Patent Watch and IP Mapping for Botanicals – Polyherbal Combinations Clustering by Condition

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Abstract— Botanicals, or herbal medicines, have gained popularity for their natural origin, minimal side effects and affordability. Polyherbal combinations involve the use of two or more plant-derived ingredients for the treatment of complex health issues. The use of polyherbal combinations is primarily due to the involvement of multiple ingredients, which leads to improved therapeutic effectiveness. Polyherbal combinations are preferred over monoherbal formulations because the interaction between ingredients enhances their effect and may reduce the risk of toxicity. Hence, protecting these combinations is crucial to prevent formulation theft and unfair competition. Securing these exclusive rights provides recognition to the inventor or developer and contributes to future innovation. This study aims to map recent patents in the botanical sector, to identify innovation trends, and analyse gaps that could guide research into treatments for a variety of diseases. The objective of this study is to highlight recently published patents on polyherbal combinations employing reliable databases like WIPO, Google Patents and Lens.org, and to categorize them based on their therapeutic use. Clustering the polyherbal combinations based on the diseases they are used for can help organize the data, making them accessible to researchers, to promote further research. It can also prevent repetitive research. The goal of this study is to create awareness and educate researchers about innovations and developments in the herbal sector, protected under Intellectual Property Rights. The outcomes of this study include detailed analysis and summaries of recent patents published on polyherbal combination, highlighting their novelty and application for the betterment of herbal medicine. These outcomes are intended to promote deeper understanding of the importance of intellectual property in the botanical sector and support developments for treatment of complex diseases.

Index Terms— Botanicals, Intellectual Property Rights, Patent mapping, Polyherbal combinations

I. INTRODUCTION

Intellectual Property are legal rights that protect creations of the mind, like inventions, logos, industrial designs, work of art, designs or business ideas which mainly result from intellectual activity in industrial, scientific, literary and artistic fields. These intangible assets provide ownership, financial incentives, economic growth and social benefits to the creator. There are four types of IP. These include patents, trademarks, copyrights and trade secret.

There are four types of IP: patents, trademarks, copyrights and trade secrets. A patent is an exclusive right granted for an invention which may be a product, a novel process or a new technical solution to a problem. It provides legal protection to the inventors which prevents others from using, selling, distributing or commercially exploiting, without consent for a limited period. Patents provide valuable information upon disclosure and promote competition and innovation. A trademark is a form of intellectual

property that includes sign, phrase, symbol or design that represents the ownership of a specific person or enterprise. It helps in identification of goods or services and protects them from being copied or misused, thus providing unique identity to the owner. Copyrights are legal rights provided to the creator for their artistic, literary or intellectual works such as films, paintings, photographs, novels and sculptures which are tangible or in a digital format. These rights have limited time period after which the work enters the public domain. For example, an old scientific textbook published years ago or a musical composition from Mozart are no longer under copyright and can be publicly shared. Trade secrets are rights on confidential business information that provides an enterprise a competitive advantage. These include

commercial, industrial or manufacturing secrets. Trade secret may include process, instrument, design or formula which is not publicly disclosed.

IP rights offer protection to the owners or inventor's creation thus providing a social, financial and economic security and exclusivity, promoting competition and innovation. As a result, it drives significant progress in research and development focused on addressing real-world challenges.

Among the various types of intellectual property, patents play a crucial role in scientific research and innovation, particularly in the areas of product development and formulation research. There are three different types of patents which protects a specific type of invention. They are utility, design and plant patents. Utility patents protect novel processes which maybe technical or industrial, machines or composition of matter (chemical or botanical formulations). These patents provide protection for a limited period of 20 years which may be extended upon renewal. Design patents safeguard ornamental design (shape or configuration) or visual appearance of the product rather than its function. Example: A smartphone interface. Plant patents protect new and distinct plant varieties which are asexually reproduced. An example of plant variety is hybrid rose as it is reproduced through methods like grafting, cutting or tissue culture.

Patents play an important role in protecting innovation in plant-based products and processes, encouraging scientific exploration of traditional herbal knowledge. Within the botanical domain, standardized polyherbal formulations, along with their extraction methods or purification techniques, can be patented. The unique use of existing or known plant compounds may also fall under patent protection. Patents help ensure the ethical use of plant resources and support the validation of indigenous practices through scientific evidence.

II. UNDERSTANDING BOTANICALS AND THEIR PATENTS

Botanicals are substances derived from plants with medicinal value or health benefits. These can be packaged and used in forms like extracts, powders, infusions, oils, or a whole plant part like the leaves, flowers, seeds, barks, etc. Examples of botanicals are neem, turmeric and ashwagandha. Botanicals are widely used in traditional systems like Ayurveda, Siddha and folk medicine and their relevance has continued to grow in modern times. They are widely used in the fields of pharmaceuticals and nutraceuticals. Curcumin from turmeric is researched for anti-inflammatory and antioxidant properties in conditions like arthritis and metabolic syndrome as shown by Azhdari [1]. Guggulsterone from *Commiphora mukul* is studied for cholesterol-lowering effects as shown by Wang [2]. An example of botanical patent is use of turmeric in wound healing [5]. This patent claims a method of promoting healing of a wound in patient, upon administration of a wound-healing agent primarily consisting of turmeric powder. Although botanicals offer wide range of health benefits, they must be cautiously used with understanding of dosage, form and interactions.

Patenting botanicals comes with several challenges. If the knowledge is already known publicly, it may question novelty. Additionally, botanicals often contain multiple active compounds which, making it difficult to describe the specific ingredient responsible for the claimed effect. This can make the patenting process complicated.

To protect traditional knowledge from misuse, various organizations work at both international and national levels. The World Intellectual Property Organization (WIPO) plays a crucial role in setting global IP standards. In India, the Indian Patent Office (IPO) is responsible for granting, examining applications and maintaining patents. Traditional Knowledge Digital Library (TKDL) is a repository of Indian traditional knowledge mainly in Sanskrit, specifically about medicinal plants and formulations into five international languages: English, German, French, Japanese and Spanish, preventing unethical granting of patents. The Ministry of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy) contributes by promoting and regulating traditional systems of medicine. It also funds evidence-based studies and sets pharmacopeial standards. TKDL and the Ministry of Ayush collaborate to protect Indian traditional medicinal knowledge from biopiracy. These bodies ensure that innovations in the botanical sector are ethically preserved.

III. TOOLS USED FOR MAPPING PATENTS

Patent databases are organized collections of technical information regarding patented innovations that can be managed, accessed and updated. They provide abstracts and complete research details from various regions. There are a number of patent offices in various countries operating in different languages and hence it is necessary for these offices to stay updated to ensure proper patent granting. Patent databases are used for conducting searches for existing patents that can encourage or contribute to a new invention and acknowledge existing patents, thereby preventing infringement. They help keep ourselves updated on new technologies and inventions in various fields. It also helps researchers or inventors weigh out risks and benefits for carrying out further research. In particular, it is important to track botanical or herbal patents as it provides recognition and documentation of ancient practices thus preserving traditional knowledge. It helps in identifying gaps and scope for further research. It promotes product development and attracts funding to experimentally back the research.

Patent databases are categorized into free patent databases and commercial patent databases. Free patent databases are available publicly for free access without subscription. They are further categorized into government and non-government databases. Government databases are maintained by patent offices in the countries. Examples are PATENTSCOPE, INPASS and Espacenet. Non-government databases are maintained by organizations that are not part of the government. Google Patents and Patent Lens are some of the non-government databases. Commercial databases are available for searchers upon subscription. These include WIPS Global from WIPS and Orbit from Questal. This study was conducted using freely accessible, non-government databases like Google Patents, WIPO and Lens.org.

WIPO (World Intellectual Property Organization) headquartered in Geneva, Switzerland, is an agency of the United Nations, that promotes IP protection and encourages innovations worldwide. It serves as a global platform for establishing and amending IP laws and policies. It provides free access to information and a platform for filing international patents and trademarks. WIPO operates on a system called The Patent Cooperation Treaty (PCT). PCT is the international patent system which provides a cost-effective means for innovators and companies to seek patent protection in multiple countries. A single PCT application has the same legal effect as filing separate patent applications in all Contracting States. The Patent Cooperation Treaty is currently recognized by 158 member countries. While WIPO does not grant patents, it provides access to published international patent applications through PATENTSCOPE database. The PATENTSCOPE database can be searched through various filters including publication date, region, application names and keywords. This simplifies the process of researching botanical formulations.

Google Patents is a search engine from Google, launched in 2006, that indexes patents and patent applications. Google Patents allows searching and reading full text of patents from around the world. It includes advanced search tools like full documents, title, abstract and claims, in addition to date of publication or filing, inventor and assignee, patent office, language, litigation and status of application which helps narrow down searches for botanical patents. It has a broad coverage and translates non-English patent text into English. Google Patents also shows forward and backward citations. This helps researchers in analyzing how a botanical patent connects to earlier or later innovations.

Lens.org, formerly known as Patent Lens, is an open-access, online database of patents, biological data and scholarly literature provided by an Australian-based non-profit enterprise Cambia. It displays patents alongside academic publications, making it easier to understand the journey from initial research to eventual patenting. In addition to document type, date of publication and filing, applicants, region, inventors and owners, Lens.org is also equipped with visualization and analysis tools including trend charts, jurisdiction filters, legal status indicators and citation graphs. It covers major patent offices including United States Patent and Trademark Office (USPTO), European Patent Office (EPO) and WIPO, thus helping in tracking international patent activity.

By using the advanced search tools and filters available in each database, it becomes possible to map trends in botanical patents more effectively. Along with identifying specific ingredients, these tools allow searches to be filtered by diseases and health conditions, making condition-based analysis practical. Such analysis or patent reports can then be used not only to detect novel formulations but also to highlight

underexplored herbs, formulations and research gaps, thereby supporting innovation in the treatment of diseases.

IV. POLYHERBAL COMBINATIONS AND ITS SYNERGISTIC EFFECTS

Polyherbal combinations are a mixture of two or more herbs in specific ratios, commonly used for therapeutic purposes. Unlike single-herb medicines, which rely on the benefits of only one plant species, polyherbal formulations offer better therapeutic efficacy and fewer side effects. They contain active compounds from whole plant parts or specific parts like root, leaf, stem or fruit, in the form of powder, extract or infusion. They can be developed from classical medicinal texts or can be formulated using modern pharmacological methods.

Polyherbalism is based on synergistic effects. Synergy is a phenomenon where the combination of substances produces a greater effect than the sum of the effects of each individual substance [3]. For example, the combined therapeutic effects of ginger, turmeric, neem and tulsi extracts have shown to reduce cough, cold and soothe sore throat [4]. Scientific evaluation of such polyherbal combinations can be carried out through lab studies, clinical trials and pharmacological screening.

The concept of Polyherbalism originated from traditional medicine systems including Ayurveda, Siddha and Unani. They are often used for metabolic disorders, hormone imbalances, respiratory conditions, skin care and weight management. They may help improve body functions, prevent disease progression and support recovery. There has been a growing interest in polyherbal combinations as people turn towards naturally derived medicines which offer reduced side effects and improve overall health by boosting immunity.

Limitations of polyherbal formulations include the difficulty of identifying active compounds in mixtures, challenges in standardization, and the inability to target the exact cause of claimed effect. Synergistic effect can also be difficult to prove scientifically. These factors make quality control and research more complex and hinder with regulatory approval.

V. ROLE OF POLYHERBALS IN TREATMENT OF DISEASES

Polyherbal combinations are used in treatment of metabolic disorders, hormone imbalances, respiratory conditions, skin ailments, cardiovascular conditions and liver disorders. They not only target specific health issues but also strengthen immunity, supporting overall well-being. Based on the research, specific disease includes diabetes and obesity (weight management), skin care, respiratory conditions like idiopathic pulmonary fibrosis (IPF), hormone-related issues like polycystic ovarian syndrome (PCOS), cardiovascular condition like atherosclerosis and liver disorders including fatty liver and hepatitis. Commonly used herbs and their active compounds include *Curcuma longa* (Turmeric) with curcumin, *Coffee arabica* (Coffee) with caffeine and chlorogenic acids, *Zingiber officinale* (Ginger) with gingerols and shogaols,

Piper longum (Long pepper) with piperine, *Terminalia arjuna* with arjunolic acid and triterpenoids, *Phyllanthus emblica* (Amla/ Indian gooseberry) with ascorbic acid, ellagic acid and emblicanin, *Camellia sinensis* (Tea plant) with catechins and *Commiphora mukul* (Guggul) with Guggulsterones.

