualities, botanical traits, cultural importance, and current state of conservation [20]. Our goal is to raise awareness of these botanical riches and promote their sustainable use and protection in contemporary healthcare practices by combining scientific study with traditional knowledge and ethnobotanical expertise [21]. Come along with us as we set out to discover the vast therapeutic potential of nature's medicine and make sure that these priceless botanical treasures are preserved for future generations.

2. THE OLDEST MEDICAL SYSTEM : AYURVEDA

Regarded as the world's oldest medical system, Ayurveda encompasses an all-encompassing philosophy that aims to achieve balance in the body, mind, and environment [22]. Its ageless writings provide remedies for a wide range of age-related ailments, such as osteoporosis, diabetic ulcers, and memory loss, which are health conditions that are frequently overlooked by modern medicine [23]. Though it has a rich historical legacy, Ayurveda has only a meagre 0.5% of the global pharmaceutical industry, making it difficult for it to become widely accepted [24]. This stark contradiction highlights the essential need for thorough scientific research and standardised Ayurvedic formulations in order to validate its effectiveness and increase its popularity internationally [25]. The Caraka teachings highlight the fluid nature of Ayurveda and promote humility and a never-ending quest for knowledge [26, 27]. This traditional system is an important bridge between modern pharmacology and indigenous folk medicine traditions, enabling the search for new drugs and therapeutic interventions.

Maintaining the invaluable legacy of Ayurveda requires concerted efforts to record traditional medicine knowledge and conserve the wide range of medicinal plants essential to its application [28]. India can demonstrate its leadership in improving human health and lifespan through the use of traditional medicinal understanding by preserving and promoting the botanical treasures of Ayurveda [29]. With its origins dating back more than 5,000 years, the traditional Indian medical system known as Ayurveda is regarded as the world's oldest [30]. The idea of attaining harmony and balance in the body, mind, and surroundings is fundamental to its tenets [31]. According to Ayurveda, disease is an imbalance that needs to be rectified in order to regain well-being, whereas health is seen as a state of harmony between these elements [32].
Ayurvedic literature from antiquity, such the Sushruta Samhita and Charaka Samhita, are rich in information about treating a variety of age-related illnesses [33]. These include, among other things, diabetic sores, osteoporosis, and memory loss. Ayurveda treats the underlying causes of sickness and seeks to restore balance to the body as a whole, in contrast to modern medicine, which frequently concentrates on treating symptoms [34]. In spite of its extensive history and shown effectiveness, Ayurveda has had difficulty becoming widely recognised in the international market. At present, it holds a mere 0.5% of the global pharmaceutical market share [35]. This lack of acceptance emphasises the necessity of rigorous scientific study and standardised Ayurvedic formulations to confirm its efficacy [36].

One of the founders of Ayurveda, Caraka, stressed in his teachings the significance of constant learning and adaptation as well as the dynamic aspect of the system [37]. By providing insights into novel medications and therapeutic approaches, Ayurveda acts as a link between contemporary pharmacology and traditional folk medicine practices [38]. In order to maintain the rich legacy of Ayurveda, efforts need to be made to protect the wide variety of medicinal plants employed in its practice as well as to record traditional medical knowledge. By doing this, India can maintain its position as a pioneer in advancing human health and wellbeing by applying the knowledge of Ayurveda [39].

2.1. ASHTAVARGA: THE EIGHT TREASURES

In the age-old healing traditions of Ayurveda, the Astavarga, a sacred set of eight medicinal plants indigenous to the Himalayan region, is highly valued [40]. Its origins can be traced to the fabled Ashwani Kumar’s, who restored the elderly

Rishi Chayavan to health using Astavarga concoctions, often referred to as Chayavanprash [41]. They were well-known for their miraculous healing powers. But over the ages, a significant loss of information about the identification and application of these botanical gems resulted from the disintegration of antiquated educational systems and oral traditions [42]. For many years, the botanical categorization of Astavarga plants was a mystery, despite their ecological uniqueness and significant medical capabilities that include cellular regeneration and immune system strengthening [43].

Though traditional writings such as the Dhanvantri Nighantu offered useful information, such as synonyms and pharmacological data, doubts continued and proposals for alternatives were made [44]. Since the independence of India, efforts to precisely categorise Astavarga plants have been sparked by a renewed interest in Ayurveda, which has been made possible by contemporary taxonomy systems [45]. In the age-old healing traditions of Ayurveda, the Astavarga—a sacred set of eight medicinal plants indigenous to the Himalayan region—plays a crucial role [46]. Its origins can be traced to the fabled Ashwani Kumars, heavenly healers well-known for their extraordinary healing powers [47]. Ayurvedic legend states that these celestial healers met the elderly Rishi Chayavan, who was extremely wise spiritually even though he was malnourished [48].

When the Ashwani Kumars saw how weak he was, they were motivated to make him stronger, so they created Astavarga, a powerful herbal remedy [49]. They restored Rishi Chayavan's youth and vitality with their extraordinary intervention. This revolutionary event gave rise to the well-known Ayurvedic tonic known as Chayavanprash, which is widely used by both kings and commoners and is highly regarded for its restorative qualities [50].

