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Exploring potential of Plant Biodiversity for sustainable and Green Drug Discovery and Development

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Abstract

The plant kingdom has high species diversity. Throughout antiquity civilizations, Herbal remedies played a significant part in the history of medicine discovery of novel drug candidates and phototherapeutics. Many plants from Chinese traditional medicine, Ayurveda, Unani medicine, Kampo medicine, and other traditions have survived to this day to be utilized for human wellness. In this regard, plant species preservation as well as sustainability is critical, given that approximately 80% of the global population depends on conventional or traditional medication. The opposite hand, intellectual property rights are critical for both locals and innovators. Plants are still appealing candidates for drug discovery and research, since many therapeutically utilized medicines were first derived from plants. Plants are not the only species employed for this purpose; bacteria, macrofungi, insects, animal venoms, and marine organisms are all used Turkey has a reasonably diverse flora, with roughly 12.000 plant species, owing to the nation's diverse climatic circumstances. It has the most diverse flora on the whole European continent. We have uncovered numerous intriguing organic substances with considerable bioactivities, notably enzyme inhibitors, through our exhaustive scanning and research across Turkish flora, as well as that of other countries. The value of plant variety in drug development will be shown in this review using example from known compounds as well as our own investigation.

Keywords: Sago starch (SS), polypropylene (PP), thermal properties, biodegradability, mechanical properties (MP), and thermogravimetric analysis (TGA)

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1. Introduction

Natural product (NP) pharmaceutical research is inextricably linked to biodiversity protection. The readily accessible nature of biodiversity as a raw material for novel medications, pharmacological probes, and fascinating chemical leads is expressly relied on in NP research [1]. The primary purpose of NP medicine development is to distinguish characterize small piece NP intricate structures, also known as additional metabolites, in order to help in their growth as valuable social material. As a general rule, various living forms produce distinct kinds of NPs. Lowland and marine microorganism fungi, invertebrates, and higher plants, for instance produce NPs, each have different and exclusive structural properties [2]. This is due to the NPs being produced by enzymatic processes propelled by proteins coded by DNA sequence that vary substantially across the source species. Different DNA reflects the many evolutionary processes at work on different creatures. Furthermore, chemical diversity is more common in geographically diverse samples. Therefore studying the same or comparable species from multiple areas has proven a fruitful way to discovering new chemical entities. As the application of NP biological prospecting has expanded globally, it has inevitably resulted in collaborative relationships between scientists from many nations, as well as government engagement in the governance of worldwide research [3]. There have been several advantages of doing NP studies on drug discovery on a global scale; nonetheless, this has needed international rules and procedures to avoid possible injury and other issues. Harmful germs, insects, or other invaders, for instance might be carried with academic samples, causing substantial harm to the surroundings. In a new way, global treaties such as the International Convention on Biological Diversity (CBD), as well as afterwards accords, have been enacted to make sure that the proper Memorandum of Recognizing and mutually beneficial arrangements are in place in the event that an economically vital important compound has been identified or built from native life forms, or "genetic supplies," of an outside nation [4].

Because of the universality of their growth and chemical creation, microorganisms, which are particularly readily transportable, have been the focal point of numerous commercial discoveries of drugs studies efforts. Over the