VI. OBJECTIVES OF PATENT WATCH AND MAPPING

The purpose of patent watch is to identify novel herb combinations and the extraction methods, track new formulation and monitor trends in patent filings in prevention or treatment of diseases. It also helps prevent duplication of research thus reducing research and development costs and promote unique formulation development. Patent mapping is particularly valuable in herbal medicines, as it reveals innovation trends by spotting popular disease targets, track filings, and analyzing pattern in herb usage. It helps in identifying leading countries or institutions by mapping geographic distribution and highlighting important research hubs. Patent watch supports research and development by inspiring new formulations and exploring gaps in under-utilized areas. It also identifies growth markets and prioritizes promising research opportunities. The goal of patent mapping is to promote research in unexplored chronic conditions, rare diseases and emerging health concerns. Many herbs remain unstudied and may hold potential for treating various conditions. Patent watch facilitates the exploration of traditional and region-specific botanicals, ensuring

they are protected from exploitation and promoting their ethical use while respecting heritage. These-region specific botanicals find the need to be protected to prevent exploitation and promote ethical use of traditional plants while respecting heritage.

VII. PATENT DATASET

The table below represents the patent dataset complied for this research project. It consists of 68 patents identified through a systematic patent watch exercise. This dataset includes details such as publication or grants year, inventors, inventor countries, herbs, disease categories, etc. This table serves as primary source of information for the analyses. By consolidating this information in one place, the table provides a clear overview of the foundation of the analysis.

S No	Patent No. / Source	Title	Disease Category	Condition	Herbs Used	Form Category	Form. Type	Publication Country	Inventor Country	Publication Year	Status
1	WO 2024/pending 023854 A1 Lens.org	Herbal anti-inflammatory composition	Allergic disorders	Inflammation	*Nigella sativa, Tinospora cordifolia, Petasites hybridus and Perilla frutescens*	Oral Solid	Tablet, capsule, liquid, powders and granules	WO	IN	2024	Granted - Active
2	WO 2024/127434 A1 Lens.org	A polyherbal formulation for immunomodulatory action	Allergic disorders	Hypersensitivity	*Inula racemosa, Clerodendrum serratum, Curcuma zedoaria, Piper longum, Piper nigrum, Abies webbiana Acorus calamus, Glycyrrhiza glabra, Calotropis gigantea, Allium sativum, Asparagus racemosus, Curcuma longa, Phyllanthus emblica, Zingiber officinale, Momordica charantia, Terminalia chebula, Tinospora cordifolia, Withania somnifera, Bauhinia variegata, Boerhavia diffusa, Chlorophytum borivilianum, Cyperus rotundus, Ficus racemosa, Moringa oleifera, Sphaeranthus indicus, Asphaltum punjabianum, Commiphora wightii*	Oral Solid	Gelatin capsules, vegetarian capsules, tablets, liquid, syrup, or dry beverage powder	WO	IN	2024	PCT Published-Pending
3	IN202321008552 WIPO	Polyherbal formulation containing slow eroding extrudate for treatment of mouth ulcer	Dental issues	Mouth ulcer	*Psidium guajava, Glycyrrhiza glabra, Matricaria recutita, Terminalia chebula* and *Aloe barbadensis*	Novel	Extrudate	IN	IN	2024	Published-Application
4	IN202221069842 WIPO	Polyherbal chewing gum with synergistic combinations for oral and dental care	Dental issues	Oral and dental care	cardamom oil, tulsi oil, peppermint oil, and betel leaf oil	Novel	Chewing gum	IN	IN	2022	Published-Application
5	IN202211005667 WIPO	Herbal candy for oral care	Dental issues	Mouth ulcers	*Punica granatum, Glycyrrhiza glabra* and *Curcuma longa*	Novel	Candy	IN	IN	2022	Published-Application
6	AU 2021/103836 A4 Lens.org	Oral wipe and its method of manufacturing thereof	Dental issues	Oral hygiene /Early childhood caries	*Terminalia chebula Retz*, *Terminalia bellerica Roxb*, *Emblica officinalis Gaertn, Glycyrrhiza glabra Linn, Curcuma longa Linn* and *Acorus calamus Linn*	Novel	Oral wipe	AU	IN	2021	Granted - Active

7	IN202121037722 WIPO	Polyherbal gel formulation	Dermatological disorders	Bacterial skin diseases	*Azadirachta indica Linn, Vitex nigundo Linn, Argemone Mexicana Linn, Trigonella foenum graecum Linn*	Topical	Topical application – Gel	IN	IN	2023	Published-Application
8	IN202021004379 WIPO	A polyherbal topical composition	Dermatological disorders	Acne-related skin conditions	*Eucalyptus citriodora, Camellia sinensis, Psidium guajava* and *Phragmites karka*	Oral Solid	Topical application - powder, gel, cream, mask, and paste.	IN	IN	2021	Published-Application
9	WO2013114394A2 Google Patents	Polyherbal combination for skin care	Dermatological disorders	Skin texture	*Ziziphus sp* *Prunus sp*	Topical	Topical	WO	IN	2013	PCT Published
10	WO 2024/142101 A1 Lens.org	A polyherbal formulation for vital effect on the pathogenesis of haemorrhoids	Gastrointestinal disorders	Haemorrhoids	*Picrorhiza kurroa, Abutilon Indicum, Cissampelos pareira, Berberis aristate, Kalinga ornata, Plumbago zeylanica* and *Terminalia Chebula*	Other	Oral administration	WO	IN	2023	PCT Published-Pending
11	WO 2022/137265 A1 Lens.org	Enteric coated HPMC based herbal oil capsule for treatment of irritable bowel syndrome	Gastrointestinal disorders	IBS	Neem seed oil, Peppermint oil	Oral Solid	Capsule	WO	IN	2022	PCT Published-Pending
12	AU 2021/103912 A4 Lens.org	A polyherbal formulation to prevent progression of ulcerative colitis	Gastrointestinal disorders	Ulcerative colitis	*Terminalia chebula, Aegle marmelos, Foeniculum vulgare, Cuminum cyminum, Asafoetida and Plantago ovata*	Oral Solid	Capsule	AU	IN	2021	Granted - Inactive
13	IN201921031321 WIPO	Effective polyherbal formulation for the treatment of ulcerative colitis.	Gastrointestinal disorders	Ulcerative colitis	*Corclia dichotoma, Berberis aristata, Cinnamomum cassia, Amaranthus spinosus, Tephrosia purpurea, Andrographis panicuiata and Piper nigrum*	Oral Solid	Capsule	IN	IN	2021	Published-Application
14	IN2170/CHE/2011 WIPO	Herbal combination of a suspension and lehya having the ability to heal piles	Gastrointestinal disorders	Piles/ Haemorrhoids	Cinnabar, Rock salt, Castor oil, *Amorphophallus paeoniifolius, Dracontium polyphyllum, Cissus setosa Roxb., Cissus quadrangularis, Mangifera indica, Aloe barbadensis, Zingiber officinalis, Terminalia chebula, Plumbago zeylanicum, Cyperus rotundus, Cassia fistula, Borassus flabellifer,* Honey, and Ghee	Oral Liquid	Oral suspension and Lehya (semisolid dosage)	IN	IN	2013	Published-Application
15	IN2589/MUM/2013 WIPO	A composition for hemoglobinopathy and method of preparation thereof	Haematological Disorders	Hemoglobinopathy	*Tinospora Cordifolia, Aloe VeraBurm .f, Aegle Marmelos, Phyllanthus Amarus Linn, Tephrosia Purpurea, Eclipta Alba, Tinospora Cordifolia*	Oral Solid	Tablet, capsule, granule	IN	IN	2015	Published-Application
16	US 7390514 B2 Lens.org	Herbal composition for treatment and maintenance of hormone dependent conditions, osteoporosis, circulatory conditions, and for use as an immunostimulant	Hormone imbalances	osteoporosis, circulatory conditions	*Glycine max, Coleus forskohlii, Camellia sinensis, Allium sativum, Withania somnifera, Boerhavia diffusa,* and *Curcuma longa*	Oral Solid	Gelatin capsule, tablet, liquid, and syrup.	US	IN	2008	Granted - Inactive

17	IN1651/DEL/2012 WIPO	A process for formulating polyherbal composition for inflammation and arthritis	Inflammatory disorders	inflammation and arthritis	*Commiphora wightii, Asparagus racemosus, Amaranthus viridis, Barleria prionitis, Stellaria media* and *Piper nigrum*	Oral Solid	Capsules, tablets, elixirs, powders, granules, suspensions, sachets, food additives, beverage, additives, and herbal teas	IN	IN	2023	Published-Application
18	WO 2025/127996 A1 Lens.org	Medicament for the treatment of liver disease, liver injury and/or hepatotoxicity	Liver disorders	Liver diseases	*Rauwolfia* spp, *Eclipta* spp and *Phyllanthus* spp	Oral Solid	Tablets, losenges, granules, powders, capsules, cachets, pills, ampoules.	WO	IN	2025	PCT Published-Pending
19	WO 2024/180571 A1 Lens.org	An herbal formulation for reducing the after effects of liver damage by regeneration and protection of hepatocytes	Liver disorders	liver damage	*Bauhinia variegata, Smilax glabra, Commiphora wightii, Indian sarsaparilla, Manjista, Glycyrrhiza glabra, Curcuma longa, Terminalia chebula, Tribulus terrestris* and Aloe vera	Other	Oral administration	WO	IN	2024	PCT Published-Pending
20	US6136316 WIPO	Hepatoprotective compositions and composition for treatment of conditions related to hepatitis B and E infection	Liver disorders	Hepatitis B and E	*Rheum emodi Wall., Phyllanthus amarus Linn., Eclipta alba Hassk., Andrographis paniculate Nees., Picrorhiza kurroa Royle ex Benth, Fumaria officinalis, Tinospora cordifolia Miers., Terminalia chebula Retz., Cichorium intybus Linn., Tephrosea purpurea Linn*. and *Boerhaavia diffusa Linn*	Oral Solid	Tablet capsule, syrup, powder, concentrate or granule.	US	IN	2000	Granted - Expired
21	IN202221055643 WIPO	Novel polyherbal formulation for renal failure in diabetes	Metabolic Disorder (Diabetes-related)	Diabetic Nephropathy	*Pedalium murex, Hordeum vulgare* and *Triticum aestivum*	Oral Solid	Capsules	IN	IN	2023	Published-Application
22	IN202011049258 WIPO	A novel polyherbal combination for peripheral neuropathy associated with diabetes	Metabolic Disorder (Diabetes-related)	Diabetic Neuropathy	*Tinospora cordifolia, Withania somnifera* and *Boerrhavia diffusa* based in Olive Oil.	Oral Liquid	Oral suspension	IN	IN	2022	Granted - Unknown
23	IN202241028018 WIPO	A polyherbal formulation targeted to the treatment of diabetic nephropathy and preparation method thereof	Metabolic Disorder (Diabetes-related)	Diabetic Nephropathy	*Bombycis corpus, Puerariae radix* and *Araliae continentalis Radix*	Oral Solid	Tablets, pills, suspensions, emulsions, powders, solutions, syrups, granules, capsules	IN	IN	2022	Published-Application
24	IN202021025843 WIPO	Polyherbal cookies for prevention and treatment of retenopathic complication of diabetes	Metabolic Disorder (Diabetes-related)	Diabetic Retinopathy	*Beta vulgaris, Terminalia bellerica, Tridax procumbens,* citrus lemon Juice and buckwheat powder	Novel	Cookies	IN	IN	2021	Published-Application
25	IN202511012300 WIPO	Formulation of "Madhumeh-Rodhak": polyherbal anti-	Metabolic disorders	Diabetes	*Azadirachta indica, Sphaeranthus indicus, Trachyspermum ammi, Foeniculum vulgare, Swertia*	Oral Solid	Tablets	IN	IN	2025	Published-Application