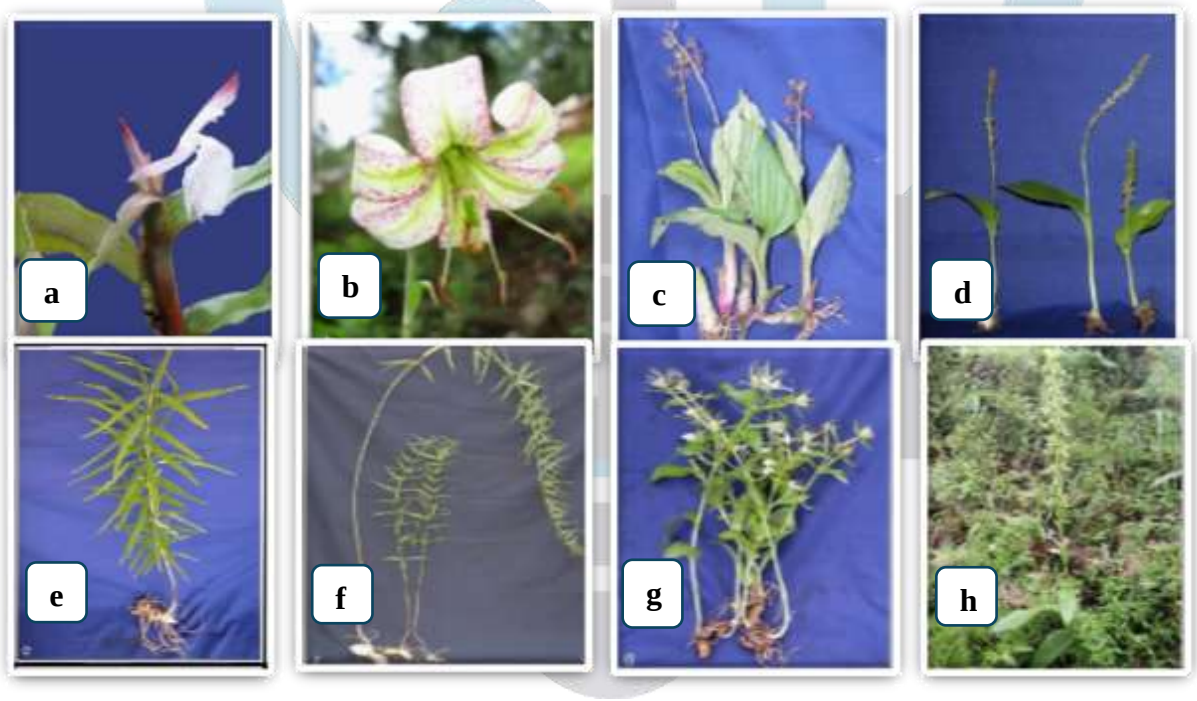

Fig 1: Astavarga plant species-; a-Kakoli *(Roscoea purpurea Smith*); b- Kshirkakoli (*Lilium polyphyllum D. Don*); c- Jeevak (*Crepidium acuminatum (D. Don) Szlach*); d- Rishbhak (*Malaxis muscifera (Lindl.) Kuntze*); e- Meda (*Polygonatum verticillatum (Linn.) Allioni);* f-Mahameda (*P. cirhifolium (Wall.) Royle*); g- Riddhi (*Habenaria intermedia D. Don*); h- & Vriddhi (*H. edgeworthii Hook. f. ex Collett*)

But over time, there were many obstacles to overcome in the dissemination of knowledge about Astavarga plants [51]. The complex knowledge of medicinal plants started to disappear with the collapse of the Gurukul educational system and the diminishing power of oral traditions. Because of this, it became difficult to identify and use Astavarga species botanically, and this was made worse by the dearth of written record [52]. Their botanical classification remained unclear despite their ecological uniqueness and substantial therapeutic qualities, which include immune system stimulation, tissue regeneration, and vitality promotion [53]. With the help of pharmacological facts and synonyms, traditional Ayurvedic books like the Dhanvantri Nighantu provided vital insights on the Astavarga group [54]. However, these ancient texts often presented conflicting information, contributing to confusion surrounding the botanical identities of Astavarga plants [55].
Considered to be one of the oldest Ayurvedic texts, the Bhav Prakash Nighantu (16th century) suggested that access to Astavarga plants was restricted even for kings, further hiding their true nature and leading to suggestions for substitute species [56]. Rekindled interest in Ayurveda in India during the post-independence era led to attempts to precisely categorise Astavarga plants [57]. The foundation for botanical inquiry given by contemporary taxonomic systems made it easier to identify and record these uncommon therapeutic riches [58]. Still, there were outstanding questions that needed to be answered in order to confirm and clarify the botanical identities of Astavarga species [59]. This thorough research aims to

close the gap between traditional knowledge and modern botanical science in response to this demand, providing a comprehensive overview of the medicinal legacy of the Astavarga group [60].

This review attempts to solve the mystery of Astavarga plants by combining knowledge from botanical studies, ethno botanical research, and ancient literature [61]. This review aims to offer a foundational resource for researchers, scientists, and practitioners committed to conserving and utilising the healing power of these uncommon botanical treasures by thoroughly examining their ecological significance, historical background, therapeutic potential, and taxonomical nuances [62]. In the end, this analysis hopes to further the ongoing revival of Ayurvedic knowledge and its incorporation into contemporary healthcare practice by illuminating the botanical treasures of Astavarga. Extensive research was required to clarify and validate the botanical identities of Astavarga species due to persistent uncertainties [63].

