



THE BIODIVERSITY OF MEDICINAL PLANTS

through history, traditions and the economy



REGIONE BASILICATA



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THE BIODIVERSITY OF
MEDICINAL PLANTS
through history, traditions and the economy

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INTRODUCTION

In the last two decades, the medicinal plant sector has witnessed a significant increase in demand for products aimed at consumers health and well-being. This has confirmed a growing interest in herbal products and highlight an ever-increasing use of medicinal plants in pharmaceuticals, cosmetics, liqueurs, alimentary and veterinary products. Furthermore [1] [2], there is a growing need for new business opportunities in the agricultural sector that can cater to various markets, particularly during a period when agriculture is confronting substantial challenges due to consumer expectations regarding product safety, quality, and authenticity.

Italy has made significant strides in boosting its profit margins through the processing and marketing of finished products over the years. However, despite meeting domestic market demands through imports, Italy still grapples with substantial production shortfalls. It is evident that increasing domestic production is of utmost importance to narrow the gap between imports and exports.

This is facilitated by recent legislation that has opened up the sector to an international perspective and, consequently, to key players in the demand for raw materials, such as the pharmaceutical industry. More recently, numerous agricultural entrepreneurs have recognized the economic potential in this type of cultivation, provided they possess specific knowledge related to production.

This knowledge encompasses technical aspects, including factors like land, equipment, labour, machinery, production and transformation costs, yields, profitability, and marketing potential. Additionally, a comprehensive understanding of the entire production process is essential for success in this endeavor.

Information on the supply chain in Italy, although having addressed some of the knowledge gaps in the initial stages, still suffers from a range of structural and economic-managerial limitations. These issues impact the deeper understanding of the sector, an essential factor for monitoring and thus for implementing policies aimed at enhancing the value of the products. The ongoing challenges in structural and managerial aspects continue to hinder a comprehensive grasp, calling for more refined strategies and policies to elevate the industry's potential and product value. Therefore, it's not just about mere cultivation, but also the feasibility of an initial in-house transformation of the plants and the precise identification of niche markets, capable of offering significant rewards while adhering to current regulations. The quality of the product is identified as the feature most directly linked to competitiveness. However, there is a need for a comprehensive "systemic" approach capable of organizing a supply chain that is adequate and comparable to those in other European countries.

Medicinal plants have a variety of applications including but not limited to supplements, cosmetics, feed, and agro-pharmaceuticals. They are not confined to a specific categorization but are instead versatile, serving as either an ingredient or a component based on specific applications and regulatory guidelines.

The classification of medicinal plants, considering their varied agronomic attributes, traces back to 1931¹ and distinguishes them based on their applications including medicinal, aromatic, and perfume purposes. The recent Unified Text [3] on medicinal plants (Legislative Decree 75/2018), following the 2014 Sector Plan, has updated and replaced outdated regulations, bringing more clarity and definition to the sector. This decree outlines specific regulations for an identified list of 2500 botanical species, agricultural activities, necessary authorizations, spontaneous collection practices, and control systems. It also encompasses orientation tools and directions for the sector, as well as branding protocols for regional and national productions. This regulatory update aims to align Italy's national regulations with international standards, acknowledging the sector's potential to yield significant results, especially in Italy's marginal and mountainous regions.

Far from being secondary, the "historicity" [4] serves as an identifying, distinctive, and cross-cutting factor for various plant species from botanical, agronomic, and ecological perspectives. Although it's not feasible to categorize them within the classical agronomic groups due to their characteristic of being a "primary product," derived from primary production and subsequently transformed and processed. As such, ethnobotany, through the study of traditional plant uses, delves into the typical culture of specific geographical areas or ethnic groups.

1 Law 6 January 1931n n.99: Discipline of the cultivation, collection and trade of medicinal plants. This is supported by testimonies and protected by the UNESCO Convention of Paris in 2003 as Intangible Cultural Heritage [5].

This interdisciplinary discipline, bridging botany and ethnography, began in the early 19th century, a period coinciding with the full development of both themes, from which other thematic areas emerged to explain the multifaceted uses of plants [6]. These areas included systematic botany (Augustin de Candolle, Swiss botanist, 1819), aboriginal botany (Stephen Powers, 1875), and ethnobotanical studies (Alphonse Rochebrune, 1876). In 1896, the American botanist John W. Harshberger first used the term ethnobotany, assigning it the function of analyzing the ancient distribution of plants, the routes through which they spread due to human actions, and suggesting useful applications in Western culture. The redefinition of the role of ethnobotany took about half a century, culminating in the definition as "the study of interactions between primitive humans and plants" in 1941. Subsequently, there have been varying interpretations of its tasks and roles, which continue to evolve today based on the interests of the defining ethnobotanist. In reality, the extensive degree of interdisciplinarity does not allow for precise sectoral boundaries or relational boundaries with other disciplines to be defined. Currently, rural populations play a crucial role in preserving practices related to the use of wild plants, especially in the more remote areas of Italy, where the uniqueness of productions still guides local dietary habits. In these regions, traditional dishes, liqueurs, and therapeutic products are prepared using specific plants and parts of wild herbs, fueling ethnobotanical research that collects and documents diverse traditions using both bibliographic and field methodologies, such as interviews and herbarium samplings, among others.

In light of such a complex reference scenario, the MEPLASUS project (MEdicinal PLAnts in a SUstainable Supply chain - experience of land-use practices) brought

together the leading research institutions in the agricultural and agricultural economics sector in Lucania - CREA-PB, DiS-Unibas, and ALSIA - along with numerous stakeholders operating in the medicinal plants supply chain. Additionally, the Faculty of Agriculture at the University of Belgrade and the Hellenic Agriculture Organization (HAO) DEMETER, a research institute in Thessaloniki, were also involved in this collaborative effort.

The project aims to promote innovation in the field of medicinal plants by focusing on the circular economy and facilitating communication between worldwide research and production sectors. It encourages multifunctionality, supports supplementary sources of income, enhances the economic competitiveness of producers and processors, and promotes the territorial development of networks between businesses. More specifically, it will strengthen and enhance the local micro-supply chains of medicinal plants in the Pollino-Lagonegrese rural area, which have been active for over a decade where a shared approach to exchanging best practices and experiences have already been implemented. This has been supported by analyses focused on historical, landscape, and socio-economic aspects, in response to increasingly demanding market requirements concerning quality, medicinal properties, and nutritional value. In reality, many areas of the Lucanian territory already have organized microeconomic systems in the form of supply chains due to the landscape, gastronomia, historical and cultural aspects and the traditional characteristics exhibited by medicinal plants. This study, "The Biodiversity of Medicinal Plants: History, Traditions, and Economics in Italy, Greece, and Serbia," aims to gather available information on medicinal plants. It does so through a historical and cultural examination of their uses and traditions, developed around the species studied in Italy and the partner countries.