		diabetic tablets & method of preparation thereof			*chirata, Tinospara cordifolia, Sesamum indicum, Pterocarpus santalinus*						
26	WO2023285999A1 Google Patents	A polyherbal formulation for weight management and a process for its preparation	Metabolic disorders	Obesity	*Coffee arabica, Garcinia cambogia, Terminalia arjuna , Commiphora mukul, Cyperus rotundus, Zingiber officinale, Piper longum*	Oral Solid	Tablet	WO	IN	2023	PCT Published
27	IN202341036711 WIPO	Development of a polyherbal tea bag formulation for evaluating its in-vivo antidiabetic potential	Metabolic disorders	Diabetes	*Ichnocarpus frutescens, Ficus dalhousiae, Creteva magna, Alpinia galanga, Swertia chirata*	Novel	Tea bag	IN	IN	2023	Published-Application
28	IN202321044291 WIPO	Polyherbal antidiabetic composition and process of preparing thereof	Metabolic disorders	Diabetes	*Momordica charantia, Gymnema Sylvestre, Salacia oblonga, Trigonella foenum-graecum, Centratherum anthelminticum, Pterocarpus marsupium, Ocimum sanctum Linn., Tinospora cordifolia, Curcuma longa, Emblica officinalis, Terminalia belerica, Terminalia chebula* and *Syzygium cumini*	Oral Solid	Tablets, capsules, powder, sachet, pills, tablet in capsules, granules, pellets	IN	IN	2023	Published-Application
29	IN202311049669 WIPO	Novel antidiabetic polyherbal formulation	Metabolic disorders	Diabetes	*M. charantia, G. sylvestre, Withania somnifera*	Oral Solid	Capsule, granules	IN	IN	2023	Published-Application
30	IN202211048737 WIPO	Polyherbal formulation for the management of diabetes and cytoprotection	Metabolic disorders	Diabetes	*Phyllanthus emblica, Annona squamosa, Berberis aristata* and *Curcuma longa*	Oral Liquid	Oral suspension	IN	IN	2022	Published-Application
31	IN202221009468 WIPO	Antidiabetic polyherbal formulation and preparation thereof	Metabolic disorders	Diabetes	*Coccinia grandis, Annona squamosa, Gymnema sylvestre*	Oral Liquid	Syrup	IN	IN	2022	Published-Application
32	IN202211072199 WIPO	Novel synergistic herbal formulation for diabetes cure and method of preparation thereof	Metabolic disorders	Diabetes	*Gymnema sylvestre, Glycyrrhiza glabra, Nigella sativa, Rosmarinus officinalis, Foeniculum vulgare, Stevia rebaudiana, Withania coagulans*	Oral Solid	Capsules	IN	IN	2022	Published-Application
33	IN5274/CHE/2013 WIPO	A pharmaceutical formulation for treating diabetes mellitus and its associated complications	Metabolic disorders	Diabetes mellitus	*Momordica charantia,* Aloe vera*, Annona squamosa, Gymnema sylvestre* and *Scoparia dulcis*	Oral Solid	Tablet, capsule, gentle capsule, granule, pill, syrup, oral solution, or oral suspension.	IN	IN	2021	Granted - Unknown
34	IN201911039213 WIPO	A polyherbal composition for diabetes	Metabolic disorders	Diabetes	*Ocimum sanctum, Aegle marmelos, Emblica officinalis, Terminalia bellirica, Terminalia chebula, Syzgium cumini, Trigonella foenum-graecum, Cinnamomum zeylanicum, Momordica charantia,* and *Curcuma longa*	Oral Solid	Tablets, soft capsules, hard capsules, pills, granules, powders, emulsions, suspension.	IN	IN	2021	Published-Application

35	WO2020012447A1 Google Patents	Polyherbal formulation and method for production thereof	Metabolic disorders	Diabetes	*Psidium guajava, Syzygium cumin, Momordica charantia, Phyllanthus emblica*	Oral Solid	Snack bar, a drink, a tablet or a capsule	WO	IN	2020	PCT Published
36	IN1999/CHE/2013 WIPO	Sweeter herbal formulations of Momordica for diabetes mellitus	Metabolic disorders	Diabetes	*Momordica charantia, Cinnamomum cassia, Stevia rebaudiana*	Oral Solid	Tablets	IN	IN	2014	Published-Application
37	WO 2024/142102 A1 Lens.org	A polyherbal for mulation for antimigraine action	Neurological disorders	Migraine	*Zingiber Officinale, Eclipta prostate, Phyllanthus niruri, Commiphora wightii, Bacopa monnieri*	Oral Solid	Capsules, tablets, liquid extracts, or powders	WO	IN	2024	PCT Published-Pending
38	IN201941028495 WIPO	A synergistic nano polyherbal formulation for Parkinson disorder	Neurological disorders	Parkinson disorder	*Allium sativum, Bacopa monniera, Citrus lemon, Citrus sinensis, Curcuma longa, Cyperus rotundus, Lycopersicon esculentum L., Mucuna pruriens, Nardostachys jatamansi, Nigella sativa, Prunus dulcis, Psidium guajava, Sesame indicum, Vicia faba, Vitis vinifera, Withania somnifera, Zingiber officinale*	Novel	Phytonanoceutical oral formulation	IN	IN	2021	Published-Application
39	IN201941025505 WIPO	A synergistic nano polyherbal formulation for anxiety disorder	Neurological disorders	Anxiety	*Convolvulus pluricaulis Choisy, Rauwolfia serpentina Linn, Tribulus terrestris, Curcuma longa*	Novel	Phytonanoceutical oral formulation	IN	IN	2021	Published-Application
40	WO 2024/142100 A1 Lens.org	A polyherbal for mulation for management of cancer	Oncology	Cancer	*Catharanthus roseus, Jasminum augustifolium, Bauhinia variegata, Glycyrrhiza glabra and Commiphora wightii*	Other	Oral administration	WO	IN	2024	PCT Published-Pending
41	IN202141055807 WIPO	Process for polyherbal formulation *using Vitis vinifera, Ixora coccinea* and *Piper longum* for anticancer potential	Oncology	Cancer	*Vitis vinifera, Ixora coccinea* and *Piper longum*	Oral Solid	Capsule	IN	IN	2022	Published-Application
42	US7744931B2 Google Patents	Methods for treating oral cancers with herbal compositions	Oncology	Oral cancer	Rosemary, turmeric, oregano, ginger, holy basil, *Scutellaria baicalensis,* green tea, huzhang, Chinese goldthread and barberry	Oral Solid	Tablet or capsules	US	US	2010	Granted - Inactive
43	WO 2013/065015 A2 Lens.org	A Synergistic Herbal composition for prevention and treatment of diabetic retinopathy and cataract	Ophthalmology	Diabetic retinopathy and cataract	*Terminalia chebula, Emblica officinalis, Terminalia belerica, Emblica officinalis, Tinospora cordifolia, Butea monosperma Curcuma sp, Triphala sp*	Oral Solid	Liquid, solid, semisolid, gel, powder.	WO	IN	2013	PCT Published-Pending
44	WO 2020/212820 A2 Lens.org	Polyherbal trans dermal patch for pain management and its process of preparation	Pain management	Pain	*Boswellia extract,* evening primrose oil, blackcurrant seed oil, Ginger, Licorice, Cat's claw and Devil's claw	Topical	Transdermal patch	WO	IN	2020	PCT Published-Pending
45	WO 2024/154156 A1 Lens.org	A novel polyherbal formulation for reducing the effects of	Renal & Hepatobiliary Disorders	Kidney stones and gall bladder stones	*Tribulus terrestris, Bergenia ligulate, Boerhaavia diffusa, , Tinospora cordifoli, Crateva religiosa, Picrorhiza kurroa, Hordeum vulgare,*	Oral Solid	Tablets or capsule	WO	IN	2024	PCT Published-Pending

		cholelithiasis and renal calculi			*Parmotrema perlatum*						
46	IN202111035835 WIPO	An herbal composition for alleviation of kidney stone	Renal disorder	Kidney stones	*Hordeum vulgare L., Foeniculum vulgare M*	Other	Liquid dosage	IN	IN	2023	Published-Application
47	IN2656/MUM/2011 WIPO	A process for the preparation of polyherbal formulation effective to treat kidney stones	Renal disorders	Urolithiasis/ Kidney stones	*Tribulus terrestris L. Hygrophila spinosa L. Ricinnus communis L. Celosia argentea L. Coleus blumei Benth, Paederia foetida L- Bryophyllum pinnatum (Lam)* and *Amaranthus spinosus L.*	Oral Solid	Powder (administered with curd or honey)	IN	IN	2017	Granted - Unknown
48	WO 2024/180572 A1 Lens.org	An Herbal Formulation Prs-14 For Reducing the Effects Of PCOD, Infertility, Endometriosis and Uterus Fibroids	Reproductive health disorders	PCOD, Infertility, Endometriosis and Uterus Fibroids	*Saraca indica, Commiphora Wightii, Emblica officinalis, Terminalia bellerica, Terminalia Chebula*	Other	Oral administration	WO	IN	2024	PCT Published-Pending
49	WO 2023/170707 A1 Lens.org	Pharmaceutical composition for managing dysmenorrhea	Reproductive health disorders	Dysmenorrhea	*Cannabis sativa, Bambusa arundinacea, Withania somnifera*	Oral Solid	tablet, capsule, solution, gel, ointment or patch	WO	IN	2023	PCT Published-Pending
50	US11382945B2 Google Patents	Herbal composition for preventing and alleviating polycystic ovary syndrome	Reproductive health disorders	PCOS	*Trigonella foenum, Tribulus terrestris, Trachyspermum ammi, Putranjiva roxburghii, Glycyrrhiza glabra, Garcinea cambogia, Ociumum sanctum, Sesamum indicum, Prunus amygdalus, Oryza sativa*	Oral Solid	Tablet	US	IN	2022	Granted - Active
51	IN202321075317 WIPO	Polyherbal formulation for treatment of asthma	Respiratory disorders	Asthma	*Hugonia mystax, Blumea lacera, Albizia lebbeck*	Oral Liquid	Elixir – Liquid form	IN	IN	2023	Published-Application
52	IN202321045632 WIPO	Polyherbal syrup formulation targeted to asthma	Respiratory disorders	Asthma	*Adhatoda Vasica* and *Boswellia serrata*	Oral Liquid	Syrup	IN	IN	2023	Published-Application
53	IN202021016940 WIPO	Polyherbal composition for respiratory system associated disorders	Respiratory disorders	Viral respiratory disorders – COVID /SARS	Triphala, daruharidra, kantakari, trikatu, moorba, guduchi, jawasa, kutaki, trayamana, netrabala neem chhaal, mulethi, kuda chhal, ajwain, bharangi, sahijn beej,chireta, vacha, chitrak, devdaru, chavya, patolpatra, kalmegh, lavang, kamal, kakoli, tejpatra, talispatra, javitri, ativisha, haldi, dalchini, shweta chandan, khareti, shalparni, and prishniparni	Oral Solid	Solid oral administration (tablets, capsule, powders or granules)	IN	IN	2022	Granted - Unknown
54	IN202011050259 WIPO	Novel polyherbal hydroalcoholic formulation for asthma, common cold and to modulate immunity	Respiratory disorders	Asthma, common cold	*Adhatoda vasica, Woodfordia fruticosa, Cinnamomum zeylanicum, Elettariacardamom, Cinnamomum tamala, Glycyrrhiza glabra, Piper cubeda, Zingiberofficinalis, Piper nigrum, Piper longum, Vetiveria zizanioide, Mesua ferrea and* Jaggery.	Oral Liquid	Syrup	IN	IN	2021	Published-Application

55	US10143717B2 Google Patents	Herbal composition for IPF	Respiratory disorders	Idiopathic Pulmonary Fibrosis	*Curcuma longa Zingiber officinale*	Oral Solid	Polyherbal tablet	US	IN	2018	Granted - Inactive
56	IN1534/DEL/2011 WIPO	A novel composition of poly herbal TX GEL (LOBODIL TX) for respiratory diseases and disorders and asthma and process there off	Respiratory disorders	Asthma	*Abies webbiana, Adhatoda vasica, Glycyrrhiza glabra, Pistacia integerrima, Ricinus communis, Zingiber officinale, Cinnamomum zeylanicum, Ficus religiosa, Piper Longum*	Oral Solid	Oral administration – tablet, gel	IN	IN	2011	Published-Application
57	IN1130/MUM/2009 WIPO	An oral herbal spray for treatment and maintenance therapy of asthma	Respiratory Disorders	Asthma	*dhatoda vasica Nees., Clerodendrum serratum Linn., Curcuma longa Linn., Solanum xanthocarpum Schrad & Wendl., Piper longum Linn*	Inhalation	Spray	IN	IN	2010	Published-Application
58	IN1401/CHE/2008 WIPO	Synergistic poly herbal composition for the treatment of bronchial asthma and the process of preparing the same	Respiratory Disorders	Bronchial asthma	*Achyranthes aspera, Woodfordia furiticosa, Solanum xanthocarpum, Justicia adhatoda, Acacia arabica, Zingiber officinalis, Syzygium aromaticum, Curcuma longa, Holarrhena antidysentercia, Enicostemma littorale, Calotropis procera, Piper longum, Piper nigrum* and *Elettaaria Cardamomum*	Oral Solid	Capsules	IN	IN	2009	Published-Application
59	WO 2023/021479 A1 Lens.org	A synergistic poly herbal formulation for treating viral infections and a process of preparation thereof	Viral infections	COVID-19	*Swertia chirata, Zingiber Officinale, Tinospora cordifolioa, Justicia adhatoda, Terminalia chebula and Trichosanthes Cucumerina*	Oral Solid	Tablet, powder, syrup and granules	WO	IN	2022	PCT Published-Pending
60	IN202021052387 WIPO	Treatment approach for coronaviruses using a herbal composition and a method of preparing said composition	Viral infections	COVID-19	*Andrographis panicullata, Phylanthus niruri, Glycirhizza glabra, Ocimum sanctum, Tinsopsora cordiflolia, Inula racemose, Alpinia galangal, Vitis vinifera, Curcuma longa, Terminalia chebula, Aloe barbandensis, Asphaltum, Piper longum, Artemisia nilagirica*	Oral Solid	Tablet and capsule	IN	IN	2022	Published-Application
61	IN202011053051 WIPO	Polyherbal formulation against single stranded RNA viral diseases	Viral infections	Dengue virus, Chikungunya virus and Japanese encephalitis virus	*Piper nigrum, Ocimum sanctum, Olive and Tinospora cordifolia*	Oral Solid	syrups or tablets or capsules	IN	IN	2022	Granted - Unknown
62	IN202241055145 WIPO	Polyherbal formulation for corona virus infection and preparation method thereof	Viral infections	Corona virus	*Tinospora cardifolia, Echinacea, Dioscorea, Glycerrhiza , Rhubarb, Zinger, Azadirachta indicia, honey, Allium sativum*	Oral Liquid	Syrup	IN	IN	2022	Published-Application