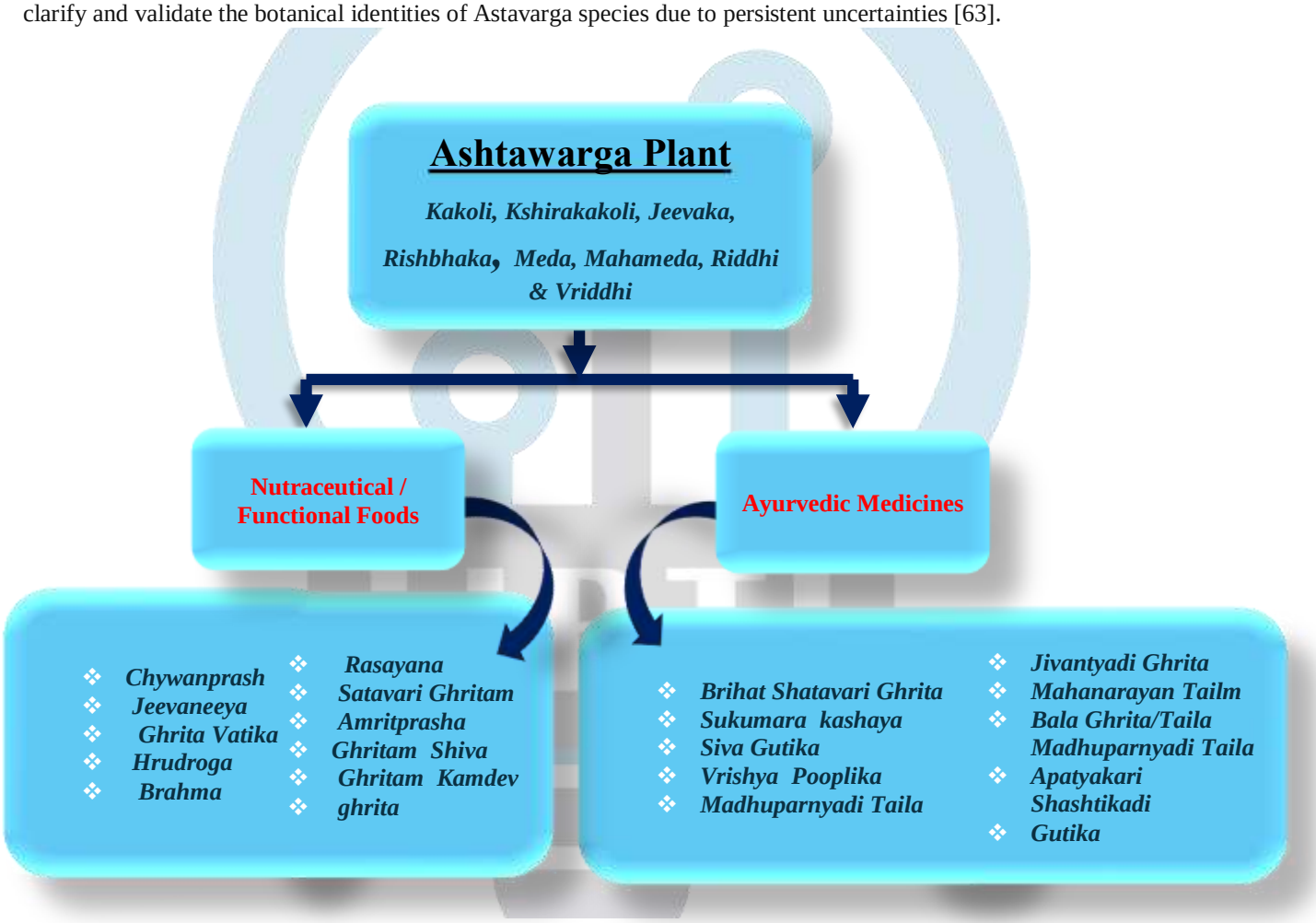

Fig 2: Medicinal products developed from Ashtavarga

To address this need, this thorough analysis seeks to integrate knowledge from historical writings with modern botanical research to provide a comprehensive understanding of the medicinal heritage of the Astavarga group [64]. This review aims to give researchers, scientists, and practitioners committed to protecting and utilising the healing power of these uncommon botanical treasures a fundamental resource by outlining the ecological significance, historical background, and therapeutic potential of Astavarga plants [65].

2.1.1. Anti-cancer activity

Rich in bioactive chemicals, ashatavarga shows promise in preventing and treating cancer by preventing tumour growth, triggering apoptosis, and reducing angiogenesis. Its effectiveness in addressing these cancer-promoting pathways has been confirmed by scientific studies, indicating its potential as a natural cancer treatment. Ashtavarga offers hope for more effective treatment approaches in the fight against cancer [53].

2.1.2. Antifungal activity

Ashtavarga displays antifungal properties effective in treating fungal infections such as candidiasis and ringworm by inhibiting the growth of fungal pathogens like *Candida albicans* and *Aspergillus species*. Scientific data confirms its ability to target these fungi, highlighting its potential as a treatment for various fungal illnesses. Ashtavarga offers a promising natural solution for fungal infections, providing hope for improved therapeutic interventions [56].

2.1.3. Antibacterial activity

Ashtavarga's strong antibacterial qualities help it fight bacterial infections and improve general health by preventing the growth of dangerous bacteria like *Escherichia coli* and *Staphylococcus aureus*. Its capacity to target these pathogens is supported by scientific research, underscoring its potential as a natural treatment for bacterial illnesses. Ashtavarga gives hope for improved therapeutic strategies by offering a promising strategy to combat bacterial infections and improve health [56].