Additionally, it delves into the socio-economic aspects to outline hypothetical future development scenarios for the sector. To achieve this, a bibliographic research was conducted on the origins of phytotherapy and the various uses of wild herbs over the centuries by cross referencing ethnobotanical studies. Similarly, an investigation into economic data on land surface areas and productions of medicinal plants to evaluate trends at international level was also carried out which allowed for the definition of the typical scenarios of the project's partner countries, thus providing the most up-to-date socio-economic framework within which to envision strategies and actions for each territory's specific supply chain, in light of the new legislation in place.



1. HISTORICAL-CULTURAL ASPECTS OF MEDICINAL PLANTS

Until just a few decades ago, the only available medicines were derived from natural products. The term "Phytotherapy" (Phyto + Therapy) [7][8], from Greek origins, refers to the first therapeutic methods employed by humans, alongside the use of water, earth, and sunlight. Various hypotheses have been proposed to comprehend the mechanism behind the discovery of therapeutic properties. As far back as the Paleolithic era [9], over 60,000 years ago, there is evidence of the search for roots, leaves, barks, and flowers for medicinal purposes. Similarly, the Mesolithic era is attributed to the earliest remnants of "gatherer" humans, including traces of Elderberries (*Sambucus nigra* L.), Cornelian Cherries (*Cornus mas*), and other wild dried fruits in villages in Northern Italy. Theories based on archaeological evidence suggest that humans relied on instinctive methods to discover the therapeutic properties of plants, often by observing the effects on animals that consumed them. Alternatively, they sometimes relied on "revelations" described in texts such as Ecclesiastes and hadiths of Muhammad [10], which highlighted certain plants as remedies for illnesses. The theory of signatures, although often associated with the Renaissance, is actually an ancient concept that has evolved and attempted to provide a scientific foundation over the centuries. According to this theory, the cure for a disease found in the natural environment depended on plants with external signs resembling human organs to which they corresponded. This suggested a therapeutic remedy for the corresponding organ.

For example, ancient Indians used yellow flowers to treat jaundice, the Chinese employed *Panax ginseng* L. as a tonic because its root resembled the human body, and the ancient Romans utilized the *Orchis erba* root as an aphrodisiac due to its double root resembling two testicles (*Historia naturalis* XXVI, 72 Pliny, 23-79 AD). Tracing the history of medicinal plants from prehistory [11] means revisiting the meaning of disease and healing in ancient societies, as well as the figures responsible for solving health problems, which were generally attributed to supernatural events and, therefore, linked to the gods. Primitive thinking was imbued with magic, and the action of plants became an expression of both good and malevolent deities. The connection between prehistoric tribes and the gods designated the figure of the priest as the keeper of knowledge regarding healing and, therefore, the representative of the medical function and so, religion and medicine remained inseparably linked for millennia.



1.1 ANCIENT CIVILIZATIONS: FROM EGYPT TO THE ROMAN EMPIRE

Traces of the existence and use of medicinal plants have been found in various historical documents, including Egyptian papyri [12],[13]. In ancient Egypt, the practice of medicine encompassed various branches, and they meticulously listed of numerous herbs used for healing, some of which are still present in the European Pharmacopoeia today. The Ebers Papyrus [10], dating back to the 7th century BC, described much older traditions, listing 700 medicinal plant species, some of which are still in use today. It identified the holders of this knowledge as individuals of great prestige, often belonging to the realm of the divine. The preparations also extended to the field of aesthetics, with priests responsible for extracting juices from herbs and creating tablets, sometimes experimenting with rather complex formulations. Although reconstructing ancient Egyptian knowledge has been challenging due to the difficulty of decoding ancient names into modern nomenclature, many herbs have been identified. These include the castor oil plant, flax, sesame, juniper, mandrake, wormwood, and henbane, which have been discovered in specific contexts that confirmed their precise usage. Additionally, mint, sage, and chamomile have been found in tombs, while cedar has been depicted in some paintings at the temple of Karnak.

Written records of herbal utilization in the East [13], which underlie Traditional Chinese Medicine and Ayurveda in India [9], [14] [17], trace their roots back to the Egyptian and Minoan-Mycenaean civilizations. These medical systems are founded on philosophical principles that view the individual as the outcome of the union between the physical body (matter) and the psyche.

This perspective, similar to modern holistic medicine, places the individual at the center of the universe, situated between the divine and the earthly, with medicinal herbs serving to maintain the balance between these two opposites, known as yin and yang, which is the ultimate goal of Chinese medicine. The first treatise on medicinal plants ever written, "Pen-t'sao" (Origin of Herbs), is attributed to the Chinese emperor Chen-Nong [13], who reigned in the 27th century BC. His work describes and classifies 365 herbs, which he likely experimented on himself to determine their healing or toxic properties. Three hundred years later, the most famous, though not the oldest, Chinese pharmacopoeia was compiled in 42 books with 1360 colour illustrations, cataloging 1100 plants divided into 68 classes, along with 8000 recipes and precise instructions for preparing medicines. Nevertheless, this writing reflects the fusion of popular traditions and more scientific knowledge, serving as a mirror of Chinese culture where philosophical thought blend with herbal knowledge. Other important work from the 16th century is attributed to Li Shichen, a Chinese pharmacologist, known as the "Pen ts'ao kang mu." It compiles 2000 different substances as the basis for over ten thousand preparations, many of which are still used in Chinese cosmetics and pharmacology today. In ancient Chinese tradition, the famous Ginseng (*Panax ginseng*), often referred to as a "cure-all," was believed to be a remedy for all diseases. Its human-like shape reinforced its magical powers, and it was considered an adaptogen that boosted the body's resistance to stress factors, rebalanced energy, stimulated the mind, and increased organ vitality.

Other herbs appeared depending on their uses, such as Astragalus (*Astragalus propinquus*) for diabetes and circulation, Angelica/Dong quai (*Angelica sinensis*) for

its estrogenic effects and hormone regulation, Ginger (*Zingiber officinale*) for fatigue, low energy, and cold conditions, and Licorice (*Glycyrrhiza glabra*) for gastrointestinal issues, malaria, insomnia, and infections.