63	WO 2021/220297 A1 Lens.org	A novel polyherbal pharmaceutical composition exhibiting immunomodulatory and anti-viral activity and method of preparation thereof	Viral infections	COVID 19 AIDS, Dengue, H1N1, and H5N1	*Morinda tinctoria, Azadirachta indica, Aegle marmalades, and Tamarindus indica,* and fresh fruit juice of *Citrus limon (L.)*	Oral Solid	Tablet and capsule	WO	IN	2021	PCT Published-Pending
64	IN202021048992 WIPO	Ayurvedic proprietary medicine for treatment of se66vere acute respiratory syndrome coronavirus 2 (SARS-COV-2)	Viral infections	SARS-COV-2	*Emblica officinalis, Terminalia chebula, Terminalia belerica, Aegle marmelos, Zingiber officinale, Ocimum sanctum, Adatoda zeylanica, Piper lingum, Andrographis panivulata, Coriandrum sativum, Tinospora cordiofolia, Cuminum cyminum, Piper nigrum*	Oral Liquid	Syrup	IN	IN	2020	Published-Application
65	IN1517/MUM/2012 WIPO	Novel anti-HIV herbal composition, method of preparation of the same and use thereof	Viral infections	HIV	*Allium sativum, Andrographis paniculata, Clerodendrum serratum, Eugenia jambolana, Mangifera indica, Nyctanthes arbortristis, Ocimum sanctum, Tinospora cordifolia*	Oral Solid	tablet, capsules, powder or syrup	IN	IN	2014	Published-Application
66	WO 2013/042132 A1 Lens.org	A novel herbal formulation for the modulation of immune system of HIV infected patients and a process of preparation thereof.	Viral infections	HIV	*Hippophae rhamnoides, Convolvulus pluricaulis, Withania somnifera, Ocimum sanctum,* and *Cynodon dactylon*	Oral Solid	Capsule and tablet	WO	IN	2013	PCT Published-Pending
67	US 7250181 B2 Lens.org	Polyherbal compositions and methods for treating viral infections	Viral infections	Viral infection caused by HIV virus	*Withania somnifera, Mangifera indica* and *Shilajit*	Oral Solid	Liquids, powders, pills, tablets, capsules and confectionery bars	US	IN	2007	Granted - Expired
68	IN202521011306 WIPO	A topical polyherbal ointment formulation and preparation method thereof	Wounds	Burn injuries	*Embelica officinalis, Terminalia chebula, Terminalia bellarica, Syzigium cumini and Syzigium caryophyllatum*	Topical	Ointment	IN	IN	2025	Published-Application

Table I. Patent dataset compiled for polyherbal combination research

VIII. VISUALISATION OF PATENT DATA

A. Distribution of Patents by Disease Category

Most patents were concentrated in Metabolic disorders i.e., diabetes and diabetes-related complications followed by respiratory disorders, viral infections and gastrointestinal disorders. Smaller but notable categories included liver disorders, dermatological conditions, oncology, dental care, neurological conditions and reproductive health disorders. This indicates a research priority towards diabetes and metabolic health, while areas such as cancer, renal disorders and certain reproductive health conditions remain unexplored, highlighting potential opportunities for future innovation.

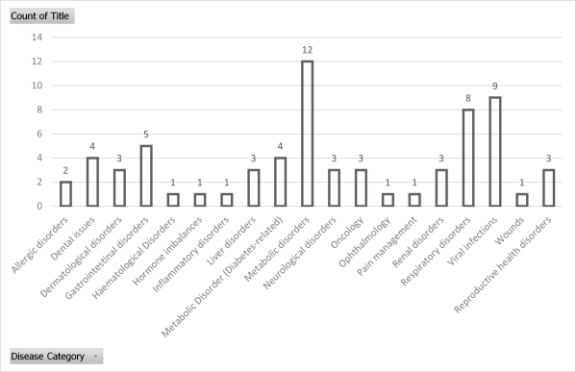

Fig. 1. Distribution of patents by disease category

B. *Distribution of Patents by Year of Publication or Grant*

Patent filings showed an increasing trend over the years. The highest activity was observed in 2022 with 15 filings, dominated by viral infections (4 patents) followed by metabolic disorders (3 patents) and diabetes-related metabolic disorders (2 patents). In 2021, there were 11 filings, with maximum contributions in metabolic disorders (2 patents) followed by diabetes-related metabolic disorders and respiratory disorder (1 patent). This trend continued in 2023 with 12 filings with maximum patents in metabolic disorders (4 patents) and respiratory disorders (2 patents). In 2024, 8 filings were recorded across diverse categories including reproductive health and diabetes-related metabolic disorders (1 patent each). This indicated a consistent research focus on metabolic and diabetes related disorders, with viral and respiratory infections also emerging as priority areas.

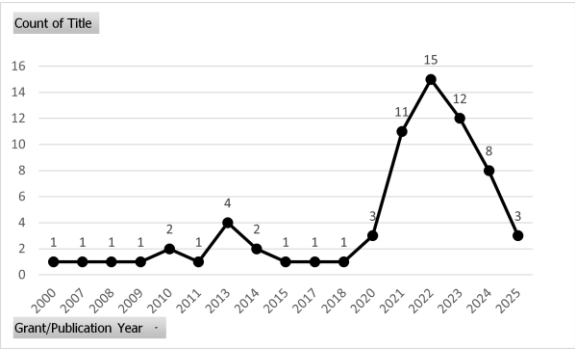

Fig 2. Trends in patent filings by year of publication or grant

C. *Geographical Distribution by Publication Country and Inventor Country*

The majority of inventions originated in India with 99%, and only 1% attributed to United States. This highlights that research and innovation in polyherbal space is driven from India. Despite the concentration of inventors in India, the filings were distributed across multiple jurisdictions with maximum publications in India (60%), followed by WO-PCT (28%), United States (9%) and Australia (3%). This reveals that although the inventions were developed in India, applicants sought protection in international platforms like PCT and other countries such as the US and Australia.

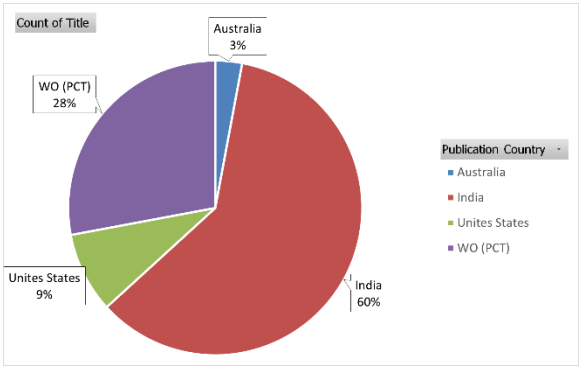

Fig. 3. Distribution of patents by publication country

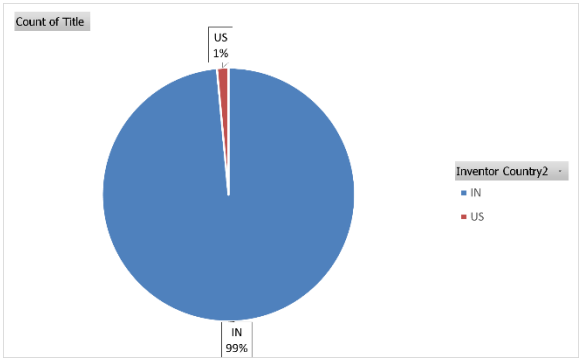

Fig. 4. Distribution of patents by inventor country

Distribution by Legal Status

Table II. Categorization of patents by legal status with reasoning and verification sources

Status Category	Reasoning / How Status Was Assigned	Reference / Verification	Percentage
Granted – Active	Patent has grant date, Lens.org shows active, indicating patent is granted and currently in force.	WIPO grant date + Lens.org (Active)	5%

Granted – Expired	Patent has grant date, Lens.org shows expired, indicating patent term has ended.	WIPO grant date + Lens.org (Expired)	3%
Granted – Inactive	Patent has grant date, Lens.org shows inactive, indicating patent was granted but is no longer active (e.g., lapsed, not renewed).	WIPO grant date + Lens.org (Inactive)	6%
Granted – Unknown	Patent has grant date, Lens.org shows unknown, indicating granted status is confirmed but current legal status could not be verified.	WIPO grant date + Lens.org (Unknown)	7%
PCT Published	WO prefix indicates a PCT publication. No pending or other legal status shown on Lens.org, so marked as published.	WIPO PATENTSCOPE + Lens.org	4%
PCT Published – Pending	WO prefix indicates a PCT publication. Lens.org legal status shows pending, so marked as pending to indicate international publication and still awaiting grant in national phase.	WIPO PATENTSCOPE + Lens.org (Pending)	22%
Published – Application	Patent has IN or US prefix and publication date, no grant date.	WIPO publication	53%

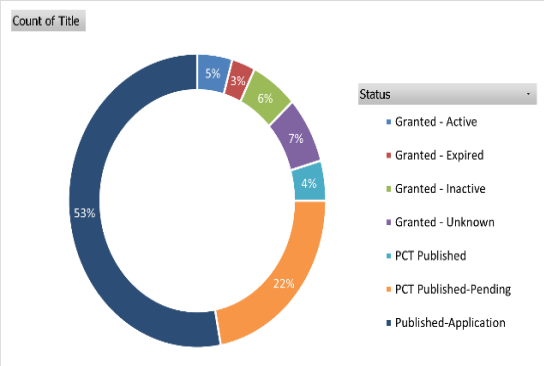

Fig. 5. Percentage distribution by legal status

D. Distribution by Formulation Category

Table III. Categorization of patents by formulation type and percentage

Formulation Categories	Formulation type in dataset	Percentage
Inhalation	Spray	1%
Novel	Chewing gum, cookies, snack bars, tea bags, herbal candy, extrudate, oral wipe, phytonanoceutical formulations	8%
Oral Liquid	Syrup, suspension, solution, elixir, drink, beverage, extract	9%
Oral Solid	Tablet, capsule, pill, granule, powder, pellet, lozenge	41%
Other / Unclassified	Mixed entries	5%
Topical	Gel, cream, ointment, paste, lotion, transdermal patch	4%

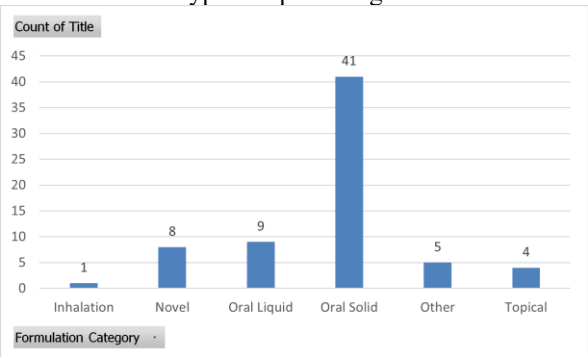

Fig. 6. Distribution of patents by formulation category

IX. GROUPING THE POLYHERBAL PATENTS BASED ON DISEASE CATEGORIES

Table IV. Grouping of patents by disease category with corresponding herbs and formulations