past two decades, studies of NP formation in microorganism have shown those generating enzymes involved in biosynthesis tend to be grouped together, which has substantially sped their identification, characterization, and consequent manufacture by genetic approaches. Once the genetic code of a living creature has been known, this has also allowed genomics-based NP drug development [5]. DNA sequence data is important not only for NP pharmaceutical research but also for ecological classification definitions. The developments of a genetic foundation for establishing a given organism's taxonomic grouping, such as the sequence for prokaryotes, has greatly improved our ability to correctly identify NP producing creatures and recognize that infections life forms are far more diverse than previously thought. Finally, this data is an essential aspect of the data portfolio necessary to better understand the value and benefits of a biodiverse planet. Plants are being utilized by humans for healthcare, sustenance, and other ethnobotanical purposes from the beginning of time. They are also employed in pharmacists as pharmaceutical constituents or as hit or leading molecules for manufactured drugs [6]. As a consequence, plant ethnomedicinal, phytochemical, and pharmacological attributes have long attracted the curiosity of scientists involved in drug research and development. Tubocurarine, quinine, physostigmine, taxol, galanthamine, artemisinine, and other plant-derived medications are examples. In this light, global diversity of plants is crucial for biosource use. However, various issues such as the challenge of acquiring a few plant species, the threat of extermination for a variety of plant types, prevalent plants, and changing political conditions in a number of nations (embargo, war, etc.) have hindered the use of plants as health care substances for many years [7]. Regardless of these characteristics, plants have long been regarded as key sources in medicine research and the beauty business to this day. On the other hand, nearly one-eighth of all plant species worldwide have been identified to be threatened with extinction. However, we will continue to employ medicinal plants since the number of compounds entering the medication market is decreasing while the expense of drug research as well as growth increases [8]. It is also obvious that conventional expertise is required, given that 80% of humanity still depends on conventional medical services and that countless individuals in different regions of the globe lack access to contemporary drugs. Pursuant to the NAPRALERT database, 15% of all kinds of plants have been researched for photochemistry, whereas only 5% have been evaluated for biological activity. In addition, integrating plants with conventional knowledge enhances the possibility of detecting novel pharmaceutical compounds by a factor of five. The research [9] investigated existing and forthcoming techniques for detecting common harvest as medicines, for health and happiness, as well as measures to balance biodiversity medical usage with aggressive protection via alternatives that are natural. The research [10] indicates that numerous herbal remedies have regenerative and curative properties for the alleviation of standard human ailments such as cancer, neurological disorders, significant depression, viral and bacterial Infections and gingivitis are also possible. We feel that natural goods are superior. Might be used as substitutes to standard drugs. The research [11] examined the significant ecological benefits given by wetland areas such as catastrophe risk reduction, with a focus on the benefits to humans' well-being and health. The medical consequences of catastrophes are seldom addressed in disaster preparation or prevention, nor are health benefits included into the frameworks used in urban open space and development choices.

The research [12] explained how the sustainable economy contributes to and encourages environmentally friendly growth. The chapter analyzes the link between green economy and equitable growth objectives in this environment. Sustainability cannot be realized until its key objectives are met. Today, Agenda 2030 for sustainable growth objectives are the most recent acknowledged objectives by the globe, and every sector of economic strives to meet these goals in order to achieve sustainable growth. The paper [13] defined the nation's species policy and covers significant conservation activities in the Republic of Ecuador, one of the world's "mega-diverse" governments with the greatest species concentration. It goes into further depth on in-situ and ex-situ preservation methods. Ecuadorian has six distinct preserving measures. The research [14] provided vital details on (1) plant stress reactions and adaptive tolerance to harsh surroundings, as well as (2) (new) radicals from plants with adaptability for avoiding and curing human ailments. Plant-based meals and goods may benefit from these full of antioxidants compounds. The study [15] looked at younger consumers of biofuels in the highlighting the economical, social, and environmental impacts while providing details regarding their long-term sustainability. The article [16] emphasized the significance that green spaces on campuses and universities play in promoting SDGs 4 and 15. According to a case study conducted at the Passé Fundo University (UPF) in the south of Brazil. The study [17] exposed doctors to the concept of dental sustainability. There is a total of seven in the collection. This is supplemented with papers on vitality, buying, transportation, garbage, nature, and participation, as well as implementing sustainability into current dentist's office. The research [18] centered on metallodrugs and the manner in which they interact with biological compounds in order to provide a medical impact; however, addressing metal-containing proteins, such as metalloenzymes, is an important and complementary subject of study. The use of metal-binding pharmaceutical substances (MBPs) that block enzymes that are as targets of therapy has been extensively reviewed and will not be discussed farther here.

2. Materials and Methods

2.1 Several Popular Plant-Derived Drugs

Plants are supposed to have created a wide range of medicines. Tuberculin, the active part in tube-curare, was extracted from the topmost layer of bark of Chondodendron tomentosum Ruiz and Pavon (Menispermaceae). Tuberculin was first found as a tranquilizer treatment. A century later, pharmacologist John Vane found that aspirin had antifungal and antibacterial properties. Quinine, a naturally occurring malaria treatment, was extracted from the outer bark of Cinchona, namely Cinchona ledgeriana Bern. Trimen (Rubiaceae) ex Moens. The vegetation was imported to Germany from South America in the middle of the 16th

century, and manufacturing of the plant to manufacture tramadol was long in charge of the Cinchona-quinine business in the Netherlands, a significant collaboration.