Indian culture, through its ancient written sources, emphasizes the crucial presence of divinity in the treatment of diseases. The God Soma, representing all herbs and the ultimate hidden healer within medicinal plants, is believed to enter the bodies of the sick to conquer illness. Extremely ancient testimonies are found in texts written between 2700 and 1500 BC, where diseases were treated through dietary means, with medicinal herbs being an integral part of the regimen. The five elements (ether, air, fire, water, and earth), which combine to create the universe, are also present in humans, governing balance and, therefore, health. An excess or deficiency in these elements can threaten one's health. The "Susruta," which lists 700 species of herbs, describes them not only from a botanical perspective but also in terms of their therapeutic properties, the best places to gather them (the slopes of the Himalayas), the expertise required to avoid confusion between beneficial and poisonous plants, and the observations of shepherds and hunters who, through their connection with nature, possess knowledge of medicinal arts. In other chapters, descriptions of intoxicating herbs like opium, hashish, aconite, betel, and aphrodisiacs, including coloquintide, the lotus, and mustard seeds, have been found. Ephedra vulgaris, known for its miraculous properties in Indian medicine and previously known to the Chinese as "ma-huang" 5000 years ago for treating asthma, is employed by modern pharmacology for a wide range of therapeutic uses (tonic, stimulant, appetite suppressant, and weight loss) thanks to the isolation of its alkaloid, ephedrine.

Many magical aspects continued to permeate the medicine of the Assyrians and Babylonians, as described in the Code of Hammurabi (18th century BC), which outlines the duties of a physician. Combining magic and religion [11], some concepts that form the basis of a consistent use of medicines began to emerge.

These concepts can be found in the library of King Assurbanipal (7th century BC) in the form of inscriptions on cuneiform tablets. They include the understanding of the relationship between dosage and effect, the definition of the modern "biological assay" (which has now been replaced by the chemical dosages of medicines), and the promotion of the cultivation of medicinal plants. Babylonian herbalism exhibited a degree of uncertainty in plant identification, similar to that observed in other civilizations. Nevertheless, some names with Babylonian roots have survived to the present day. It's interesting to note that the Hebrews preferred external applications of medicines over internal ones, poultices, for instance, were used to treat various ailments and the Sacred Scriptures provide detailed descriptions of their medical knowledge, for example, the prophet Isaiah prescribed a poultice made from dried figs to treat abscesses or boils. Another method, known as "malagma," involved chewing various herbs and applying them to the wound after mastication. These preparations were stored in wooden boxes and dedicated rooms.

The Greek civilization [13],[15],[16],[17], while groundbreaking in its concepts and interpretations of natural phenomena, was less influenced by religion than previous cultures and acknowledged the sources of knowledge from both the Egyptians and Mesopotamians. Hippocrates of Cos (460-377 BC), often regarded as the father of Western medicine, refined this knowledge, moving it away from magic and into the realm of prescriptions, dosages, and diets. His contributions had a profound influence on the Roman and medieval worlds.

However, in the ancient Greek world, particularly in archaic Greece, the influence of mythology on medicine was so pervasive that it attributed the power of healing to gods and heroes. For instance, Achilles' proficiency in using medicinal plants came from the teachings of his mentor Chiron, the leader of the Centaurs, who was believed to be a cultivator of medicinal plants in vast gardens near his cave in Thessaly where he conducted lessons. Chiron taught future heroes how to use herbs to heal themselves in case of battle injuries. Interestingly, Chiron personally made use of this knowledge when he accidentally got wounded by Hercules with an arrow dipped in Hydra's venom. He managed to heal the wound using a herb, and this herb was later named after him as Centaurea. The discovery of new herbs with medicinal properties was considered an activity guided by the gods in ancient Greece. According to legend, Diana discovered Artemisia as a regulator of the menstrual cycle, while Aphrodite bestowed upon all Greeks the knowledge of aphrodisiac herbs. Similarly, drugs or substances to induce a state of intoxication or ecstasy were well-known, including "Nepenthes," a beverage recently believed to be composed of a base of Indian hemp or opium. The discovery of new herbs with medicinal properties was often attributed to the actions of deities in ancient Greek mythology. According to legend, Diana discovered Artemisia, which was believed to regulate the menstrual cycle, and Aphrodite was said to have given the Greeks herbs with aphrodisiac properties. There was also knowledge of substances used for inducing altered states of consciousness, such as "Nepenthes," a beverage that was recently believed to be composed of a base of Indian hemp or opium. In various rituals, the use of plants accompanied the ceremonies in a specific sequence.

One notable example is the Eleusinian Mysteries, which were documented through inscriptions and paintings on the walls of sanctuaries, as well as on vases and other ceramic artifacts.

Additionally, accounts of these ceremonies were provided by writers who participated in them, including figures like Aeschylus, Sophocles, Herodotus, Aristophanes, Plutarch, and Pausanias. These rituals, which were part of ancient religious practices, often involved the consumption of certain substances, and their precise ingredients and effects have been the subject of various theories and interpretations. While some suggest an Egyptian origin, others propose Thracian or other influences. Due to the secrecy surrounding the most sacred aspects of these rites and the oaths sworn by participants, detailed descriptions of the substances used remain elusive. Some theories regarding the ingredients of the "kykeon" beverage exclude wine, as it was considered inappropriate for the goddess Demeter, but instead, they suggest the presence of psychoactive compounds responsible for altered states of consciousness. The origins of the "kykeon," a beverage used in the Eleusinian Mysteries, are a subject of debate among scholars. Some believe it may have Egyptian origins, while others suggest it could have come from Thessaly or Thrace. Due to the secrecy surrounding the most sacred aspects of the rituals, detailed descriptions of the kykeon's ingredients are lacking. However, it is generally believed to have been a preparatory drink for the ceremony and was composed of water, mint, and barley (associated with Demeter). While wine was excluded from the kykeon, there are hypotheses that suggest the presence of psychoactive substances, which may have been responsible for altered states of consciousness during the rituals.

A student of Chiron, Asclepius (Aesculapius) is credited with the discovery of a miraculous herb capable of resurrecting Hippolytus, the son of Theseus, and wild rose for curing hydrophobia, as recalled by Pliny. However, the son of Apollo, who later became the god of medicine, had numerous prescriptions: anise, sage, cedar, hemlock, and pine buds. Hippocrates, in addition to ascribing natural causes to various diseases and carefully observing patients, symptoms, and potential disease progressions, was also the first to classify around 400 species of medicinal plants. The importance he placed on education is undoubtedly paramount, not merely aimed at discrediting magicians, but emphasizing the significance of experience, benefiting the concepts of anamnesis and physical examination. In the Hippocratic Corpus, Hippocrates categorizes a number of medicinal plants for both treatment and prevention, valuing the holistic approach common in that historical period. Among the plants classified in the Corpus are mullein, mallow, hyssop, asparagus, oak, flax, garlic, verbena, laurel, sage, centaury, thyme, yarrow, and many others, including poisonous medicinal plants useful in certain therapies at controlled dosages, such as black hellebore, squill, aconite, mandrake, and belladonna. The first establishments where doctors began to prepare and sell medicines, while closely guarding their formulas, were known as "rhizotomists." These individuals were dedicated to gathering roots and medicinal plants from well-known locations and also acted as suppliers to traveling pharmacists. Hippocrates' instructions were essentially directed at treating symptoms with their opposite (*contraria contrariis curantur*) and with their similar (*similia similibus curantur*).