Row Labels	Count of Patent No / Link	% of Grand Total	Common herbs	Common formulations
Metabolic disorders	16	23.53%	*Tinospora cordifolia, Terminalia spp, Pedalium murex*	Tablets, capsules
Viral infections	9	13.24%	*Tinospora cordifolia, Ocimum tenuiflorum, Terminalia spp., Zingiber officinale*	Tablets, capsules, syrups
Respiratory disorders	8	11.76%	*Zingiber officinale, Piper longum, Curcuma longa, Adhatoda vasica*	Syrups, tablets/capsules
Gastrointestinal disorders	5	7.35%	*Terminalia chebula, Plumbago zeylanica, Cinnamomum spp.*	Capsules, oral suspension
Dental issues	4	5.88%	*Terminalia spp., Glycyrrhiza glabra, Curcuma longa*	Chewing gum, oral wipes, candy
Reproductive health disorders	3	4.41%	*Terminalia spp., Tribulus terrestris, Glycyrrhiza glabra*	Tablets, capsules
Renal disorders	3	4.41%	*Tribulus terrestris, Hordeum vulgare, Boerhaavia diffusa, Tinospora cordifolia*	Tablets, capsules, powders,
Dermatological disorders	3	4.41%	*Azadirachta indica, Psidium guajava, Eucalyptus sp, Camellia sinensis*	Topical gels, creams
Liver disorders	3	4.41%	*Terminalia spp., Phyllanthus spp., Eclipta, Picrorhiza*	Syrups, paste
Oncology	3	4.41%	*Catharanthus roseus, Vitis vinifera, Zingiber officinale, Camellia sinensis*	Capsules, tablets
Neurological disorders	3	4.41%	*Zingiber officinale, Bacopa monnieri, Curcuma longa*	Phytonanoceutical oral forms
Others	8	11.76%	*Tinospora cordifolia, Glycyrrhiza glabra, Curcuma longa, Terminalia chebula, Commiphora wightii*	Tablets, capsules, syrups, powders, ointments, transdermal patch
Grand Total	68	100.00%		

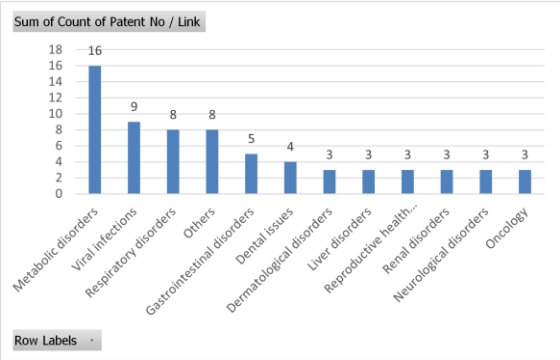

Fig. 7. Clustering of polyherbal patents by disease categories

The polyherbal patents were clustered into disease categories to identify core research areas, therapeutic priorities and innovation gaps. Among the 68 patent entries analysed, the major categories identified were metabolic disorders, viral infections, respiratory conditions, gastrointestinal disorders, reproductive health, dermatological, oncology, dental and neurological disorders.

The largest cluster was observed in metabolic disorders with sixteen patent entries (23.53%). This dominance reflects the global rise of lifestyle-related diseases, growing concerns around diabetes and the availability of documented medicinal plants with proven metabolic benefits and clear regulations. The most common herbs in this category were *Tinospora cordifolia, Terminalia spp* and *Pedalium murex* and the major dosage forms were tablets and capsules.

Moderate patent activity was observed in viral infections, respiratory disorders and gastrointestinal concerns suggesting continued but less intensive research interest.

Small clusters were observed in oncology, dermatology, reproductive health and neurological disorders with only three to four patents each. These fields remain unexplored due to the complexity of conditions, challenges of standardizing multi-herb formulations and the requirement of strong clinical evidence to meet strict regulatory standards.

Tinospora cordifolia, *Curcuma longa, Terminalia spp.,* and *Zingiber officinale* appeared across multiple categories, highlighting broad immunomodulatory and anti-inflammatory properties. Tablets axnd capsules were the most common dosage forms probably due to their ease of administration, manufacturing efficacy and patient compliance.

In conclusion, the dataset suggests strong research priority toward metabolic disorders, viral infections and respiratory health, while also highlighting potential opportunities for innovation in cancer, reproductive and neurological conditions.

X. IDENTIFYING COMMON HERBS, FORMULATIONS AND ANALYSING SIMILAR TRENDS

The main focus of this module is to identify common herbs and repeated formulations in polyherbal patents with an aim of highlighting recurring patterns and similarities across the dataset. Analyzing herbs that dominate filings and combinations that appear repeatedly, the goal is to provide insights into therapeutic significance of certain botanicals and their industrial preferences for shaping formulations. The analysis also distinguishes between broadly used herbs and specialized herbs, providing a clearer view of the current innovation landscape and potential areas for future research and novel formulations.

A. Most Used Herbs

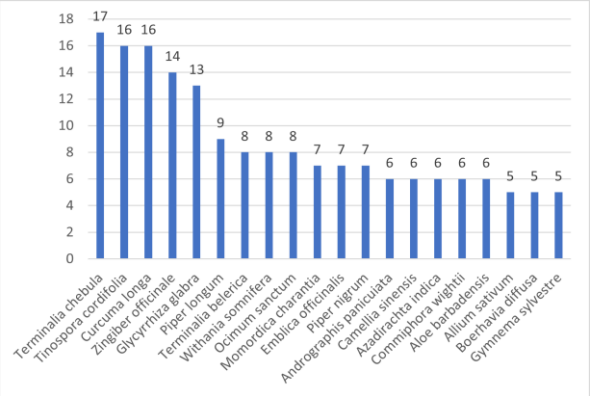

Fig. 8. Most frequently used herbs across polyherbal patents

This bar graph represents the herbs that appear most frequently across all patents. The most common herb is *Terminalia chebula* (17 patents), followed by *Curcuma longa* (16 patents) and *Tinospora cordifolia* (16 patents). Others are widely used but are less frequent. The frequent occurrence of these herbs highlights both their therapeutic significance and their popularity in patent filings. The 'Others' category (291 entries) shows wide experimentation with diverse botanicals, even if most herbs do not feature prominently. This directly reflects on the diversity of botanicals being explored.

B. Top 10 Herbs

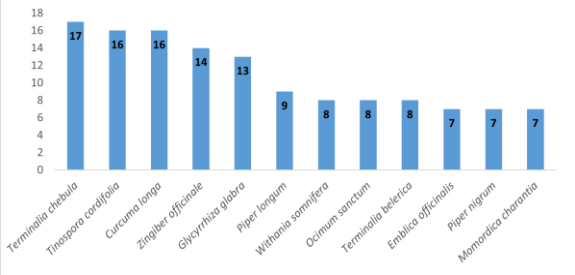

Fig. 9. Top 10 most frequently used herbs in polyherbal patents.

This chart shows the top 10 most frequently used herbs, highlighting dominating species. *Terminalia chebula, Tinospora cordifolia* and *Curcuma longa* together constituted 38% of total usage. The concentration of patents around these herbs suggests strong commercial and therapeutic value but also highly competitive domain of botanical patents.

C. Disease Category vs Herbs Heatmap

Row Labels	*Terminalia chebula*	*Tinospora cordifolia*	*Curcuma longa*	*Zingiber officinale*	*Glycyrrhiza glabra*
Viral infections	17.6%	37.5%	6.3%	21.4%	7.7%
Metabolic disorders	11.8%	12.5%	18.8%	7.1%	7.7%
Respiratory disorders	5.9%	6.3%	25.0%	28.6%	23.1%
Allergic disorders	5.9%	12.5%	6.3%	7.1%	7.7%
Reproductive health disorders	5.9%	0.0%	0.0%	0.0%	7.7%
Dental issues	5.9%	0.0%	12.5%	0.0%	15.4%
Neurological disorders	0.0%	0.0%	12.5%	14.3%	0.0%
Gastrointestinal disorders	17.6%	0.0%	0.0%	7.1%	0.0%

Fig. 10. Distribution of top 5 herbs across top 8 disease categories

The purpose of this heatmap is to show the relative distribution of each herb's application across different disease categories. Each row and column represent one herb and one disease category respectively. Each cell is the percentage of that herb's total use in patents that fall in the disease category and hence each row sums to 100% distribution of an herb's application. The colours in the heatmap are variable to the percent distribution of herbs. Light blue is close to 0%, mid blue is approximately 50% and dark blue is close to 100%.

Herbs used in high concentration in one disease category are:

- *Curcuma longa* – 18.8% in metabolic disorders, 25% in respiratory conditions, 12.5% in dental care, and 12.5% in neurological conditions.
- *Zingiber officinale* – 28.6% in respiratory conditions, 21.4% in viral infections, and 14.3% in neurological conditions.
- *Terminalia chebula* – 17.6% in viral infections, 17.6% in gastrointestinal disorders, 11.8% in liver disorders, and 11.8% in metabolic conditions.

Herbs with moderate use are:

- *Tinospora* cordifolia – 37.5% in viral infections, 12.5% in metabolic disorders, 6.3% in respiratory, and 12.5% in allergic conditions.
- *Glycyrrhiza glabra* – 23.1% in respiratory, 15.4% in dental, and 7.7% in viral infections.

While these herbs are not dominant in a single category, they represent either broad-spectrum applicability (*Curcuma longa, Zingiber officinale, Terminalia chebula*) or supportive roles across multiple disease conditions (*Tinospora cordifolia, Glycyrrhiza glabra*). This focused 8×5 heatmap helps identify which herbs are therapeutic specialists versus generalists within the patent domain.

D. *Herb vs Formulation Category*

Row Labels	Inhalation	Novel	Oral Liquid	Oral Solid	Other	Topical	Grand Total
Terminalia chebula		2	2	9	3	1	17
Tinospora cordifolia			3	13			16
Curcuma longa	1	4	1	9	1		16
Zingiber officinale		1	4	8		1	14
Glycyrrhiza glabra		3	2	5	2	1	13
Piper longum	1		2	6			9
Withania somnifera		1	1	6			8
Ocimum sanctum			1	7			8
Terminalia belerica		2	1	3	1	1	8
Emblica officinalis		1	1	3	1	1	7
Piper nigrum			2	5			7
Momordica charantia				7			7
Grand Total	**2**	**14**	**20**	**81**	**8**	**5**	**130**

Fig. 11. Herb vs formulation category (Top 10 herbs)

The heatmap of herb vs formulation category shows which herbs are used most often in which formulation categories. This chart helps in spotting specialization patterns which highlights herb-formulation relationships. Oral solid dominates with 81 patents and herbs involved are *Tinospora cordifolia* (13), *Terminalia chebula* (9), *Curcuma longa* (8). Topical is rare with 5 patents and mainly *Curcuma longa* and *Zingiber officinale.* Novel formulations appear across several herbs, with notable activity in *Glycyrrhiza glabra* and *Terminalia* species. Inhalation had only two in total. This dominance of oral solids is probably due to industrial feasibility and easier administration route, while limited use of inhalation and topical forms suggests underexplored formulation opportunities.

E. *Disease Category vs Formulation Category*

Count of Title	Column Labels						
Row Labels	Inhalation	Novel	Oral Liquid	Oral Solid	Other	Topical	G T
Metabolic disorders		1	2	9			1
Viral infections			2	7			9
Respiratory disorders	1		3	4			8
Gastrointestinal disorders			1	3	1		5
Metabolic Disorder (Diabetes-related)		1	1	2			4
Reproductive health disorders				2	1		3
Oncology				2	1		3
Dermatological disorders				1		2	3
Dental issues		3					3
Liver disorders				2	1		3
Neurological disorders		2		1			3
Allergic disorders				2			2
Haematological Disorders				1			1
Hormone imbalances				1			1
Ophthalmology				1			1
Renal disorders				1			1
Oral / Gastrointestinal disorder		1					1
Inflammatory disorders				1			1
Pain management						1	1
Wounds						1	1
Renal & Hepatobiliary Disorders				1			1
Renal disorder					1		1
Grand Total	**1**	**8**	**9**	**41**	**5**	**4**	**6**

Fig. 12. Disease category vs formulation category

This heatmap highlights how different disease categories are linked with different formulation types. Rows and columns represent disease categories and formulation categories respectively. Oral solids dominate across most disease categories, majorly metabolic disorder had 9, viral infections had 7, respiratory disorders had 4. Oral liquid appeared mainly for respiratory disorders (3), metabolic disorder (2) and viral infections (2). Topicals are rare, but appear primarily in dermatological disorders (2), pain management and wound care (1). Novel formulations appear sporadically, mainly in dental (3) and neurological disorders (2). Inhalation is rare with only one case for respiratory disorders.

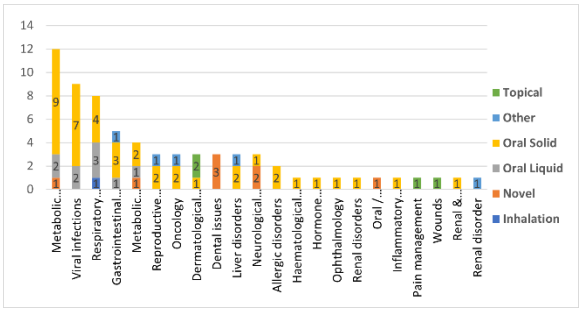

Fig. 13. Disease category vs formulation category

The purpose of this stacked bar chart is to identify relationship between disease category and formulation category where each bar represents a disease category and each segment within the bar is a formulation type. Taller bars indicate disease categories with more total patents. Metabolic disorders, viral infections and respiratory disorders are the top 3 categories in terms of patent filings. Oral solid formulations dominate within these categories making them the preferred formulation type. Dermatological conditions, pain management and wound show a preference for topical formulations.