1.1.4. Antioxidant activity

Strong antioxidants included in ashtavarga help scavenge free radicals, minimise oxidative stress, and shield cells from harm, which lowers the chance of chronic illnesses including cancer and cardiovascular issues. Its effectiveness in preventing oxidative damage is supported by scientific evidence, indicating that it may be used as a preventive measure against a number of illnesses. Ashtavarga offers promise for better well-being by presenting a viable path for preserving health and lowering the risk of chronic disorders [56].

2.1.5. Antiulcer activity

By reducing stomach acid output, strengthening mucosal protection, and reducing inflammation, ashatavarga has potent antiulcer effects that relieve gastric ulcers and improve gastrointestinal health. Its efficacy in treating ulcerative disorders is substantiated by scientific study, which also underscores its promise as a natural therapy for enhancing digestive health. With its potential to improve gastrointestinal function and alleviate ulcers, ashtavarga offers hope for better treatment outcomes [61].

2.1.6. Neuropharmacological activity

Because of its advantageous effects on the neurological system, ashatavarga has the potential to improve mood regulation, stress reduction, and cognitive performance. As a result, it shows promise in the treatment of illnesses such as anxiety, depression, and neurodegenerative disorders [61]. Its effectiveness in favourably affecting certain neural pathways is supported by scientific research, indicating its relevance as a home treatment for improving mental health. Ashtavarga is a promising treatment option for a range of neurological disorders, with the possibility of better therapeutic results [61].

2.2. SARPGANDHA; THE SERPENT'S ROOT

Rauvolfia Serpentina, commonly known as Sarpgandha, is a medicinal plant deeply rooted in Indian and Chinese traditional medicine, with a history dating back almost 3000 years [66]. Its therapeutic properties stem from a diverse array of phytochemicals present in its root, stem, and leaves, with the root harbouring the highest concentration [67]. These phytochemicals, categorized into carbohydrates, lipids, phenolics, terpenoids, alkaloids, and other nitrogen-containing compounds, underpin the plant's pharmacological actions [68]. Notably, *R. Serpentina* has demonstrated efficacy in lowering blood pressure and exerting sedative effects, making it valuable in neuropsychiatric, gynecological, and geriatric disorders [69].

Fig 3: *Rauvolfia tetraphylla L.* plant and root.

Its applications extend to mental disorders like anxiety, schizophrenia, epilepsy, insomnia, and gastrointestinal ailments, including diarrhea and dysentery. Additionally, folklore attributes its name to its reputed effectiveness against snake bites, supported by its historical use as a remedy for insanity [70]. Cultivated primarily in India, Bangladesh, China, Sri Lanka, and Japan, *R. Serpentina* thrives in bio-rich acidic sandy soils and tropical Himalayan regions [71]. Its phytochemical profile comprises alkaloids, phenols, tannins, and flavonoids, with the oleoresin being a key active ingredient responsible for its sedative properties [72]. Recent research has unveiled its potential in cancer therapy, exhibiting anti-prostate cancer activity through DNA damage and cell cycle control pathways. Furthermore, clinical trials have demonstrated its effectiveness in alleviating migraines, cardiovascular diseases, and diabetes, highlighting its multifaceted therapeutic potential [73]. This review aims to comprehensively explore the phytochemical composition and therapeutic benefits of *R. Serpentina*, shedding light on its rich medicinal heritage and contemporary relevance in holistic healthcare practices [74].

2.2.1. Anti-cancer activity

Rich in alkaloids such as reserpine, sarpgandha has anti-cancer properties through apoptosis induction, tumour growth inhibition, and angiogenesis suppression [68]. These characteristics demonstrate its promise as a treatment option for leukaemia, breast cancer, and prostate cancer, among other cancers. Its effectiveness in preventing tumour growth and specifically targeting cancer cells is supported by scientific study. In the battle against cancer, sarpgandha shows promise as a natural medicine and offers hope for better treatment outcomes [68].

2.2.2. Antifungal activity

By preventing the growth of fungal pathogens like *Candida albicans* and *Aspergillus species*, sarpgandha exhibits antifungal qualities that are useful in the fight against fungal illnesses including candidiasis and ringworm. Its effectiveness against these fungi is supported by scientific research, indicating that it may be used to treat a variety of fungal diseases. Sarpgandha offers hope for better treatment strategies by providing a viable natural remedy for fungal diseases [68].

2.2.3. Antibacterial activity

Sarpgandha's strong antibacterial qualities help treat bacterial infections and improve general health by preventing the growth of dangerous bacteria like *Escherichia coli* and *Staphylococcus aureus*. Its capacity to attack these pathogens is confirmed by scientific research, underscoring its potential as a natural treatment for bacterial illnesses. Sarpgandha is a potentially effective way to fight bacterial infections and promote health, which gives hope for improved treatment approaches [72].

2.2.4. Antioxidant activity

Because of its strong antioxidant capabilities, sarpgandha can scavenge free radicals, lessen oxidative stress, and shield cells from harm. This means that it may help prevent chronic illnesses including cancer, heart problems, and neurological disorders. Its effectiveness in preventing oxidative damage is supported by scientific research, indicating that it may be used as a natural preventive measure against a range of illnesses. A potential treatment for preserving health and lowering the risk of chronic disorders is sarpgandha [72].

2.2.5. Antiulcer activity

By lowering inflammation, strengthening mucosal defence, and preventing stomach acid release, sarpgandha exhibits strong antiulcer qualities that help treat gastric ulcers and improve gastrointestinal health. Its efficacy in treating ulcerative disorders is substantiated by scientific study, which also underscores its promise as a natural therapy for enhancing digestive health. Sarpgandha offers hope for better therapy outcomes by presenting a potential strategy to relieve ulcers and enhance overall gastrointestinal function [72].