The introduction of principles related to diagnosis, the specificity of remedies, the transmissibility of diseases (the Latin word for poison being "virus"), therapy, and the use of plants, along with the preparation of plants for treatment (known as galenic), can be attributed to figures such as Hippocrates (5th century BC), Celsus (1st century AD), Dioscorides (1st century AD), and later, the Roman physician Galen (2nd century AD). These individuals were pioneers in the process of systematizing medicine and also played a pivotal role in the inception of the first herbal texts. Historical sources mention Diocles of Carystus (4th century BC), an anatomist who authored the first text outlining rules for plant collection, protocols for medicine preparation, and methods for therapeutic application. Meanwhile, the earliest comprehensive treatise on pharmaceutical botany, "De historia plantarum," was authored by Theophrastus (372-287 BC). This work documented 500 plant names [18], which often differ significantly from contemporary designations. The classifications were primarily based on stem type and whether or not the plant species could be cultivated. In Book IX, drugs and medicinal substances were classified for the first time in antiquity, along with their corresponding therapeutic properties. The earliest known illustrated herbal, likely in the history of such works, was commissioned by Mithridates VI (132-63 BC) for his personal physician Crateva. This endeavor was a response to the achievements of the school of Aristotle, which had engaged some of the most knowledgeable botanists and scientists from the Middle East. Although the monograph itself has been lost to history, it remains the oldest illustrated herbal that has survived to the present day. It also serves as the earliest documentation of Dioscorides' Pharmacopoeia, currently housed at the National Library of Vienna.

A different classification system, based on the affinities of plants and their effects on the human body, is credited to Dioscorides Pedanius, a Greek physician from the first century BC. His work, titled "De Materia Medica," was translated into Latin in 65 AD and subsequently translated into multiple languages. It was extensively illustrated and served as a model for the creation of later herbal texts. This comprehensive work spans five volumes and encompasses 650 medicinal substances of plant origin, 85 of animal origin, and 50 of mineral origin. Many of these substances, such as anise, chamomile, cinnamon, pepper, rhubarb, thyme, marjoram, ginger, and more, continue to hold a place in modern pharmacopoeia.

In Etruscan society, the practice of medicine was intricately linked to both magical rituals and a robust knowledge of medicinal plants. This ancient civilization, enriched by a blend of magic and practical plant-based remedies, relied heavily on folk medicine. Essential plants, such as male fern, garlic, and onion, were favored for combating intestinal parasites. Chamomile was cherished for its soothing properties, castor oil served as a potent purgative, and myrtle was used to manage intestinal disorders thanks to its astringent qualities.

Greek herbal wisdom encountered stern resistance in Rome [13], notably from Cato. Despite this staunch opposition, Cato was an adept herbalist himself, well-versed in the medicinal applications of four cabbage varieties, amongst others. He firmly believed in the sufficiency of his herbal expertise to address a broad spectrum of health concerns, from diseases and abscesses to fractures and eye conditions. As Rome ascended as a Mediterranean powerhouse, it became a melting pot of cultural, economic, and scholarly exchanges. The city bore witness to the influx of plant drugs and the

establishment of *Apotheca*, a pioneering pharmacy in the 2nd century BC. This establishment was instrumental in transforming various substances, spanning animal, plant, and mineral origins, into medicines. It was equipped with ampoules, jars, and balances and extended its services to the creation of cosmetic products. The era was marked by an elevated emphasis on body care, particularly for women. The market saw a proliferation of masks, ointments, and dental powders. Noble women of the time were distinguished by their use of natural-based makeup products, importing kajal for eyes from India and fragrances from regions like Egypt, Cyprus, and Greece. Government policies prioritized public health, spearheading initiatives aimed at disease prevention, improved sanitation, and the elucidation of disease treatment modalities, with a spotlight on skin conditions. Literary works of the time, such as "*Historia Naturalis*" by Pliny the Elder and "*De Medicina*" by Celsus, highlighted the experimental value of plant preparations and their intricate classification. Celso is notably credited with a significant piece of work among his publications, "*De Artibus*," of which only the "*Treatise on Medicine*" (covering dietetics, pharmacology, and surgery) has survived. In this treatise, he compiled all the Greek and Roman medical knowledge of his era in elegant Latin, deviating from the traditional use of Greek for this discipline. This choice facilitated the widespread dissemination of the text, which authoritatively dominated and influenced Roman medical education until Galen's era. Overlooked during the Middle Ages, the "*Treatise*" was rediscovered by Pope Nicholas V and published in 1478. Dioscorides, a 1st-century AD author, described approximately 700 plants, their botany, effects, and flavors (*De materia medica*) in a text that remained in use until the Renaissance and throughout the medieval period.

Galen, a physician to the gladiators in Pergamum and Rome, and later the personal physician for Emperor Marcus Aurelius's expedition against the Germans and court physician for his son Commodus, is credited with providing the greatest impetus to scientific studies of the time. Galen marked a turning point in medicine, advancing studies and research through the trusted role bestowed upon him by the emperors of his era. His disdain for Roman doctors was justified by his observations of their corruption, greed, laziness, vice, and poor understanding of the human body, diseases, and diagnoses, betraying the principles of the Hippocratic school. In response, Galen produced an encyclopedic compilation of medical knowledge, drawing from his experiences at the Museum of Alexandria in Egypt, the works of Herophilus and Erasistratus, Aristotle's contributions to zoology and biology, the Hippocratic school's teachings on elements, qualities, and humors, and Plato's *Timaeus* for the doctrines of "innate heat" and "pneuma."

As such, Galen's classification of plants led to the creation of his own pharmaceuticals, comprising simple and complex remedies, juices, ointments, and specific tablets. These were categorized according to Hippocratic theories into 'hot' plants like lemon balm, cinnamon, St. John's wort, and valerian, and 'cold' plants such as fumitory, plantain, poppy, and pellitory. He emphasized the therapeutic role of diet, analyzing the characteristics and limitations of commonly consumed Roman foods, from cereals to legumes. While providing limited details on seeds, he offered a more thorough examination of seasonal fruits, particularly summer and autumn varieties, and small berries (such as rosehip fruits, juniper, and blackberry) known for their purifying and immune-boosting properties, along with vegetables and wild herbs (like wild fennel, nettle, chervil, and cumin).

Galen's scientific approach had its limitations, notably in the minimal use of surgery and anatomical studies, which were considered more 'plebeian' and only employed after diet and medicinal treatments.