F. *Formulation Trend over Time*

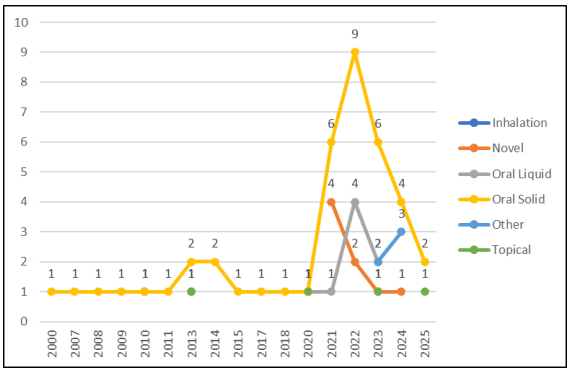

Fig. 14. Formulation trends over time

This chart tracks the evolution of formulation categories over time, based on patent filings where X-axis is years, Y-axis is patent counts and each line represents a formulation category. Oral solids dominate across most years, peaking in 2022 with 9 filings. Oral liquids and novel formulation emerged more prominently after 2020, suggesting more diversified dosage forms. Topicals remain consistently rare but appeared with skin-related conditions. Inhalation appear only in the most recent times, indicating new patent activity. The surge in filings after 2020 suggests an increased interest in polyherbal formulations. This shift suggests increasing industrial interests and diversification of delivery methods in recent years.

G. Herb Usage Over Time

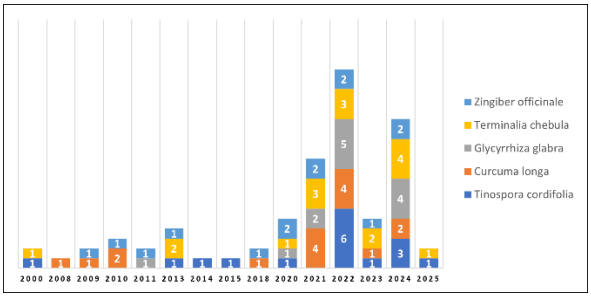

Fig. 15. Herb usage over time

This chart tracks the patent filings over time for the five most commonly used herbs, Tinospora cordifolia, Curcuma longa, Glycyrrhiza glabra, Terminalia *chebula*, and *Zingiber officinale*. Patent activity for these herbs remained minimal until around 2018, then surged rapidly, peaking in 2022. *Tinospora cordifolia* shows the strongest growth, with 6 filings in 2022, confirming its importance in recent formulations. *Glycyrrhiza glabra* and *Terminalia chebula* also rise significantly in 2021–2024, showing renewed patent activity and research attention. *Curcuma longa* demonstrates steady but modest patent activity, consistent with its established use. *Zingiber officinale* contributes moderately but shows continuous presence across multiple years. After 2022, there is a slight decline in total filings, though activity remains higher than the before 2018. Post 2020, there has been a resurgence of use of classical ayurvedic herbs in polyherbal patent filings. This peak may reflect increased interest in botanical solutions for metabolic health and chronic conditions in recent years.

XI. IDENTIFYING NOVELTY IN PATENTS

Novelty refers to the new quality of an invention that sets it apart from what already exists in previously filed patents. In the context of botanicals and polyherbal patents, novelty can be established through the use of new herbs, innovative formulations or delivery systems, or unexplored applications of herbs for commercial and therapeutic purposes. Identifying novelty is crucial as it provides a competitive advantage and strengthens the patent grant. Common herbs like *Tinospora cordifolia* and *Withania sominfera* are frequently used in multiple patents, novelty is when less explored herbs like *Rauwolfia spp*., and *Bergenia liglata* are included. Tablets and capsules may be considered as traditional formulation that are widely patented while novelty is recognized when patents propose delivery forms like chewing gum, tea bags, nano-formulations, cookies, oral wipes and exudates. Novel therapeutic applications can be identified when polyherbal combinations are used for conditions such as Parkinson's disease, migraine and PCOD, which are quite rare in botanical patent literature.

Documenting novelty is essential as it not only highlights innovative trends but also prevents duplication and explore the unexplored areas for further development.

A. Rubrics for Novelty Assessment

Table V. Rubric for identifying novel herbs

Criteria	Definition	Examples	Score/Flag
Common herb	Appears in Module 10 Top/Most used herb list	*Curcuma longa, Tinospora cordifolia, Zingiber officinale*	Not Novel
Novel herb	Absent from Module 10	*Nigella sativa, Inula*	Novel

	dataset (top/common herbs)	*racemosa, Psidium guajava*	

Table VI. Rubric for identifying novel formulations

Criteria	Definition	Examples	Score/Flag
None	Formulation/delivery is standard and already common in Module 10	Oral solids (tablets, capsules), Oral liquids (syrup, suspension)	None
Novel	Any non-traditional or rare formulation/delivery system not dominant in Module 10	Chewing gum, candy, oral wipes, extrudate, tea bag, snack bar, spray, phytonanoceutical	Novel

Table VII. Rubric for identifying novelty in therapeutic applications

Criteria	Definition	Examples	Score/ Flag
Common	Major clusters from Module 9 with high patent activity	Metabolic disorders (diabetes), respiratory disorders (asthma, cold), viral infections, gastrointestinal disorders	Not Novel
Novel	Rare or underrepresented disease categories in Module 9	Oncology, neurological disorders (Parkinson's, migraine), reproductive health (PCOS, dysmenorrhea), renal disorders, ophthalmology, pain management, wounds	Novel

Using the above rubrics, each patent was systematically evaluated to determine novelty across herbs, formulations or delivery system and therapeutic application. Patents were classified into these three categories depending on the nature of novelty observed. This approach ensure consistency in assessment.

B. Novelty Type Distribution

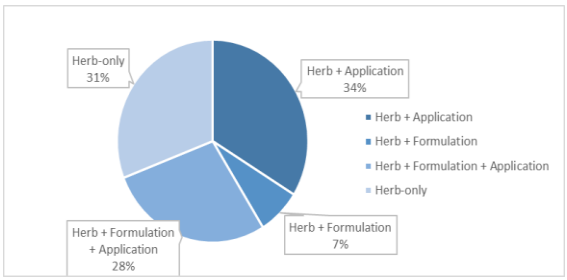

Fig. 16. Distribution of novelty types in patents

Among the patents analysed, largest share of novelty arises from Herb +Application (34%), followed by Herb-only (31%) and Herb + Formulation + Application (28%). A smaller portion is seen in Herb + Formulation (7%) indicating that applications and herb novelty drive most of the innovative activity.

C. Novelty by Disease Area

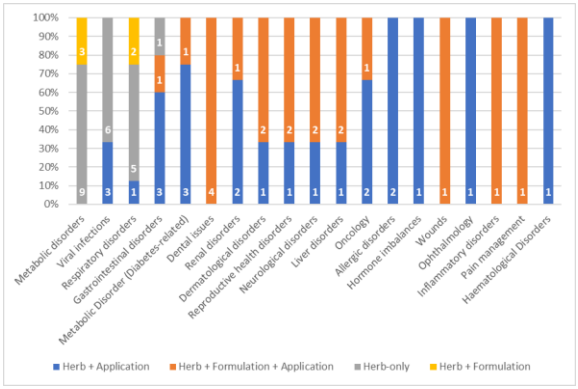

Fig. 17. Distribution of novelty across disease areas

Novelty is most concentrated in metabolic disorders (9 patents), viral infections (6 patents), respiratory disorders (5 patents), while underexplored categories such as (oncology, neurological disorders, reproductive health, and wounds) also exhibit novel activity. This suggests novelty is not limited to high-volume disease areas but extends to rare therapeutic applications.

D. Novelty by Formulations

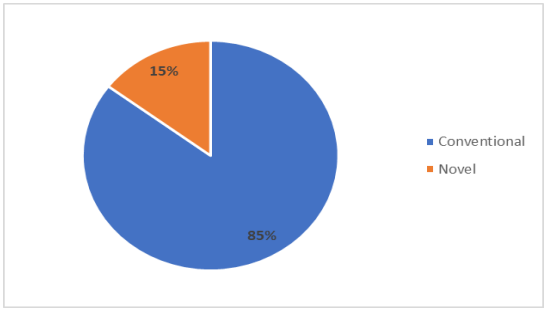

Fig. 18. Comparison of conventional vs novel formulations in patents

The above chart compares conventional and novel formulations in the dataset. It shows that 85% of the patents rely on conventional dosage forms, while only 15% introduce novel delivery systems. This chart is included to provide an overview and to establish how much of novelty exists relative to conventional approaches.

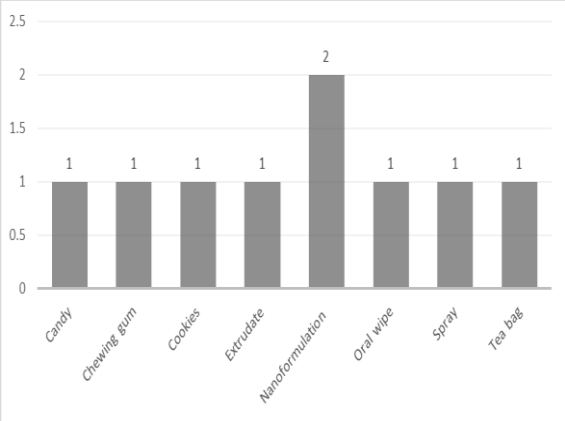

Fig. 19. Distribution of novel formulation types identified

This chart provides a detailed breakdown of the novel formulations identified. The most frequent type is nano-formulations with 2 patents, while other categories appear only once each, including candy, chewing gum, cookies, extrudate, oral wipe, spray and tea bag. Although each type is individually limited, their presence reflects diverse experimentation and differentiated dosage forms beyond conventional oral and topical forms.

E. Novelty Trend over Time

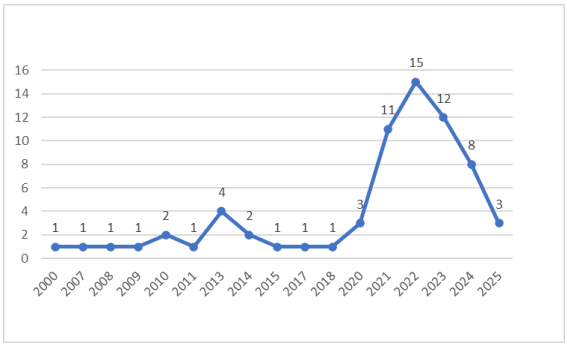

Fig. 20. Novelty trend over time

Novelty-driven patents were rare before 2019, typically 1–2 per year. A surge is visible from 2020 onward, peaking at 15 patents in 2022, followed by a decline in 2023 at 12 patents and 2024 at 8 patents. This pattern indicates a recent acceleration in novelty filings, with 2025 numbers expected to be incomplete. The analysis of novelty in botanical patents shows that innovation is primarily driven by herb novelty with significant contributions also from therapeutic applications and formulations. The rise in diverse dosage forms and emerging disease categories reflects experimentation beyond traditional practices, pointing to new opportunities for future research.

F. Herb Usage Over Time

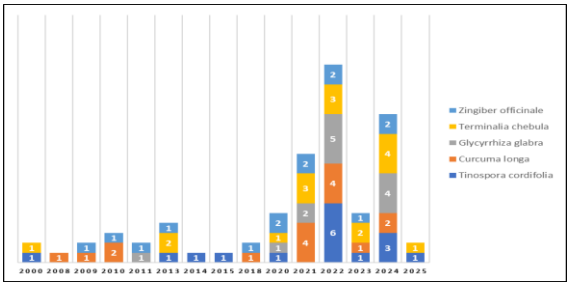

Fig. 21. Herb usage trends over time

Table VIII. Yearly patent counts for top 5 herbs (2000–2025)

Row Labels	*Tinospora cordifolia*	*Curcuma longa*	*Glycyrrhiza glabra*	*Terminalia chebula*	*Zingiber officinale*	Grand Total
2000	1	-	-	1	-	2
2008	-	1	-	-	-	1
2009	-	1	-	-	1	2
2010	-	2	-	-	1	3
2011	-	-	1	-	1	2
2013	1	-	-	2	1	4
2014	1	-	-	-	-	1
2015	1	-	-	-	-	1
2018	-	1	-	-	1	2
2020	1	-	1	1	2	5
2021	-	4	2	3	2	11
2022	6	4	5	3	2	20
2023	1	1	-	2	1	5
2024	3	2	4	4	2	15

2025	1	-	-	1	-	2
Grand Total	16	16	13	17	14	76

This chart tracks the patent filings over time for the five most commonly used herbs, Tinospora cordifolia, Curcuma longa, Glycyrrhiza glabra, Terminalia *chebula*, and *Zingiber officinale*. Patent activity for these herbs remained minimal until around 2018, then surged rapidly, peaking in 2022. *Tinospora cordifolia* shows the strongest growth, with 6 filings in 2022, confirming its importance in recent formulations. *Glycyrrhiza glabra* and *Terminalia chebula* also rise significantly in 2021–2024, showing renewed patent activity and research attention. *Curcuma longa* demonstrates steady but modest patent activity, consistent with its established use. *Zingiber officinale* contributes moderately but shows continuous presence across multiple years. After 2022, there is a slight decline in total filings, though activity remains higher than the before 2018. Post 2020, there has been a resurgence of use of classical ayurvedic herbs in polyherbal patent filings. This peak may reflect increased interest in botanical solutions for metabolic health and chronic conditions in recent years.