Despite this, tetracycline use has declined due to its increasing toxicity; nonetheless, it is still utilized in the treatment of severe malaria patients in resource-limited settings. It is the first spindle stabilizing drug to be tested, and it has been shown to be particularly effective versus breast, lung, and pancreatic malignancies, as well as Kaposi's sarcoma, that leads to neutrophil and damage to the peripheral nerves. Basic research is now being supported in order to acquire a better understanding of how docetaxel works in various kinds of cells and how it may be used to treat other kinds of cancer. Galanthamine, on the opposite hand, is a one-of-a-kind anti-Alzheimer's medication developed from the bulbs of Galanthus woronowii Losinsk. It is a family of long-lasting and selective highly effective and transient ace antagonists that were created in Bulgaria in the early 1950s but were recently approved for use in universities.

Galanthamine passes the barrier between the brain and the blood fast and has fewer negative effects than other Alzheimer's disease (AD) medications in clinical trials. Artemisinine, an instinctive plasmodium drug derived from the petals of the blossoming plant Artemisia annua L., was approved as first-line therapy for malaria by the World Health Organization (WHO) in 2006. It was first tried in China in the 1970s. In part, many artemisinin analogs/derivatives have been developed. In reality, Youyou Tu, a Chinese scientist, was awarded the Nobel Prize in Medicine in 2015 for discovering artemisinin in since the late 1990s, artemisinin by and its metabolites have been shown to be proven to have anti-cancer capabilities.

2.2 Our Continuous Research on Plant-Derived Polymers as Catalytic Inhibitory Chemicals

Turkey, sometimes known as "Asia Minor," is a land bridge between Asia and Europe. It has an 8300-kilometer coastline, over 10,000 plant species, and a 30% total diversity rate. Turkey is one of the few countries that are largely enclosed by each of the world's 34 sustainable hotspots, particularly the Euro-Siberian, Irano-Anatolian, and Mediterranean Seas. It has a rich cultural history and archeological track dating back to the Pale era, as well as an ancient wisdom. It also benefits from its position, which places it at the crossroads of three continents, between subtropical and tropical zones. As a result, previously said, Istanbul has an abundance of natural resources, which herbal doctors and pharmacognosists highly value. In this context, we have focused on fresh plant-derived hit materials that have various inhibitory effects against a variety of catalysts that act as which includes cholinesterases, the tyros a collagenase activity enzyme, lipoxygenase, a compound called the oxidation enzyme, hydroxymethylglutaryl coenzyme-Q10, phosphodiesterase-I, and others. We discovered a number of plant-derived derivatives with extremely potent and efficient butyrylcholinesterase (BChE) restriction, which are being connected to the etiology of Alzheimer's disease. We isolated imperatorin, xanthotoxin, and bergapten from the fruits of Angelina vulgaris L. (Apiaceae), as the first coumarins were, and with significant kinase suppression. Molecular docking studies revealed that pteryxin can communicate with BChE in a number of ways, include polar and hydrophobic contacts. We recently observed that several furanocoumarins, as well as natural and semisynthetic O-alkylcoumarin derivatives, exhibit powerful and specific BChE-inhibitory activity. Aside of natural coumarins, which we've discovered a host of phenolic compounds that inhibit enzymesO-alkyl coumarin. Cholinesterase inhibitors include flavonoids, or benzene (tanshinones), chemical compounds (rosmarinic acid), and others. Plant-derived alkaloid (N-acetyltryptophan), anhydrase and urease inhibitors, t-inhibiting medicines that include cinnamic acid instruments such as derivatives and other phosphodiesterase-1 (PDE-1) inhibitors.

2.3 Plant Conservation Threats in Turkey

Many plant types, areas, and ecological interactions are under imminent danger of extinction as a result of human-induced factors such as higher temperatures, loss of habitat, excessive use, invasive alien species, emissions, eliminating for farming, settlement, and free the collection. Trifolium parchycalyx, Lathyrus undulatus, Centaurea iconiensis, Thermopsis turcica, Sonchus erzincanicus, Silene sangaria, and others are among the plant species. Furthermore, several geophytes taxa are threatened in Turkey, because there are roughly 600 geophytes. Orchids are other plants on the verge of extinction in Turkey as a consequence of illegal and unintentional harvesting of orchid tubers. Actually, Turkey boasts over 200 flower organisms, 30 of that are indigenous, and locals pluck more than 120 million orchids every year to be slaughtered for the production of a specific frozen dessert as well as a customary hot drink known as "salep." Notwithstanding the fact that collection has been prohibited by the Turkish Ministry of Forestry and Agricultural since 1974, there are barely 200 Ophrys lycia Renz & Taubenheim thriving in Turkey.