1.2 THE MIDDLE AGES: FROM BOTANICAL GARDENS TO ALCHEMISTS

During the Middle Ages [13], civil society was not spared from the upheaval caused by the Barbarian invasions, marking another historic period where the decline in the quality of urban life was addressed by the Church of Rome, spurred by the vigorous advent of Christianity. This transformation led to the eclipse of ancient Greek knowledge, with monasteries becoming the custodians of learning. Every convent was equipped with a botanical garden for the cultivation of herbs and a laboratory for preparing medicinal concoctions. Medicine underwent a transformation, moving away from Hippocratic science and opening its doors to thaumaturgy – a practice that centered on waiting for divine "miracles" for healing the ill. Herbal preparations were seen as tools of God. God's will, detached from material elements, nullifying the concepts of dose-response relationship and specificity of remedies.

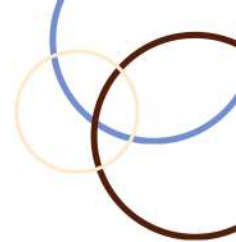
Between the 10th and 15th centuries (Late Middle Ages), superstition and occultism [11] took root, and medicine became akin to a magical event. Such beliefs, closely tied to the geocentric view of Earth, are still recognized today. Medical knowledge developed and was preserved in major centers like the University of Federico II in Naples, the Abbey of Montecassino, and the Salerno School.

These institutions owed their growth to Arab and Jewish influences, which led to the creation of the first Hortus Salutaris. Additionally, the Benedictines, thanks to Abbess Saint Hildegard of the Monastery of St. Rupert in Bingen on the Rhine, cultivated hundreds of medicinal species in their convents. The tools of this epoch were primarily empirical, with the mortar as a crucial tool for grinding various substances into powder. A notable artifact from this period is the herbal "Herbe pincte" by Antonio Guarnerino (or Guarnerio), presumably originating from Feltre and written in the vernacular. Through popular-style illustrations, it represented the type of medical culture prevalent in the University of Padua in the 15th century. The manuscript consists of a first part featuring 74 plants (simple remedies) illustrated in figurative scenes and a second part comprising 150 drawings of plants depicted according to the so-called Italian botanical 'schemata,' void of any naturalistic effect. In the 19th century, the volume appeared in an inventory of books owned by the Bergamo physician Luigi Carrara (Bergamo, Civic Library Angelo Mai, AB 208).

In contrast to the decline of the classical world during the European medieval period, the Arab civilization was on the rise, not only militarily and in the development of various arts but also in the scientific and medical fields. The Arabs reevaluated Greek and Roman culture, leading to the translation and restoration of numerous medical texts and initiating a series of insights into the transformation of substances that laid the foundations for chemistry. Muhammad himself promoted the revival of medicine and herbalism and endorsed several prescriptions, urging the Arabs to trade and import every type of drug from the East, especially from the island of Ceylon, to be disseminated in Europe.

The most renowned Arab pharmacologist, Ibn al-Baitar, represented a scholarly figure who compiled the knowledge he inherited from Dioscorides and Galen, enriching it with his personal insights. His work included about 1400 medicinal plants, of which 300 were recorded for the first time, with names indicated by comparing Arabic terminology with Persian, Chinese, Spanish, and other Eastern civilizations. A notable innovation, indicative of many features of modernity, was undoubtedly the establishment of the public pharmacy. This marked the beginning of scientific organization in research and experimentation and initiated the distribution to Italy of herbs and drugs in ceramic containers, heralding the art of majolica on the peninsula.

The isolation of the first pure substances and the discovery of processes like sublimation and distillation were linked to a new art – alchemy [11], deeply philosophical in its principles and strongly tied to the geocentric conception of the Earth. Among the most notable Arab physicians, Avicenna (979-1037), a Persian scientist, and philosopher, wrote the “Canon of Medicine,” a medical treaty utilized in universities until the 1600s. The spread of Arab culture in Europe around 1100 AD, facilitated by the crusades, firmly established alchemy. Saint Thomas Aquinas (1225-1274), a theologian and alchemist, and the author of two alchemical texts - the Treatise on Alchemy and the Treatise on the Philosopher’s Stone, described the characteristics of an alchemist. Closing this period, which extended until the 1700s, was Isaac Newton, the discoverer of the universal law of gravity, the calculation of planetary motion, and the heliocentric system, even though he was torn between the apparent contradiction separating alchemy and modern science.



1.3 RENAISSANCE AND ENLIGHTENMENT

Paracelsus (1493-1541), a Swiss physician, marked the entrance of medicine into the Renaissance period. His combination of Greco-Roman knowledge with Arab alchemy enabled him to attribute the effectiveness of medicinal plants to their contained substances, leading to the definition of the quintessence, or active ingredient. This essence could be extracted and used in a more concentrated and effective form through known techniques. Advocating for nature, where he believed a “cure for every disease” existed, and for the manifestation of healing forces, he reassessed concepts like the connection between dose and effect and the principle of specificity. Despite being obliged to naturally justify the association between disease and the plant suited for its cure (Theory of Signatures), his principles garnered significant success across various European courts. We also owe the birth of a new discipline, iatrochemistry, to Paracelsus, which served as the precursor to modern pharmaceutical chemistry.

The establishment of the first university chairs in experimental botany at Padua and Bologna between 1533 and 1539 highlighted the need to teach the recognition of officinal and medicinal plants, leading to an increasing demand for dried samples. This demand, in turn, reintroduced the concept of "gardens of simples" for educational purposes at Pisa, Padua, and Florence. Simultaneously, the invention of the microscope and the refrigerator, coupled with advancements in biochemistry, allowed for the observation and isolation of new active principles, marking the initial stages of industrialization in this field.

The period also benefited from the invention of movable type printing in 1492, enabling the publication and dissemination of classical botanical works to a broader audience and facilitating the intense reproduction of a “pharmaceutical botany,” one of the most replicated of the 16th century. This opportunity favored the discovery of numerous species, published in the first “Floras” – actual catalogued collections of species found throughout Europe. Copper engraving gave rise to so-called “herbals” and “florilegia” illustrated with species cultivated in gardens and botanical gardens. Lemery Nicolas (Rouen 1645 – Paris 1715), one of the major exponents of late 17th century French chemistry, experimented in the chemical field and taught the subject with great success, both to pharmacists and to nobles and the bourgeois. As the king's apothecary and owner of a famous Parisian pharmacy, he authored “Cours de chymie” (1675), “Pharmacopée universelle” (1697), “Traité universel des drogues simples” (1698), and “Traité de l'Antimonine” (1707).