XII. IDENTIFYING GAPS AND UNEXPLORED AREA

In this module, the focus shifts from reviewing existing patent activity to mapping the gaps that remain within the polyherbal IP landscape. While earlier modules highlighted trends in disease areas, formulations and herbs, the emphasis here is on underexplored zones where innovation potential remains strong. These gaps may emerge in the form of underutilized herbs, neglected disease categories and less common dosage forms, each pointing to opportunities for differentiated therapeutic applications. The purpose of identifying these less-developed niches is to provide a structured pathway for researchers and innovators to align their work with traditional knowledge and emerging market needs.

To make the gap analysis concrete, visual representations are employed to highlight where patent activity is concentrated and where it remains limited. By mapping disease categories against formulation types and comparing the frequency of herbs, the areas of high or low activity become clearer. These visuals not only summarize the data from earlier modules but also serve as a baseline for pinpointing future opportunities in polyherbal IP landscape.

Key terms used in the analysis are:

- Gap: A category was flagged as “GAP” when it had ≤4 patents. This indicates the area is under-represented and could benefit from new innovations.
- Whitespace signals: These signals show underexplored areas i.e., when a disease, formulation, or herb is recognized in research but has limited patents.
- High opportunity score: This score reflects the strength of whitespace signals. A value of ≥2 (two or more whitespace signals) indicates strong innovation potential.
- Recommendation categories:
  - Prioritize: When there are a clear gap (≤4 patents) and a “HIGH” opportunity count (≥2).
  - Shortlist: When there is a gap (≤4 patents) but the opportunity count is “LOW” (<2), meaning whitespace signals are weak or absent.
  - Backlog: When the area is well-covered (≥5 patents) or whitespace signals are “LOW” (<2).

The analysis covered three key categories: a total of 19 diseases, 6 formulations, and 466 herbs.

A. *Disease Level Gap Analysis*

The disease summary provides an analysis of the gaps and opportunities for various diseases. The findings are summarized below.

Table IX. Gap and opportunity analysis for diseases

Disease	Patent Count	Disease Gap Flag	HOC	Recommendation	Observation
Allergic disorders	2	GAP	10	Prioritize	This disease is under-represented with only 2 patents (GAP) but shows 10 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.
Dental issues	4	GAP	0	Shortlist	This disease is under-represented with only 4 patents (GAP) and has no whitespace signals. It is shortlisted as a rare niche with potential, though current evidence is weak.
Dermatological disorders	3	GAP	0	Shortlist	This disease is under-represented with only 3 patents (GAP) and has no whitespace signals. It is shortlisted as a rare niche with potential, though current evidence is weak.
Gastrointestinal disorders	5	OK	0	Backlog	This disease is well-represented with 5 patents and only 0 whitespace signals. The opportunity is too weak, so it is placed in the backlog.
Haematological disorders	1	GAP	1	Backlog	This disease is under-represented with 1 patent and only 1 whitespace signals. The opportunity is too weak, so it is placed in the backlog.
Hormone imbalances	1	GAP	2	Prioritize	This disease is under-represented with only 1 patent (GAP) but shows 2 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.
Inflammatory disorders	1	GAP	1	Backlog	This disease is under-represented with 1 patent and only 1 whitespace signals. The opportunity is too weak, so it is placed in the backlog.
Liver disorders	3	GAP	5	Prioritize	This disease is under-represented with only 3 patents (GAP) but shows 5 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.
Metabolic disorder (diabetes-related)	4	GAP	0	Shortlist	This disease is under-represented with only 4 patents (GAP) and has no whitespace signals. It is shortlisted as a rare niche with potential, though current evidence is weak.
Metabolic disorders	12	OK	0	Backlog	This disease is well-represented with 12 patents and only 0 whitespace signals. The opportunity is too weak, so it is placed in the backlog.
Neurological disorders	3	GAP	5	Prioritize	This disease is under-represented with only 3 patents (GAP) but shows 5 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.
Oncology	3	GAP	4	Prioritize	This disease is under-represented with only 3 patents (GAP) but shows 4 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.
Ophthalmology	1	GAP	4	Prioritize	This disease is under-represented with only 1 patent (GAP) but shows 4 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.
Pain management	1	GAP	2	Prioritize	This disease is under-represented with only 1 patent (GAP) but shows 2 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.
Renal disorders	3	GAP	0	Shortlist	This disease is under-represented with only 3 patents (GAP) and has no whitespace signals. It is shortlisted as a rare niche with potential, though current evidence is weak.
Reproductive health disorders	3	GAP	0	Shortlist	This disease is under-represented with only 3 patents (GAP) and has no whitespace signals. It is shortlisted as a rare niche with potential, though current evidence is weak.
Respiratory disorders	8	OK	3	Prioritize	This disease is well-represented with 8 patents (OK), yet it shows 3 herb–formulation gaps. Despite frequent use, the presence of gaps makes it a priority area.
Viral infections	9	OK	0	Backlog	This disease is well-represented with 9 patents and only 0 whitespace signals. The opportunity is too weak, so it is placed in the backlog.
Wounds	1	GAP	3	Prioritize	This disease is under-represented with only 1 patent (GAP) but shows 3 herb–formulation gaps. The rarity combined with whitespace signals makes it a priority for innovation.

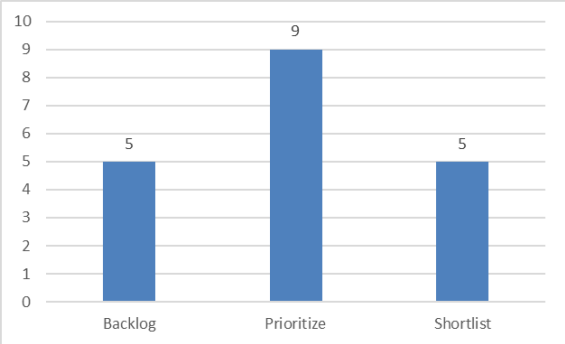

Fig. 22. Disease recommendation countsA total of 19 disease was analyzed in this module. Out of these:

- 9 diseases were prioritized (≤4 patents + HOC ≥2).
- 5 diseases were shortlisted (≤4 patents + HOC <2)
- 5 diseases were placed in backlog (≥5 patents or HOC <2).

Key findings:

- Allergic disorders were prioritized. It is under-represented with only 2 patents but shows 10 whitespace signals, making it a priority for innovation.
- Dental issues were shortlisted. It is under-represented with only 4 patents and zero whitespace signals, so it is considered a niche with potential but weak evidence.
- Metabolic disorders were placed in backlog. It is well-represented with 12 patents and has zero whitespace signals, so the opportunity is too weak to justify prioritization.

  These examples illustrate how both patent count and whitespace signals together determine whether a disease category has immediate potential or should be monitored for future opportunities.

A. Formulation-Level Gap Analysis

The formulation summary analyses the patent landscape for various formulation types. A total of 6 formulation categories were analysed. Out of these:

- 4 formulations were prioritized (≤4 patents + HOC ≥2).
- 2 formulations were in the backlog (≥5 patents or HOC <2).

Table X. Gap and opportunity analysis for formulations

Formulation	Patent Count	Formulation GAP	HOC	Recommendation	Interpretation
Inhalation	1	GAP	1	Backlog	This formulation is under-represented with 1 patent and only 1 whitespace signals. The opportunity is too weak, so it is placed in the backlog.
Novel	8	OK	2	Prioritize	This formulation is well-represented with 8 patents (OK), yet it shows 2 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Oral Liquid	9	OK	0	Backlog	This formulation is well-represented with 9 patents and only 0 whitespace signals. The opportunity is too weak, so it is placed in the backlog.
Oral Solid	41	OK	14	Prioritize	This formulation is well-represented with 41 patents (OK), yet it shows 14 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Other	5	OK	3	Prioritize	This formulation is well-represented with 5 patents (OK), yet it shows 3 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Topical	4	GAP	2	Prioritize	This formulation is under-represented with only 4 patents (GAP) but shows 2 whitespace signals. The rarity combined with multiple signals makes it a priority for innovation.

Key findings:

- Oral solid formulations (e.g., tablets, capsules, powders) were prioritized. Although well-represented with 41 patents, they also showed 14 whitespace signals, and this combination of saturation with evident gaps makes them a strong priority for innovation.
- Inhalation-based formulations (e.g., sprays) were placed in the backlog. They are under-represented with only 1 patent and show just 1 whitespace

signal, which is too weak to justify prioritization at this stage.

This analysis indicates that while oral solid formulations continue to offer meaningful innovation opportunities despite their widespread presence, inhalation forms remain underdeveloped and show limited potential at this stage. This contrast helps researchers highlight the areas where efforts could make the greatest impact.

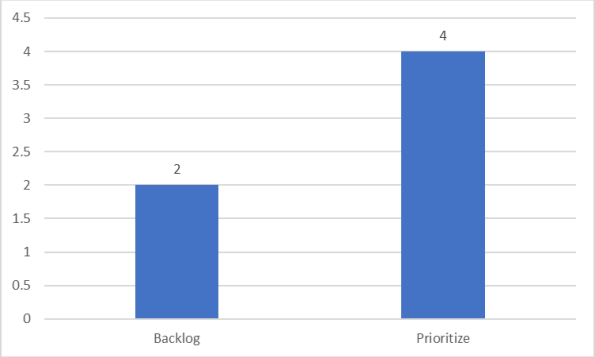

Fig. 23. Formulation recommendation counts

B. Herb Level Gap Analysis

The herb summary examines the number of patents for each herb and identifies whitespace opportunities.

Herb	Herb Count	Herb Gap Flag	High-Opportunity Count	Recommendation	Interpretation
Terminalia chebula	17	OK	6	Prioritize	This herb is well-represented with 17 patents (OK), yet it shows 6 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Curcuma longa	16	OK	7	Prioritize	This herb is well-represented with 16 patents (OK), yet it shows 7 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Tinospora cordifolia	16	OK	6	Prioritize	This herb is well-represented with 16 patents (OK), yet it shows 6 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Zingiber officinale	14	OK	6	Prioritize	This herb is well-represented with 14 patents (OK), yet it shows 6 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Glycyrrhiza glabra	13	OK	5	Prioritize	This herb is well-represented with 13 patents (OK), yet it shows 5 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Piper longum	9	OK	3	Prioritize	This herb is well-represented with 9 patents (OK), yet it shows 3 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Terminalia belerica	8	OK	3	Prioritize	This herb is well-represented with 8 patents (OK), yet it shows 3 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Withania somnifera	8	OK	4	Prioritize	This herb is well-represented with 8 patents (OK), yet it shows 4 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Emblica officinalis	7	OK	3	Prioritize	This herb is well-represented with 7 patents (OK), yet it shows 3 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
Piper nigrum	7	OK	2	Prioritize	This herb is well-represented with 7 patents (OK), yet it shows 2 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.

Table XI. Gap and opportunity analysis for prioritized herbs

A total of 466 herbs were analysed. Out of these:

- 10 herbs were prioritized (≤4 patents + HOC ≥2).
- 199 herbs were shortlisted (≤4 patents + HOC <2)
- 10 herbs were placed in backlog (≥5 patents or HOC <2).

Key findings:

- *Terminalia chebula* herb is well-represented with 17 patents, yet it shows 6 whitespace signals. Despite frequent use, the presence of gaps makes it a priority for innovation.
- *Ocimum sanctum* is well-represented with 8 patents and only 1 whitespace signals. The

opportunity is too weak, so it is placed in the backlog.

- *Coffee arabica* is under-represented with only 1 patent and has no whitespace signals. It is shortlisted as a rare niche with potential, though current evidence is weak.