2.2.6. Neuropharmacological activity

Sarpgandha has neuropharmacological effects by reducing oxidative stress, inhibiting neuroinflammation, and modulating neurotransmitter levels. These effects improve cognitive function and provide therapeutic relief for neurological disorders like depression, anxiety, and Alzheimer's disease. Its effectiveness in addressing these pathways is supported by scientific evidence, indicating that it may have use as a natural treatment for neurological conditions. Sarpgandha offers hope for improved well-being by presenting a viable option for controlling different neurological diseases and promoting brain health [75].

2.3. KALI HALDI: THE BLACK TURMERIC

Because of its extraordinary therapeutic qualities, *Curcuma Caesia Roxb*, sometimes known as black turmeric, is considered a botanical marvel in the *Zingiberaceae* family [75]. The medicinal effectiveness of this herb is attributed to its unique bluish-black rhizomes, which are a storehouse of bioactive substances such as flavonoids, terpenes, amino acids, and alkaloids [76]. Black turmeric has been used in traditional medicine for more than 3000 years, and its many health benefits have been praised. The plant has gained significant commercial value due to its ability to treat a variety of ailments, including impotence and fertility issues, bronchitis, leprosy, piles, and asthma. Black turmeric is a highly valuable medical herb, but it is also endangered, which emphasises the urgent need for conservation initiatives to protect its biological habitats and genetic variety.

Black turmeric, however rare, is still highly valued both culturally and medicinally. It is used in religious ceremonies and conventional medical techniques all throughout the world. Numerous therapeutic actions are revealed by its pharmacological profile, including antifungal, anticancer, antibacterial, and antiulcer effects [80]. Additionally, preclinical research has shown that black turmeric has intriguing neuropharmacological actions, including anti-convulsant and muscle relaxant properties. Its relevance in holistic healthcare systems is further highlighted by its function as a potent smooth muscle relaxant and a promoter of rapid wound healing [82]. Black turmeric, a rare and endangered species, is nevertheless

a representation of nature's immense healing capacity because it provides a wealth of therapeutic advantages for a variety of illnesses and conditions [83].

Efforts to conserve and propagate this botanical treasure are essential not only for preserving traditional knowledge but also for unlocking its therapeutic potential in modern healthcare practices, paving the way for a sustainable future where rare medicinal plants like Black Turmeric continue to enrich human health and well-being. Major activities include:- 1. Anti-Cancer Activity 2. Antifungal activity 3. Antibacterial activity 4. Antibacterial activity 5. Anti-Ulcer Activity 6. Neuropharmacological activity [84].

Fig 4: Kali Haldi: The Black Turmeric

2.3.1. Anti-cancer activity

Black Turmeric, containing Germacrone and curcumin derivatives, exhibits anti-cancer properties, emitting a slightly bitter and pungent aroma. Studies indicate its efficacy against cancerous cells, highlighting its potential as a therapeutic agent in oncology. This promising anti-cancer activity underscores the significance of Black Turmeric in modern medicine, offering hope for the development of novel treatments against malignancies [85].

2.3.2. Antifungal activity

The primary ethanolic and aqueous extracts of *Caesia* demonstrate significant antifungal properties, offering valuable therapeutic benefits. These findings highlight the plant's potential in combating fungal infections, contributing to the development of effective antifungal treatments. Such antifungal activity underscores the importance of exploring *Caesia's* medicinal properties, providing insights into its traditional use in treating fungal ailments and potentially expanding its applications in modern pharmacology [86].

2.3.3. Antibacterial activity

The methanol and ethanolic extracts derived from black turmeric rhizome exhibit notable antibacterial efficacy, targeting both human and plant pathogenic bacteria. These extracts demonstrate promising antibacterial properties, suggesting their potential in combating a wide range of bacterial infections. This highlights the significance of investigating black turmeric's therapeutic applications against bacterial pathogens, offering insights into its traditional use as a medicinal plant and its potential in modern pharmaceutical development [87].

2.3.4. Antioxidant activity

The antioxidant activity of this plant is attributed to its ability to scavenge free radicals, effectively neutralizing oxidative stress. This property makes it an important source of antioxidants, offering protection against cellular damage caused by free radicals. By combating oxidative stress, this plant contributes to overall health and well-being. Understanding its antioxidant potential provides valuable insights into its therapeutic applications and underscores its significance in traditional medicine and modern healthcare practices [88].

2.3.5. Antiulcer activity

The ethanolic extract of this plant demonstrates antiulcer activity by reducing gastric ulcer formation, acid secretion, and pepsin levels. These constituents found in the plant contribute to its efficacy in alleviating ulcer symptoms. By targeting various factors involved in ulcer development, this plant extract offers therapeutic benefits against gastric ulcers. Understanding its antiulcer properties provides valuable insights into its potential use as a natural remedy for gastrointestinal disorders [89].

2.3.6. Neuropharmacological activity

Neuropharmacological studies conducted in rodent models have revealed the anti-convulsion and muscle relaxant effects of this plant. These findings demonstrate its potential therapeutic applications in managing conditions related to convulsions and muscle tension. By elucidating its neuropharmacological activity, this research provides valuable insights into the mechanisms underlying its medicinal properties, paving the way for further exploration of its potential in neurological disorders [90].