The Enlightenment of the 18th century [20], [22], despite its significant discoveries about nature and the establishment of sciences on rational foundations, excluded medicine from the realm of scientific progress. This exclusion was primarily due to the complexity of life's mechanisms and the limited knowledge about living beings during that era. Medicine was still predominantly regarded as an art, although there was a growing understanding of anatomical principles. One notable document [20] from this period is the “Inventory of the shop of the apothecary Antonio Raspi” (1776), which provides a detailed account of a Bergamasque apothecary's shop from the latter half of the 18th century. The inventory meticulously lists extracts and roots of medicinal plants such as poppy extract, gentian, and spotted persicaria, as well as the roots of mallow and cyclamen.

It also enumerates various types of spices, including cardamom, turmeric, cinnamon, and saffron. Of particular interest is the description of the tools utilized in the preparation and preservation of these substances. The inventory highlights the use of a still with a copper lid, a brass balance, an iron spoon, and six brass spatulas. Maiolica jars, crystal glasses, and ampoules were employed for storing and preparing substances, reflecting the fusion of artistic craftsmanship and practical functionality in the equipment of that era. Each tool and ingredient played a crucial role in illustrating the intricate relationship between art and science in the practice of medicine during the Enlightenment.

Basilius Besler, author of *“L’herbier des quatre saisons ou Le jardin d’Eichstätt,”* is credited for Hortus Eystettensis, a grand garden in Eichstätt, Bavaria, commissioned by the botany enthusiast Prince Bishop Johann Konrad von Gemmingen. The garden’s modern edition describes about 1084 plants meticulously described and depicted in natural size across 850 pages of text, complemented by 367 hand-engraved and hand-painted watercolour prints. The work aligns with the most modern form of herbs of the period, encompassing German, Southern and Southeastern European, Asian, African, and American species. This period also saw the *“Hortus siccus pisanus”* attributed to Liborio Tommasini, confirming the century of enlightenment’s interest in botanical studies and the need for a knowledge organization aimed at stimulating interest in naturalistic disciplines. The parallel study of botany and medicine spurred the production of herbals and *“dry gardens”* texts, where dried plants were associated with their descriptions, furthering the direct knowledge of herbs.

However, the need for laws governing the vital process that could help define various therapies, prompted some individuals to establish Romantic Medical Schools. These schools were often only active during the lifetime of their respective founders. Among those that have survived to the present day are Homeopathy, Eclectic Medicine, and Bach Flower Remedies. This was the era of Linnaeus, the founder of modern botany and a passionate herbalist.

1.4 MODERN PHYTOTHERAPY

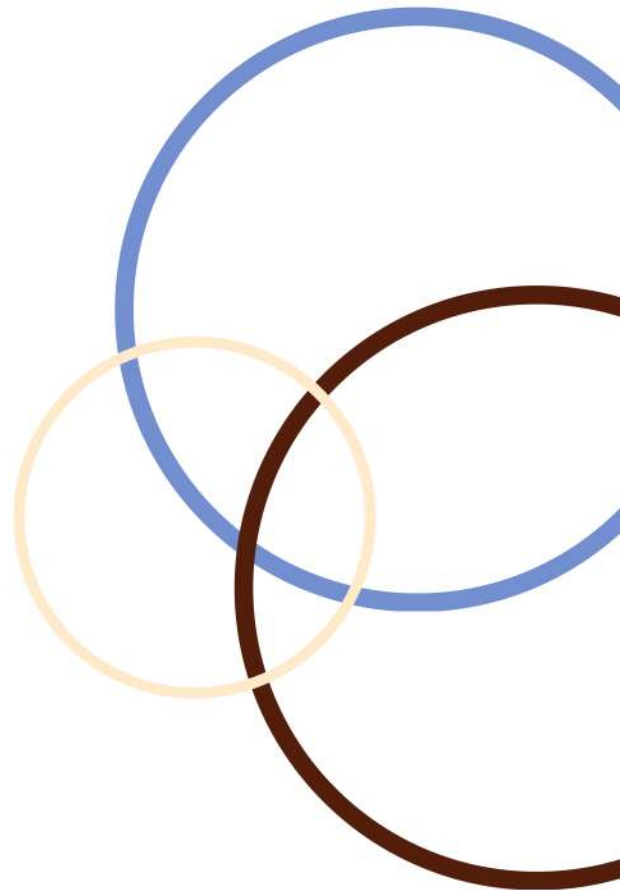
Modern medicine characterizes the 19th century [8], [11], marked by a progressive departure from empiricism. Indeed, a series of chemists distinguished themselves for their ability to extract active principles from plants for use as drugs. The isolation of quinine (from the bark of the cinchona tree, 1820), atropine (*Atropa Belladonna*, 1831), and digitoxin (*Digitalis purpurea*, 1868) was followed by the advent of microbiology and immunology (1890) and the discovery of penicillin (1929). In 1870, salicylic acid was synthesized at Bayer's dye works in Germany, marketed in 1874, and its efficacy was illustrated in 1876 with the first clinical study published by *Lancet*, although its mechanism of action—the inhibition of cyclooxygenase, responsible for activating inflammation and sending pain messages to the brain—was only learned in 1970. The novelty lies in the production of the first new synthetic drug, different from its natural counterpart, with more side effects.



In 1889, the first chemical alkaloid, coniine, was introduced. It occurs naturally in hemlock (*Conium maculatum*) and was used as an analgesic and painkiller due to its anticholinergic properties. To replace animal adrenal gland extracts, which were used for stress relief (by German pilots during World War II) and in anti-inflammatory therapies, cortisone was synthesized in 1944. It exhibited similar activity to adrenal steroid hormones and, during the initial trials in 1949 by an American doctor, allowed a severely disabled patient with rheumatoid arthritis to ride a bicycle. The first biological drug industry emerged in 1977, driven by advanced genetic engineering technologies that produced highly pure and specific sequences of monoclonal antibody proteins. These proteins had the capability to bind to sites with greater specificity compared to conventional immunosuppressants. The modern era has seen a revival of the ancient role of Phytotherapy, a term coined by Henri Leclerc (1870-1955) [10]. However, the discovery and isolation of active ingredients have reduced the importance of using plants as standalone drugs, favoring their incorporation into galenic preparations for administration.

The contemporary resurgence in the value of medicinal plants for therapeutic substitution of synthetic drugs has prompted the medical field to reevaluate its stance, acknowledging the validity of many plants in various pathological contexts. This choice has received support from the UN and WHO, both of which promote further research on the use of medicinal plants. They classify these plants from a therapeutic perspective and create regulations regarding product purity and galenic preparations. Therefore, Pharmacopoeias play a crucial role in providing methods and analytical procedures for the identification and quantification of active ingredients and impurities.

They also establish the quantities of active principles contained in preparations and set limits. Ensuring an adequate standard of quality begins at the cultivation stage, where contamination by herbicides, heavy metals, bacteria, fungi, etc., is challenging to control. However, for cultivated medicinal plants, a series of agricultural rules (known as good agricultural practice or GAP) are applied, not only during cultivation but also during drying and transportation.