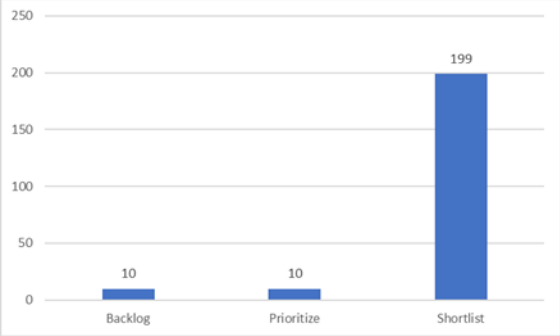

Fig. 24. Herb recommendation counts

The herb summary initially covered 466 herbs assessed for patent activity, gaps and whitespace opportunities. However, to maintain clarity and focus, only herbs categorized as "Prioritize" were shortlisted for further discussion. From this prioritized set, the top 10 herbs (ranked by patent count and opportunity score) are presented in the table above.

C. Summary of Findings

1. Patterns across categories-

The strongest whitespace signals are concentrated around under-represented diseases such as allergic disorders and neurological disorders and around less-explored formulations like topical and novel dosage forms. Herbs including *Terminalia chebula, Tinospora cordifolia* and *Curcuma longa* emerge consistently across multiple prioritized categories. This suggests that even well-known botanicals still possess potential for innovation when applied in new contexts.

2. Disease-Formulation links-

Diseases like allergic disorders and reproductive health disorders were observed to be under-served (≤4 patents) but with meaningful whitespace signals. These align with formulation gaps such as topical and novel delivery formats. Together, these findings highlight opportunities for re-purposing familiar herbs in dosage forms where the patent landscape is relatively empty.

3. Herb-level observation-

From the 466 herbs analysed, only 10 herbs were ultimately flagged as "Prioritize". The top 10 herbs i.e., *Terminalia chebula, Curcuma longa, Tinospora cordifolia, Zingiber officinale, Glycyrrhiza glabra, Piper longum, Terminalia belerica, Withania somnifera, Emblica officinalis*, and *Piper nigrum,* align with the top used herbs identified in earlier modules. This overlap suggests that the most promising innovations may not come from obscure plants, but from familiar herbs applied in novel ways.

XIII. GLOBAL VS INDIAN PATENTS

This module focuses on examining geographic patterns in botanical patent filings, highlighting both domestic and international protection. The analysis considers regional weightage, filing routes, inventor vs publication countries and novelty distribution. The aim is to clarify how Indian patents are positioned relative to global filings and identify opportunities for cross-reginal innovation. A visual analysis of these patterns is provided in the sections below.

A. Year Trends

Fig. 25. Year-wise patent filings in India vs Global

The year-wise analysis highlights India's stronger and more consistent patenting activity. In 2022, India recorded 12 filings compared to only 3 Global filings, demonstrating India's clear dominance in that peak year. By 2024, Global filings rose to 7, yet India's earlier surge reflects its established leadership and proactive approach in botanical patenting.

B. Filing Route (National vs PCT)

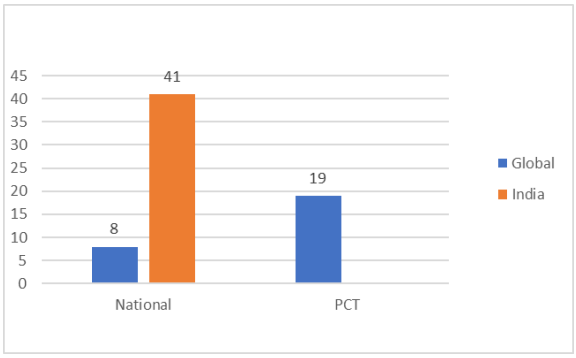

Fig. 26. Comparison of filing routes (National vs PCT) for India and Global patents

The filing route comparison shows that India's botanical patents are filed through the National route with 41, whereas Global filings are more evenly split, with 8 national filings and a larger share of 19 PCT filings. This suggests that Indian applicants prioritize strengthening their domestic IP base, while Global filings reflect a strategy aimed at international reach through PCT despite their lower overall numbers.

C. *Publication Country vs Inventor Country*

Count of Title	Column Labels				
Row Labels	AU	IN	US	WO	Grand Total
AU	2				2
IN		41			41
US			6		6
WO				19	19
Grand Total	2	41	6	19	68

Fig. 27. Comparison of publication vs inventor country for India and Global filings

This chart compares where patents are published with where the innovations are based, highlighting the link between origin of innovation and filing destination. The data shows India as the main hub with 41 publications and the majority of inventors while Global coverage extends into WO (19), US (6) and Australia (2). This indicates that India drives most of the inventive activity, while Global filings serve as extensions into selected international jurisdiction.

D. *Disease Categories*

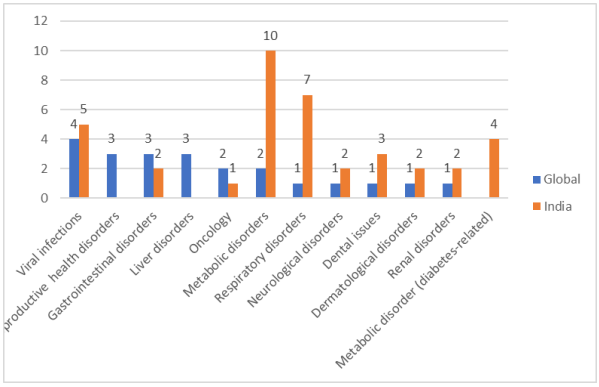

Fig. 28. Distribution of patents by disease categories

This chart maps patents to their associated disease areas, helping identify which therapeutic domains attract more innovation in India versus Global filings. India leads across the major categories with 10 patents in metabolic disorders and strong contributions in viral (5) and respiratory conditions (7). Global filings appear in smaller numbers across similar areas, confirming India's broader and more consistent coverage of therapeutic domains.

E. *Formulation Categories*

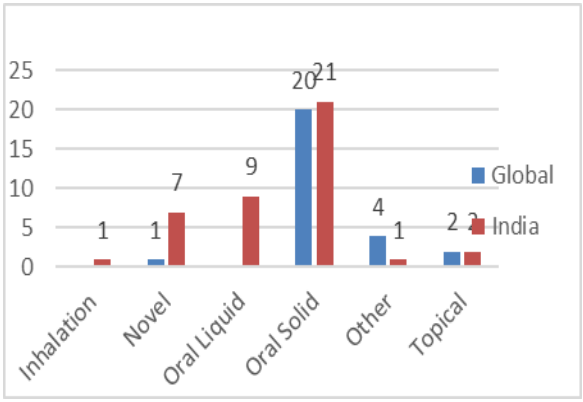

Fig. 29. Distribution by formulation categories

This chart examines the types of formulations used in patents, showing how India and Global filings differences in dosage form preferences. Both India and Global filings are concentrated in oral solids with 21 Indian and 20 Global patents, showing this dosage form as the common ground. India, however, extends its strength into 9 oral liquids and 7 novel forms, where global activity is minimal. Global filings show smaller entries but overall, India demonstrates broader coverage across categories.

F. Novelty Categories

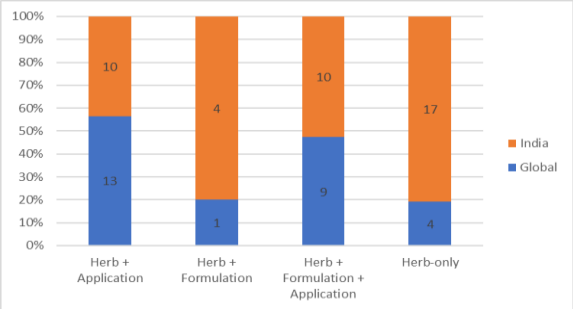

Fig. 30. Distribution of patents by novelty categories

This chart categorizes patents based on the type of novelty they claim, enabling comparison of India's and Global approaches to innovation. Global filings lead in Herb + Application novelty with 13 patents against 10 Indian patents, suggesting more emphasis on therapeutic claims at the international level. In contrast, India dominates Herb-only novelty with 17 patents compared to 4 Global patents and also contributes strongly in Herb + Formulation + Application with 10 vs 9 patents. Even in Herb + Formulation, India shows higher activity with 4 patents versus 1 Global patent. Overall, India demonstrates broader and more balanced novelty coverage, while Global filings are concentrated in fewer categories.

Overall, the comparison makes it clear that India holds the stronger position in botanical patenting. Its filings are not only higher in number but also more consistent and wide-ranging, while Global activity remains more scattered and limited. This points to India setting the pace in this field, with international filings playing more of a supporting role.

XIV. REGULATORY AUTHORITIES FOR BOTANICAL PATENTS IN INDIA

In India, the regulation of botanical patents involves several authorities that together aim to promote innovation while also protecting traditional knowledge.

The Indian Patent Office (IPO) is responsible for examining and granting patents on botanical inventions, provided they meet the conditions of novelty, inventive step, and industrial applicability. Botanicals, however, often receive closer scrutiny because of their overlap with traditional medicinal knowledge. Claims that depend only on traditional use are generally not considered patentable.

To reduce the risk of misappropriation, the Traditional Knowledge Digital Library (TKDL) was established as a digital repository of traditional formulations. Its role is to provide patent examiners with access to prior art so that patents are not granted for remedies already documented in classical texts such as Ayurveda, Unani, and Siddha.

The Ministry of AYUSH has a different function. It does not grant patents but issues guidelines to regulate the quality, safety, and standardization of herbal products. These standards influence how botanical inventions are assessed for safety, efficacy, and their potential for commercial use.

Together, the IPO, TKDL, and AYUSH form a complementary system. The IPO handles patentability, the TKDL protects traditional knowledge from biopiracy, and AYUSH provides oversight for safety and public health.

XV. CHALLENGES IN IP MAPPING FOR BOTANICALS

IP mapping for botanicals is considerably more complex than for conventional pharmaceuticals. This mainly comes from the overlap between traditional knowledge and modern IP systems. This in turn creates ambiguity in assessing patent novelty and enforceability. Inconsistent or unclear classification systems often create overlaps. In this study, categories such as herbs, formulation and therapeutic applications tended to intersect. This causes hindrances or difficulties in tracking across various jurisdictions. The documentation of traditional knowledge is difficult because it is based on fragmented sources and oral traditions. Poor documentation often results in under-protection. Since many herbs are already known in Ayruveda, Unani or Siddha, examiners must evaluate whether a claimed polyherbal combination represents a genuine innovation or is just a replication of prior art Limited clinical validation and lack of standardization reduce the strength of botanical patents. Even when patents are granted, enforcing them internationally is difficult because of differences in laws, recognition of traditional knowledge, and jurisdictional conflicts. Addressing these challenges is key to strengthening innovation, protecting traditional knowledge and supporting future research.

APPENDIX

To make the patent watch dataset easier to interpret, two supporting tables are provided here.

A. Patent Status Categories

Table XII. Explanation of the status labels assigned to patents in the dataset.

Status Category	Reference / Verification
PCT Published – Pending	WIPO PATENTSCOPE + Lens.org (Pending)
PCT Published	WIPO PATENTSCOPE + Lens.org
Granted – Active	WIPO grant date + Lens.org (Active)
Granted – Inactive	WIPO grant date + Lens.org (Inactive)
Granted – Expired	WIPO grant date + Lens.org (Expired)
Granted – Unknown	WIPO grant date + Lens.org (Unknown)
Published – Application	WIPO publication

The table clarifies the status categories used in the dataset, indicating whether each patent is granted and active, granted but inactive or expired, published or still at the application stage. This distinction is important because it shows inventions' current position in the patent life cycle. The categories were standardized after reviewing information across three major databases (WIPO PATENTSCOPE, Lens.org and Goggle Patents).

B. Patent Formulation Categories

Table XIII. Standardized classification of dosage forms and formulation types used in the dataset.

Formulation Categories	Formulation type in Dataset
Oral Solid	Tablet, capsule, pill, granule, powder, pellet, lozenge
Oral Liquid	Syrup, suspension, solution, elixir, drink, beverage, extract
Topical	Gel, cream, ointment, paste, lotion, transdermal patch
Inhalation	Spray
Novel	Chewing gum, cookies, snack bars, tea bags, herbal candy, extrudate, oral wipe, phytonanoceutical formulations
Other / Unclassified	Mixed entries not clearly assignable (very rare in the dataset)

The table for formulation categories defines the dosage forms applied across the dataset. Since the patents describe a wide range of dosage forms, a consistent classification system was created. This grouping helps in comparing formulation trends across therapeutic areas and highlights how innovation in polyherbal products is moving beyond traditional forms.

ACKNOWLEDGMENT

The author expresses sincere gratitude to all who guided and supported the completion of this project titled *"Patent Watch and IP Mapping of Botanicals – Polyherbal Combinations Clustering by Condition."* Special thanks are extended to Mr. Md Quamruz Zafar (Director, Clinivance) for his invaluable insights and direction, and to the Clinivance team for providing practical exposure and research-oriented tasks during the internship. The author also thanks their parents for their constant encouragement, patience, and understanding, which served as the pillars of success. Heartfelt appreciation is offered to all who contributed to enhancing the learning experience and shaping this project.

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