2.4. SHYONAK: THE HEALING BARK

Shyonak is a member of the *Bignoniaceae* family and is scientifically known as *Oroxylum indicum (L.) Kurz*. It is used extensively in traditional Indian medicine, especially as a constituent of "Dashmoola" and the well-known Ayurvedic remedy "Chyavanprash" [91]. Its root and stem bark are precious and are used to treat a variety of conditions, including dysentery, diarrhoea, and snake and scorpion stings. On the other hand, *Ailanthus excelsa Roxb* [92] stem bark adulteration was discovered in several market cases. In an attempt to allay this worry, quality requirements for the stem bark and root of *O. indicum* as well *as A. excelsa* have been established [93]. HPTLC fingerprinting demonstrated distinguishing bands, aiding in accurate identification. Acknowledged in various Ayurvedic formulations, *O. indicum* root bark boasts astringent and bitter properties, catering to conditions ranging from coughs to rheumatism [94].

Fig 5: Shyonak: The Healing Bark

Its wide phytochemical profile—roughly 111 chemicals, mostly flavonoids—highlights how versatile it is as a medicine [95]. Its effectiveness in a variety of pharmacological activities, including diuretic, antibacterial, antiulcer, and immunostimulant qualities, has been validated by science. *O. indicum* has the potential to be medicinal, but indiscriminate collection has made it vulnerable and endangered in a number of Indian states [97]. Since root bark and stem bark can be substituted for one another, quality control methods are essential to prevent adulteration [98]. To guarantee the integrity and effectiveness of this botanical treasure, careful evaluation of the macro-microscopic traits, physicochemical parameters, and thin-layer chromatographic profiles of *O. indicum* and its possible adulterants—specifically, *A. excelsa*—sourced from different parts of India is required [99].

2.4.1. Anti-cancer activity

Shyonak bark's abundance of bioactive chemicals, which can hamper cancer cells' capacity to proliferate and metastasize, makes it a promising candidate for use in cancer therapy and prevention. Its promise as an adjuvant treatment for many forms of cancer is supported by scientific research. Research suggests that the bark of shyonak possesses phytochemicals that have anticancer qualities by focusing on important pathways that contribute to the development of cancer. Its effectiveness in lowering the danger of metastasis and inhibiting tumour growth is demonstrated by clinical research. In the fight against cancer, shyonak bark is emerging as a vital natural resource that offers promise for better treatment outcomes [95].

2.4.2. Antifungal activity

Strong antifungal qualities found in shyonak bark help prevent fungal infections including athlete's foot, candidiasis, and ringworm while also promoting general skin and nail health. These antifungal characteristics highlight its therapeutic importance in treating different types of fungal infections. Its effectiveness in stopping the growth of harmful fungi and treating and preventing fungal diseases is supported by scientific study. Clinical research supports its historic application as an antifungal treatment, highlighting its significance in complementary medicine. Shyonak bark shows promise as a natural remedy for fungal illnesses and as a useful tool for enhancing the health of the skin and nails [95].

2.4.3. Antibacterial activity

Strong antibacterial qualities found in shyonak bark efficiently prevent the growth and spread of a number of dangerous pathogens, including *Staphylococcus aureus* and *Escherichia coli*. Its antibacterial properties support its medicinal promise in preventing bacterial infections and improving general health. Its effectiveness in preventing the formation of harmful germs and so enhancing health and assisting in the treatment of infectious diseases is supported by scientific evidence. Its traditional use as an antibacterial agent is supported by clinical data, underscoring its significance in natural therapy. It turns out that shyonak bark is a useful tool for treating bacterial infections and enhancing immune function [98].

2.4.4. Antioxidant activity

Shyonak bark is rich in antioxidants such as flavonoids and phenolic compounds, which play a crucial role in neutralizing free radicals and reducing oxidative stress. These bioactive constituents contribute to its therapeutic potential by mitigating inflammation and lowering the risk of various chronic diseases, including diabetes, cancer, and heart disease. Scientific research underscores the efficacy of shyonak bark in promoting overall health and well-being through its antioxidant properties. Clinical studies provide evidence of its protective effects against oxidative damage, highlighting its significance as a natural remedy for preventing and managing chronic illnesses [98].

2.4.5. Antiulcer activity

Notable antiulcer characteristics of shyonak bark protect the stomach lining from irritation, acidity, and ulcer development, supporting overall gastrointestinal health [98]. Science backs up its effectiveness in reducing ulcerative conditions. Research indicates that it can reduce pain and improve the general health of the digestive system. Flavonoids and tannins are examples of bioactive chemicals that contribute to the plant's medicinal benefits. Its historic usage as a gastroprotective drug is supported by clinical data. As a natural ulcer treatment, shyonak bark shows promise and offers a comprehensive approach to digestive health, highlighting its potential applications in complementary medicine [98].

2.4.6. Neuropharmacological activity

Shyonak bark has been shown to have potential; it has a favourable effect on the neurological system and improves mood regulation, brain health, and cognitive performance. Research indicates that it can be used to treat a variety of neurological disorders. Its importance is highlighted by its neuroprotective qualities, which are ascribed to substances like flavonoids and polyphenols. Clinical investigations also show that it works well for disorders like Parkinson's and Alzheimer's. Shyonak's numerous advantages highlight its worth as a natural treatment for neurological health, which encourages more investigation and verification in scientific studies [99].

3. PRESERVING HERBAL MEDICINES: THE SIGNIFICANCE OF STANDARDISATION AND QUALITY ASSURANCE PROCEDURES

Strict standardisation and quality control procedures are necessary to guarantee the efficacy and safety of herbal remedies [100]. Chromatographic and electrophoretic techniques offer accurate analysis of the chemical makeup of herbal treatments, which is necessary for their identification and validation [101]. Notably, chromatographic fingerprints generated using these techniques are essential tools for ensuring the consistency and calibre of herbal treatments, which reduces challenges related to quality control [102].