2. TRADITIONS AND USES OF MEDICINAL PLANTS THROUGH ETHNOBOTANIC RESEARCH

2.1 ITALY

As mentioned earlier, ethnobotany [6], an interdisciplinary science that combines botany, phytochemistry, pharmacology, and cultural anthropology, has played a crucial role in analyzing and enhancing plant utilization by studying folk practices. These practices serve as historical records of agrarian societies' interactions with the plant world. Ethnobotany has its roots in humanity's early interactions with plants, as people sought them for sustenance, medicine, and the crafting of everyday tools. The oral and direct transmission of this knowledge is vital for the survival of human societies, especially in the face of ongoing socio-economic changes, the increasing importance of land preservation, and the development opportunities arising from local knowledge. For a long time, it was assumed that the knowledge systems of indigenous and peasant communities lacked scientific validity and were based solely on descriptions and perceptions. However, ethnobiology, emerging in the 1960s, along with subsequent research conducted by scholars such as Brent Berlin and Darrell Posey, has demonstrated the validity of these knowledge systems. These systems operate based on unique and irreplaceable mechanisms, often only loosely connected to "official" plant-based medicine. Among its various applications, therapeutic use, being the most prevalent, was often the only available option for sustaining the health of geographically isolated populations, such as those residing in the Alpine region.

The retrieval of this knowledge presents an opportunity for modern medicine to reevaluate active compounds and harness the advantages of both natural and cultural biodiversity within these regions. Reflect upon the revival of numerous minor crops, including ancient varieties of fruit plants, vegetables, cereals, and more, which have been rediscovered, safeguarded, and enhanced alongside the associated cultivation techniques and regional peculiarities.

This underscores the significance of the overarching strategy employed by ethnobotany. Moreover, considering that this knowledge has traditionally been transmitted solely through oral tradition, it faces a substantial risk of disappearing, particularly due to the generational gap. This becomes especially pertinent in light of the prevailing trends towards natural and organic products in both the food and therapeutic sectors. Research in this field has unveiled that, across various utilization sectors, approximately 1200 to 1500 species (accounting for around 20% of the Italian vascular flora, Guarrera, 2006; C.E.T., Centro Etnobotanico Toscano) are employed for medicinal, curative, and preventive purposes against various diseases and for various other uses.

The regional diversity in terms of distribution mainly depends on the lack of related studies. Specifically, mountain valley areas affected by partial geographical and socio-cultural isolation have a low incidence of research in the field of ethnobotany and ethno-pharmacology, as demonstrated by other studies conducted in different regions ((Vitalini et al., 2013; Cornara et al. 2014; Vitalini et al., 2015). Indeed, less external conditioning allowed for more careful preservation of local traditions and biodiversity, supported by the potential presence of a protected area and/or a regional/national park.

The terms "officina" or "opificina" clearly refer to Italy's historical and cultural tradition, where the pharmaceutical laboratory, often annexed within a convent, housed various transformation phases, from drying to drug and/or other preparations production, through intermediate processing stages (drying, grinding, maceration, distillation, extraction of active principles) that led to the definition of "medicinal plant."



In addition to the depiction of the "workshop," often termed the "warehouse" in medieval Latin, and the "store²" primarily serving as a sales venue rather than a production site, the existence of a garden dedicated to the cultivation of both food and medicinal plants, distinguished by their practical and profound symbolic significance, has been a prevailing characteristic throughout history. The dissemination of herbal knowledge in Italy, as well as in Europe, can be attributed to Christian monks between the 9th and 11th centuries. This dissemination was further accelerated following the discovery of America, as it facilitated the cross-pollination between European therapeutic practices and those from overseas.

² The American Merriam-Webster dictionary gives this definition of the word official: (...) Classical Latin officina meant workshop, manufacturing, laboratory, and in medieval monastic Latin it was applied to a general warehouse; it was thus applied to a shop where goods were sold rather than to a place where things were made

Archaeological sites scattered across Italian territory serve as vital repositories of wild species that have endured over time, affirming their presence even before human cultivation. This is notably observed in some archaeological sites in Sicily [23], where approximately 174 plant species were cataloged amidst the Greek ruins.

Among these species, around forty were utilized by Sicilians, including borage and asphodel, the latter's bulb contains toxic yet thermolabile substances, and was consumed by Sicilians until the post-war period instead of potatoes. Also, wood sorrel, whose underground tubers were roasted and consumed like chestnuts, poppies with edible leaves, and thyme, a renowned melliferous plant known for its medicinal properties in countering respiratory problems. Additionally, *inula viscosa*, known as "holy herb," has hemostatic characteristics thanks to its sticky leaves applied to wounds and is aromatic and antiparasitic when burned. Among the oral testimonies³ unearthed through targeted research, including accounts provided by the elderly, shepherds, and farmers who serve as bearers of knowledge passed down through generations, a wealth of documentation originates from the Sabina, Cicolano, and Terminillo regions [24], primarily associated with the province of Rieti (ANNEX 1). Indeed, local traditions, not always substantiated by specific and comprehensive works, have found significant documentary support in historical literature, sourced from ancient texts, records, and volumes.

³ The results of the field interviews, aimed at demonstrating typical customs and traditions of the various areas of the peninsula, of the investigation carried out in archives and libraries in the Rieti area and of the analysis of the literature on the subject were published in the article: Silvia Moronti, " HEALING USES OF TREES AND SHRUBS IN THE PROVINCE OF RIETI", #Natura. Rivista di Ambiente e Territorio dell'Arma dei Carabinieri, 15/11/2017, <https://www.carabinieri.it/media---comunicazione/natura/la-rivista/home/tematiche/ambiente/usi-curativi-di-alberi-e-arbusti-nella-provincia-di-rieti>.

One example of these traditional uses is the application of common elm (*Ulmus minor* Mill.) for treating skin inflammations or for its disinfectant and hemostatic properties in the province of Rieti. This practice can also be traced back to the text "Dei discorsi di M. Pietro Andrea Matthioli sanese medico cesareo et del serenissimo principe Ferdinando arciduca d'Austria etc nelli sei libri di Pedacio Dioscoride Anazarbeo della materia medicinale." This work represents the Italian rendition of Dioscorides' renowned medical treatise, authored by the renowned Greek botanist (40-70 AD).

Among the shrubs cultivated in the past for culinary and medicinal purposes, specifically in the Reatino area, common sage (*Salvia officinalis* L.) was already recognized by the Romans (from the Latin *salus* - salvation, health) for its antiseptic, digestive, and calming properties. During the medieval period, it was also noted for its antidiarrheal function in children and for promoting blood circulation (DI MARIO, R.-1989).