Fritillaria is another plant species worth mentioning in this context. Turkey has the most Fritillaria species of any country, with 43 in total. The most popular as ornamental flowers are F. imperialis and F. persica (Adyaman lalesi), with each bulb costing between 5 and 15 Euro in Europe. As a consequence, both of these species have grown to be the most popular in Turkey.In truth, Turkey boasts over 200 orchid creatures, 30 of which are indigenous, and inhabitants harvest 120 million orchids each year to be sacrificed for the production of a specific ice cream as well as a traditional hot drink known as "salep." Despite the Turkish Ministry of Forestry and Agriculture's prohibition on collection since 1974, there are only 200 Ophrys lycia Renz & Taubenheim flourishing in Turkey. Fritillaria is another plant genus worth mentioning in this context. Turkey is the world's richest country in terms of Fritillaria species, having 43 in total. The most commonly grown as flowers for decoration are F. imperialis and F. persica (Adyaman lalesi), with one bulb costing between 5 and 15 Euro in Europe. As a consequence, these two species have grown to be the most popular in Turke.

3. Results and discussions

3.1 The Development and Present Situation of Natural Medicines

Some of our most significant pharmaceuticals come from plants and fungi, particularly those with extremely intricate chemistry. It has been claimed that turning to nature for novel pharmaceuticals is redundant since the plethora of chemically diverse natural compounds would not correspond to the number of varied biological functions, and ligands that target particular molecules are likely to be present in a range of species.

3.2 Latin American medicinal plants

South America has a high level of plant the environment, notably in the Amazonian rain forest, the Andes Mountain range, and the Americans' tropical and subtropical woods. Although knowing that only around 25,000 plant varieties have been professionally assessed, the usage of plants for medical purposes typically grows with the particular variation of the area. Considering the fact that only around 25,000 species of vegetation have been professionally examined, the usage of plants for therapeutic reasons grows in lockstep with the diversity of the local flora. Figure 1 depicts a number of risks associated with the use of vegetation and fungus as drugs, meals, and in ceremonies for healing throughout antiquity.

3.3 The relative weight of various threats

Medicinal use has been recorded for the year 509 of the 13,289 Latin American creatures investigated due to their globally threatened status (IUCN, 2020), nevertheless the type of creature being assessed may not be an adequate sample; for example, more than one in ten are cacti, a group in which all known species have been investigated examined. Figure 2 shows that 14% of the medicinal plants studied in this area are Extinct/Extinct in the Wild/Threatened with Extinction, whereas 38% of the Southern American flora studied is Extinct/Extinct in the Wild/Threatened with Death, a figure that is consistent with the global trend. In Latin America, there are 38 fungal species, although just a few of them are medicinal (IUCN, 2020). The Hasankeyf region's medicinal plants are arranged chronologically by group and chemical name. 171 items were gathered during this investigation, and 94 taxa from 72 families and forty separate families have been identified. One taxon represented 20 loved ones, whilst the other twenty families were made up of many taxons. Lamiaceae (13), The most common families were the ones containing asters (8), malware (6), Rosaceae (6), Amaryllidaceae (5), Brassicaceae (4), Solanaceae (4), Boraginaceae (3), and Fabaceae (3) (Figure 3).

There were 74 indigenous species (78.72%) and 20 cultivars (21.27%). The majority of they (65 taxa) in this research were herbs, however there were also bushes (15 taxa) and timber (12 taxa). A plant called a fern and one fungus were included as well in the research. Recently, toxic substances were detected in certain medicinal plants. We were instructed that the latex-like material of Euphorbia craspedia, the Euphorbia macroclada, and Ficus carica types ought to not come into touching the tongue when used for pain treatment. It is also advised that the Teucrium polium plant be taken with caution, since excessive amounts of it may cause gastrointestinal troubles. The hallucinatory effect of Hyoscyamus albus plants was also stressed, as was the poisonous effect of Dispersion communis sources.

3.4 Plants Components Used

Aerial components (39) were among the most frequently utilized therapeutic parts in conventional drugs for treating ailments; nevertheless many different components had been used: vegetables (23), leaves (22), below ground elements (10), blossoms and blooms (8), latex (4), seeds (4), subsidiaries (3), whole parts (2), barks (1), and resin (1) (Figures 4). Olive oil, animal milk, breast milk, nectar, soap, salt, and sugars are also utilized by the inhabitants. In many cases, numerous organs of the same organism are used in the production of diverse medicines.