Investigating Chemometric methods, such as information theory-based strategies, improves the standardisation process and offers perceptions into the legitimacy and calibre of herbal remedies [103]. The analysis goes on to discuss the cultivation, standardisation, and quality assurance of herbal medicines in Africa, covering a range of preparation techniques like pills, syrups, and decoctions [104].

It is imperative to stress the value of standardisation in laboratory settings, especially in areas like Africa where traditional medical practices are common [105]. The evaluation emphasises the need for stringent quality control protocols in the manufacture of herbal medicines, taking into account variables such variations in botanicals and possible contamination [106].

The study also elucidates differences in how countries register standardised herbal medicines with proven safety and clinical efficacy [107]. Although several nations possess efficient quality control protocols for herbal medicines, India's insufficient system impedes its competitive edge in the international market [108]. It is necessary to develop comprehensive standards for herbal medications and formulations in order to preserve consumer trust. The study also emphasises how important chemical markers are to breakthroughs in species identification, extraction technique refinement, and purity assessment in a variety of herbal medicine research disciplines [109].

Research using chemical markers has the potential to advance herbal medicine discoveries and lead to new treatment modalities [110]. This paper provides a thorough overview of the difficulties and advancements in quality control and standardisation in the herbal medicine industry [111]. The significance of chemical markers in promoting learning and innovation in herbal medicine is emphasised by looking at chromatographic procedures, chemometric approaches, and quality control measures [112].

4. CONSERVATION CHALLENGES AND SUSTAINABLE PRACTICES IN HERBAL MEDICINE

Herbal medicine provides a wealth of phytochemical diversity and therapeutic potential, making it an essential component of traditional healthcare systems across the globe [113]. It becomes clear that there are substantial obstacles in the way of their conservation as we continue to investigate the therapeutic potential of uncommon traditional plants [114]. The purpose of this systematic review is to provide light on the difficulties associated with herbal medicine conservation and the sustainable measures required to protect these priceless resources [115].

4.1. CONSERVATION CHALLENGES IN HERBAL MEDICINE

Indigenous people have been using medicinal plants for therapeutic purposes for thousands of years, capitalising on the natural healing powers of the environment [116]. But widespread deforestation, habitat loss, overharvesting, and climate change have put plant populations under tremendous strain, endangering their very existence. In addition to reducing the amount of medicinal resources available, biodiversity loss endangers the traditional knowledge and cultural legacy of herbal medicine [117].

Furthermore, because of the growing market for natural medicines, the commercialization of herbal items has resulted in unsustainable harvesting techniques [118]. The exploitation of plant species is made worse by inadequate control and monitoring, which accelerates the loss of those species [119]. The younger generation's ignorance of and lack of appreciation for traditional medicinal herbs also plays a role in their eventual neglect and demise [120].

4.2. SUSTAINABLE PRACTICES IN HERBAL MEDICINE CONSERVATION

Adopting sustainable practices is essential to ensuring the long-term viability of herbal medicine in the face of these obstacles [121]. The preservation of plant ecosystems through the creation of reserves, conservation areas, and sustainable harvesting zones must be given top priority in conservation efforts [122]. Responsible resource management can be promoted through community-based initiatives that involve local stakeholders and cultivate a sense of ownership and responsibility [123].

Additionally, combining conventional wisdom with cutting-edge scientific methodologies can improve our comprehension of plant ecology, propagation strategies, and cultivation practices [124]. We can ensure a sustained supply of medicinal plants while easing the strain on wild plant populations by supporting agroforestry efforts and cultivation programmes [125]. Supporting the cultivation of uncommon and endangered species and adopting farming methods that are sympathetic to biodiversity can also help with conservation efforts [126].

4.3. CONSERVATION AND SUSTAINABILITY OF THESE HERBAL TREASURES

The four precious herbal gems of Ashtavarga, Sarpagandha, Kali Haldi, and Shyonak must be safeguarded and preserved. These priceless plants not only offer incredible medicinal properties, but they are also seriously endangered due to habitat loss, misuse, and climate change [127]. Through targeted conservation activities and sustainable practices, we hope to preserve these floral beauties for future generations, ensuring the survival of traditional medicine and biodiversity preservation. Join us on a journey to preserve the legacy of herbal remedies and nature's pharmacy[128].

4.3.1. Conservation Challenges and Sustainable Practices in Preserving Ashtavarga:

Ashtavarga, a revered collection of eight Ayurvedic medicinal plants, has urgent issues due to habitat loss and overexploitation. The over-harvesting and habitat degradation of these precious plants, which are prized for their medicinal qualities, is putting them in danger [129]. Organic farming and agroforestry are two examples of sustainable agricultural techniques that must be used to guarantee their existence [130]. Initiatives for seed banking can also be extremely important for maintaining genetic variety. Community-led conservation initiatives, which include local people in preserving these priceless plant species, are equally significant. Through the integration of scientific understanding and community involvement, we can ensure the sustainability of Ashtavarga and its priceless benefits to human health and welfare [131].

4.3.2. Conservation Challenges and Sustainable Practices in Preserving Sarpagandha:

Because sarpagandha (Rauvolfia serpentina) contains a high concentration of alkaloids, it is useful in treating hypertension and sleeplessness. Ignorant harvesting methods are a serious threat to its survival even if it has therapeutic potential [132]. The delicate balance of its native habitat is upset by uncontrolled collecting, which also reduces wild populations.

Implementing regulated harvesting techniques is essential to addressing these conservation concerns because it ensures sustainable utilisation and prevents overexploitation [133]. Furthermore, in order to preserve the ecosystems in which sarpagandha grows and increase its long-term sustainability, habitat restoration projects are crucial [134]. Additionally, by supporting alternative therapies and farming practices, pressure on wild populations can be lessened and extensive harvesting can be avoided. We can maintain the ecological relevance of sarpagandha for future generations while also protecting its therapeutic advantages by incorporating these sustainable methods into conservation initiatives [135].

4.3.3. Conservation Challenges and Sustainable Practices in Preserving Kali Haldi:

Because of its pharmacological qualities, Curcuma caesia, also referred to as Kali Haldi or Black Turmeric, is extremely important in traditional medical and cultural customs [136]. However, habitat destruction and widespread overcollection pose immediate dangers to this species. Tight laws that restrict wild harvesting operations are needed to lessen these issues and guarantee its survival [137]. In addition, encouraging environmentally friendly farming methods like agroforestry and community-managed gardens can help relieve pressure on wild populations and provide a consistent supply of medicinal materials [138]. Simultaneously, it is imperative to educate local populations, stakeholders, and politicians about Kali Haldi's crucial conservation status [139]. By putting these steps into place, we can support Kali Haldi's sustainable management and preserve its priceless contributions to cultural traditions and healthcare [140].

4.3.4. Conservation Challenges and Sustainable Practices in Preserving Shyonak:

Shyonak, which is made from the bark of *Oroxylum indicum*, is an essential part of traditional medicine because of its many medicinal uses. However, increasing habitat fragmentation and deforestation pose a threat to Shonak's sustainability [141]. Conservation strategies must give habitat restoration projects that attempt to restore damaged habitats favourable to Shyonak growth top priority in order to solve these urgent issues [142]. A sense of stewardship is fostered by including local populations in sustainable harvesting practices through education and cooperation, which is crucial for the long-term preservation of the species [143]. Additionally, by providing workable alternatives, research projects looking at alternate suppliers of Shyonak-derived items can lessen the strain on wild populations [144]. Through the integration of these diverse techniques, conservation efforts can successfully alleviate the dangers that Shyonak faces, guaranteeing its continued availability for medical reasons and biodiversity preservation [145].

5. CHARACTERISTICS PROPERTIES OF THESE MEDICINAL PLANTS - A COMPARATIVE ANALYSIS

Table 1. Characteristics Properties of These Medicinal Plants

Ashtavarga :		
Scientific Name:	Ashtavarga is a group of 8 herbs: **Jeevak** (*Malaxis muscifera)*; **Rishbhak** (*Malaxis acuminata*); **Meda** (*Polygonatum verticillatum*); **Mahameda** (*Polygonatm cirrifolium)*; **Ridhi** (Habenaria intermedia); **Vridhi** (*Habenaria acuminata*); **Kakoli** (*Roscoea alpina*) & **Kshirkakoli** (*Lilium polyphyllum*)	
Medicinal Properties:	Sweet taste (Madhura), heavy (Guru), slimy (Snigdha), and cold potency (Sheeta)	
Phytoconstituents:	Various alkaloids, flavonoids, and glycosides	
Uses:	Treatment of bone fractures, fever, diabetes, and strength enhancement	
Origin:	Himalayan ranges	
Part Used:	Root/rhizome/whole plant	
Dosage:	About 2-3 g in divided doses per day	

Sarpgandha (*Rauwolfia serpentina*) :		
Scientific Name:	*Rauwolfia serpentina*	
Medicinal Properties:	Bitter, astringent, and cold	
Phytoconstituents:	Reserpine (major alkaloid)	
Uses:	Hypertension, anxiety, and insomnia	
Origin:	Tropical regions of Asia	
Part Used:	Root/rhizome/whole plant	
Dosage:	As per physician's recommendation	

Kali Haldi (*Black Turmeric*) :		
Scientific Name:	*Curcuma caesia*	
Medicinal Properties:	Antioxidant-rich, anti-inflammatory	
Phytoconstituents:	Curcuminoids (similar to regular turmeric)	
Uses:	Various health issues	
Origin:	India	
Part Used:	Rhizome	
Dosage:	Varies; consult an Ayurvedic practitioner	

Shyonak (*Oroxylum indicum*) :		
Scientific Name:	*Oroxylum indicum*	
Medicinal Properties:	Bitter, astringent, pungent	
Phytoconstituents:	Flavonoids, alkaloids	
Uses:	Fever, respiratory disorders, digestive issues	
Origin:	Tropical regions of Asia	
Part Used:	Bark, leaves, seeds	
Dosage:	As per Ayurvedic guidelines	

CONCLUSION

Plants like Ashtavarga, Sarpgandha, Kali Haldi, and Shyonak are vital to our well-being. However, factors like habitat loss and climate change put them in danger. In order to safeguard them and ensure that their growth can be sustained, we must move quickly. Verifying the authenticity and safety of herbal items derived from these plants is also essential. Global regulations are needed to guarantee the efficacy and safety of herbal remedies. To create strict regulations and quality assurance mechanisms, citizens, scientists, legislators, and traditional healers must work together. To learn more about these plants and develop substitutes, we ought to invest more time in researching them. We can ensure that these unique plants survive for the benefit of future generations by acting now. Keeping these plants safe and promoting human health requires collaboration and creativity.

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