3.5 Plants that Treat Diseases

Hasankeyf plants are utilized in medicine to treat 69 various sorts of people's ailments and difficulties. Herbal remedies are most frequently employed to address intestine difficulties (44), respiratory diseases (29), urogenital and kidney disorders (14), internal and external inflamed issues (13), diabetes (12), wound rehabilitation efforts, and the scalp and hair concerns (11). Ailments were divided into 17 categories according to data from evaluations. Internal and external inflamed problems had the highest FIC score (0.89). Plants that have been used to treat various ailments includes Allium cepa, Hyoscyamus albus, Plantago major, and Ranunculus species. Hypertension had the greatest FIC (0.82). Plants like Oak brantii, Teucrium polium, Teucrium chamaedrys, and Bryonia aspera may aid with this. Urogenital and renal disorders had the third highest FIC score (0.79), while respiratory issues received the fourth highest (0.76). Rheumatoid induced by ranked sixth with a FIC score of 0.66. A FIC score of 0.64 was observed with ear issues.

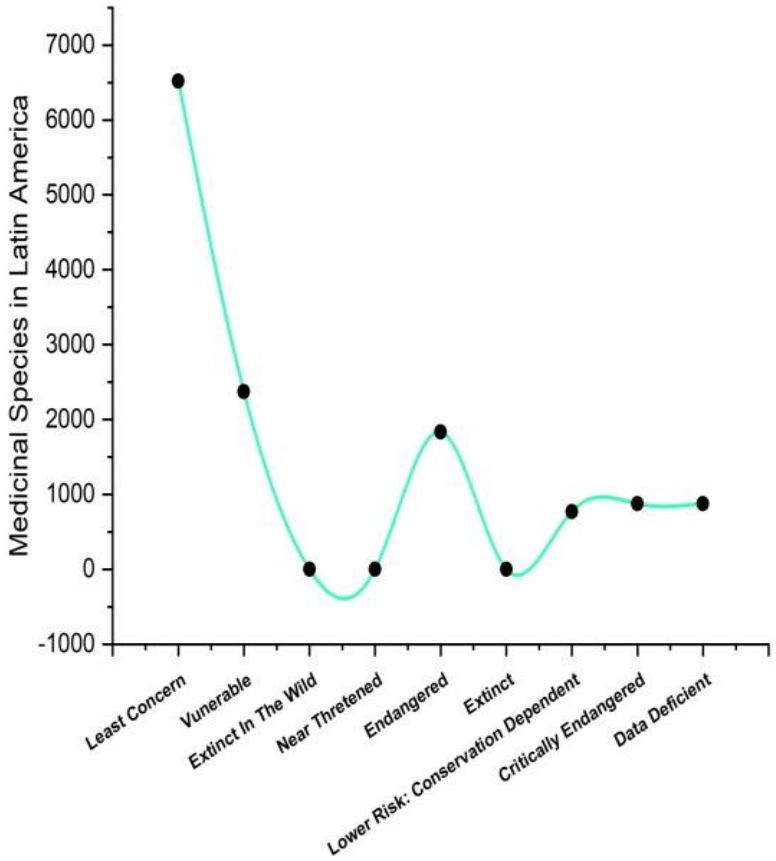

Figure 1(A): Conservation status

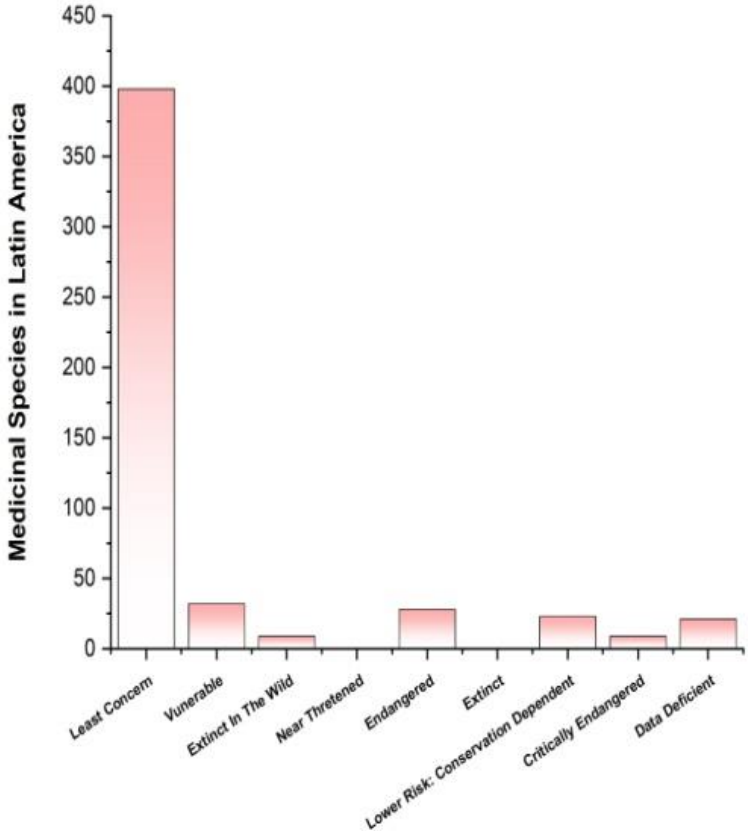

Figure 1 (B): Medicinal plants in assessed

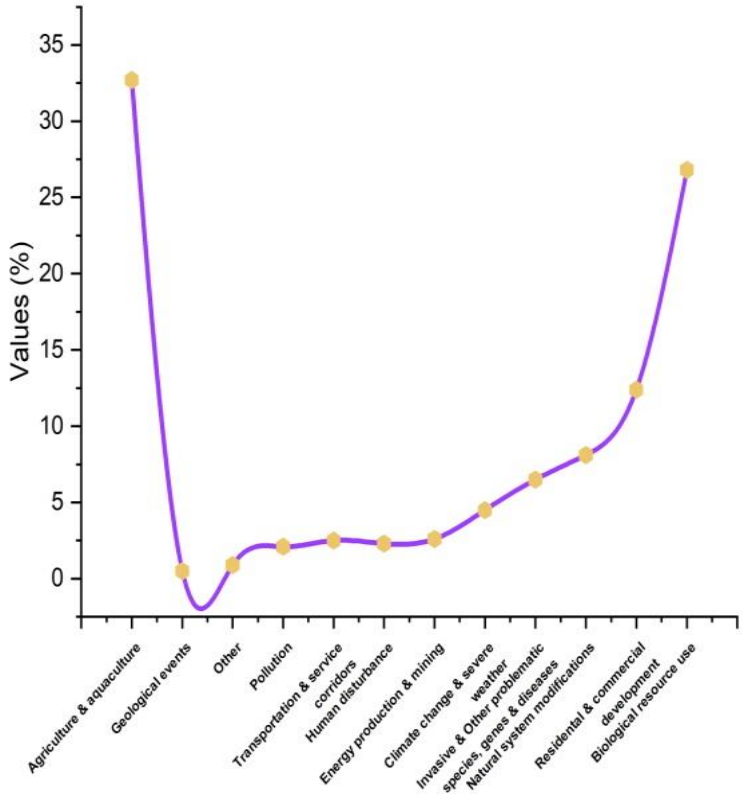

Figure 2: Relative Importance of Different Threats

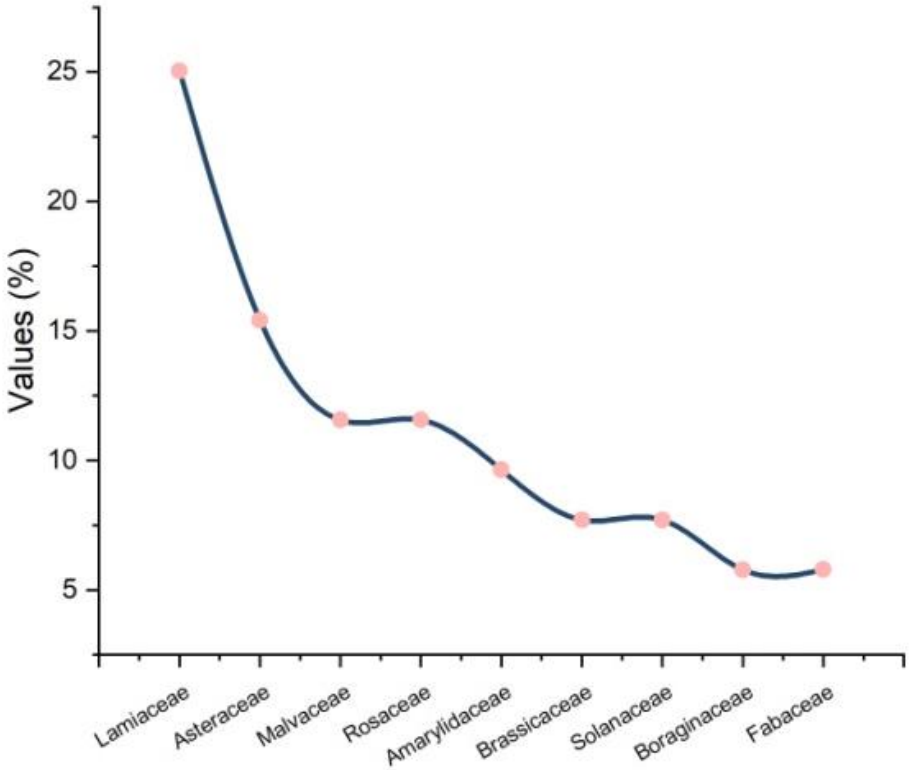

Figure 3: The percentages of most used plant families in Hasankeyf

Table: 1 Computation analysis of the percentages of most used plant families in hasnkeyf

	Values (%)
Lamiaceae	25.04
Asteraceae	15.42
Malvaceae	11.56
Rosaceae	11.56
Amarylidaceae	9.64
Brassicaceae	7.71
Solanaceae	7.71
Boraginaceae	5.78
Fabaceae	5.79
	Values (%)
Lamiaceae	25.04
Asteraceae	15.42
Malvaceae	11.56
Rosaceae	11.56
Amarylidaceae	9.64
Brassicaceae	7.71
Solanaceae	7.71
Boraginaceae	5.78
Fabaceae	5.79

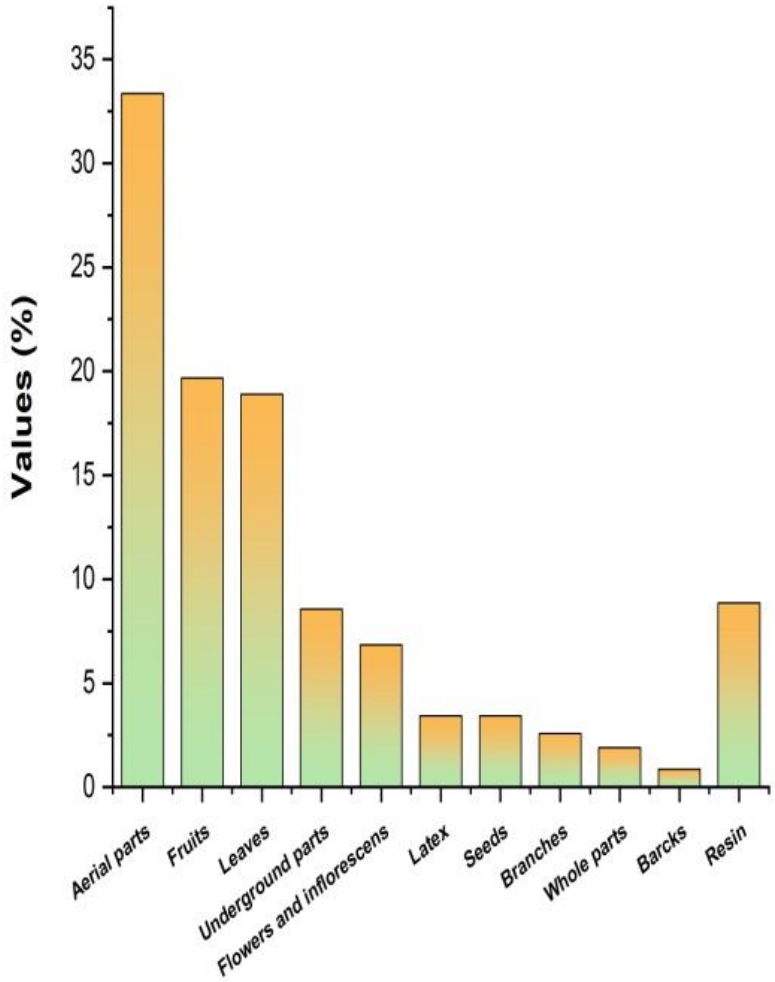

Figure 4: The percentages of most used plant parts in Hasankeyf.

Table 2: Computation of analysis the percentages of most used plant parts in hasankeyf.

	Values (%)
Aerial parts	33.35
Fruits	19.67
Leaves	18.9
Underground parts	8.56
Flowers and inflorescens	6.85
Latex	3.43
Seeds	3.43
Branches	2.58
Whole parts	1.9
Barcks	0.87
Resin	8.87

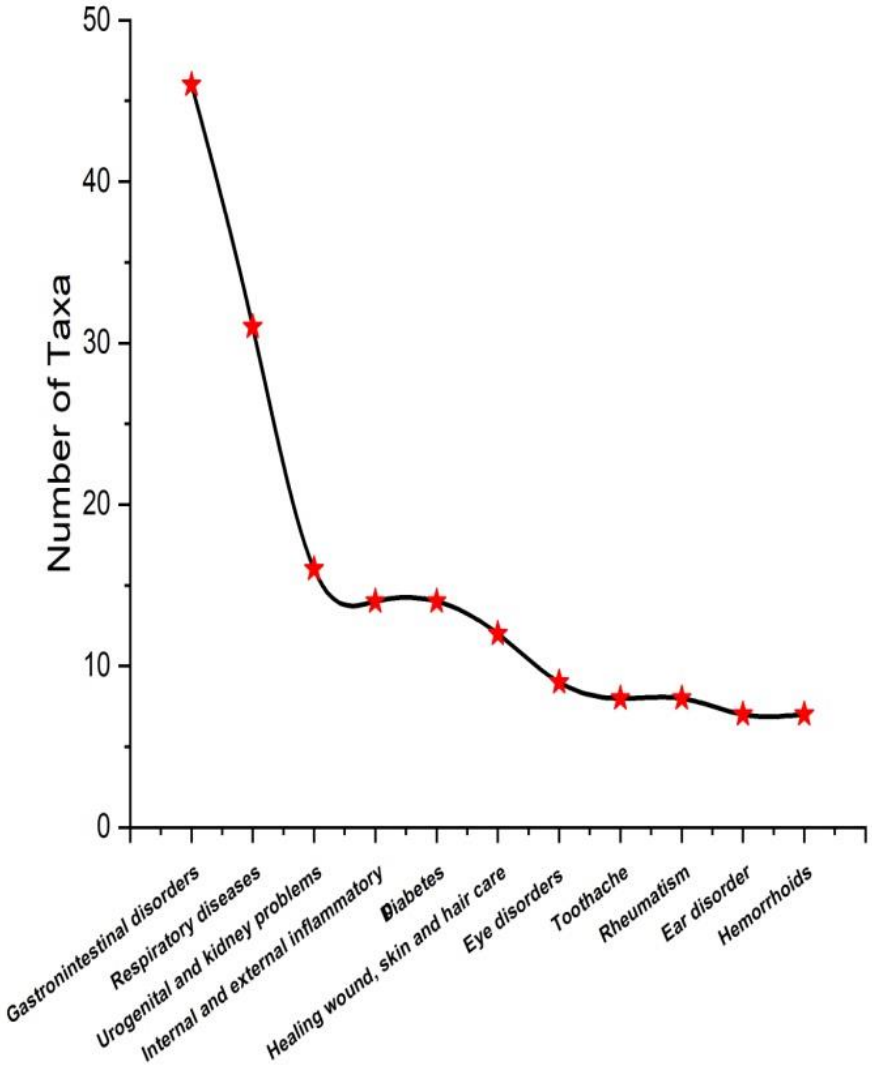

Figure 5: The most common ailments treated by plants in Hasankeyf.

Table 3: Computation of the most common ailments treated by plants in hasankeyf

	Number of Taxa
Gastrointestinal disorders	46
Respiratory diseases	31
Urogenital and kidney problems	16
Internal and external inflammatory p.	14
Diabetes	14
Healing wound, skin and hair care	12
Eye disorders	9
Toothache	8
Rheumatism	8
Ear disorder	7
Hemorrhoids	7

5. Conclusions

We examined over 100 chemical compounds derived from plants for inhibitory activity against many enzymes that are targets for a variety of diseases that jeopardize the well-being of people. We focused on these compounds and ran in silico studies to detect molecular interactions. As stated before, this research illustrates that plants with medicinal and aromatic properties are always excellent starting points for developing drugs.

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