The information obtained, whose verification has indicated the widespread phyto-medicinal use beyond the investigated areas, pertains to the medicinal folk uses of shrubs, trees, and woody species. These uses are associated with specific ethnic groups, previously undocumented in literature, who were precursors to modern and official medicine and the discovery of certain active principles (such as derivatives of salicylic acid, codeine, vinblastine, etc.).

In the Western Piedmont Alps (Chisone, Germanasca, Angrogna, and Pellice), the use of wild edible, medicinal, and veterinary plants was investigated by an ethnobotanical study conducted in an area inhabited by about 20,000 Waldensians [25]. Interviews conducted with a sample of 47 elderly people, both of Waldensian religion (though a minority) and Catholics, revealed the use of 85 food plants, 96 medicinal plants, and 45 veterinary plants. The study also aimed to understand how the knowledge of herbs has changed over time and space by comparing some data recorded at the end of the 1980s and 800's. Specifically, one of the valleys (Germanasca) confirmed similar utilization methods over the decades. Regarding the knowledge acquired on food and medicinal plants, the religious differences between the two groups, in reality, did not have an impact, although the broader knowledge of the Waldensians stood out. In this community, moreover, a widespread use of very ancient remedies (the fern *Botrychium lunaria* for skin problems) was recognized, as were therapies derived from mixtures with other more European traditions (*Veronica centrale* and *allionii* and *Valeriana officinalis* for recreational infusions; *Cetraria islandica* for cough infusions).

The Aosta Valley [26], for instance, although a region of great value owing to the presence of the Gran Paradiso Park and its five valleys, which span both Piedmont and the Aosta Valley, lacks a substantial body of ethnobotanical research. Nevertheless, some recent studies, like an ethnobotanical Bachelor's thesis by Barinotto L. in 2013, have begun to shed light on the distinctions that exist between plant species and cultural traditions in the Piedmont and Aosta valleys in relation to the Park.

Ethnobotanical research in Alto Maceratese [27], as in many other regions, has revealed a wealth of traditional knowledge preserved among a few elderly individuals and transmitted orally. This valuable information, which is at risk of being lost, forms the foundation for collecting data and insights to

support more extensive research. The continuity between the past and the present, recognized by those who appreciate its scientific, socioeconomic, and environmental significance, serves as a bridge through which traditions shed light on plants that have maintained their functions and uses over time, even if the practice itself has faded for various reasons. The floristic heritage of Alto Maceratese comprises around 2700 species, with approximately 1200 identified for their medicinal properties. These plants have been used in popular medicine in the past and are employed today, although many have faded from collective memory. However, they remain versatile resources, contributing to the enhancement of the region through associated traditions. For example, during the medieval period, the female flowers (beechnuts) of the *Fagus sylvatica* were crushed and macerated to soothe sore eyes and fresh wounds. Ash obtained from the burned fruits alleviated kidney stones, and the leaves were chewed to relieve gum and lip pain, act as tonics, and combat the plague.⁴

Although the use of beech nuts evolved over time (serving as livestock feed, human consumption in some cases, seasoning, and lamp fuel), today can be found in cosmetics and soap production, with rootlets used as anticonvulsants and buds for treating violent shocks. The Yew (*Taxus baccata L.*), also known as the "Tree of Death," was prevalent near hermitages and Mount Montecavallo. Its wood, bark, and leaves were used to produce the "Tobacco of Spain" for dyeing wool, silk, and linen and cotton fabrics pale pink.⁵

⁴ P.A. Mattioli, I discorsi nei sei libri della Materia Medicinale di Pedacio Discoride Anazarbeo, Bologna 1984, pag.129

⁵ A.Reali, Gli alberi e gli arbusti del circondario e dell'Appennino camerte. Memoria sulle loro utilità e sui loro pregi in rapporto alla industria, al commercio, alle arti e al miglioramento del patrio suolo, Camerino 1871, p.128

While Pliny believed that the smoke from the burned leaves could kill mice, Mattioli reported that ingesting the seeds caused dysentery and fever. The seed's aril, free from toxic elements, was employed in popular therapy to prepare syrups for respiratory issues. Today, precursors of taxol, known for their antitumor and antimalarial properties, are extracted from the leaves and have shown effectiveness against ovarian cancer, locally advanced breast cancer, and lung cancer. White Willow (*Salix alba* L.), renowned for its medicinal virtues since ancient times, was described by Mattioli as useful for alleviating hip pain when crushed leaves were mixed with wine and pepper, as an abortive when macerated bark was mixed with vinegar for plasters against warts and corns, and as a remedy for fresh wounds when the juice of the leaves and bark was cooked in oil in a pomegranate shell. In the Camerino area, the bark was used for rheumatic pains, dysentery, and intermittent fevers as an alternative to quinine, owing to the presence of acetylsalicylic acid precursors. Crushed leaves were used against insect bites and skin inflammations. Hawthorn (*Crataegus oxyacantha* L.) bark decoctions were used for dyeing, while leaves, flowers, and fruits were employed to support heart health, regulate blood pressure, and combat arteriosclerosis. Flower infusions served as sedatives in tea, while tinctures and fluid extracts acted as cardiotonics for mild heart failure. Gentian (*Gentiana Lutea* L.), commonly found in rocky high-altitude pastures (Ragnolo e Bolognola), was utilized as an antimalarial and antipyretic, and its roots were used to address hypertension. In ancient Rome, Galen (129-199 d.C.) recommended it as a diuretic and remedy against scorpion stings, while during the Middle Ages, it was mixed with rue, pepper, and wine to combat snake bites and used with water to alleviate stomach and liver pains. The root was also used to prepare eye drops that stimulated childbirth, heal ulcers and wounds, and soothe eye inflammations.⁶

⁶Mattioli, I discorsi nei sei libri, pag. 326

Today, gentian roots and rhizomes find applications in the liquor industry for aperitifs, digestives, and bitters, as well as in cosmetics for preparing infusions that lighten freckles and cater to oily skin. Gentian is also utilized in anti-smoking therapy and the production of anti-tobacco products.

Ethnobotanical studies conducted in Basilicata [28] (APPENDIX 2) have explored the diverse uses of medicinal plants in the realms of food, cosmetics, and therapy. Among these studies, one of the most notable was carried out by the Faculty of Agriculture at the University of Basilicata, employing questionnaires distributed in the Potentino and Materano regions.



These questionnaires were thoughtfully validated to overcome the reliance on local populations' knowledge, which often identified plants using dialectal or colloquial names and could easily confuse similar species from different genera. This research effort spanned approximately a decade, from 1987 to 1996, with the goal of gathering as much information as possible and comprehensively representing the analyzed territory. In pursuing a thorough exploration of the regional area, aside from specific, well-defined responses tied to particular sites, the research aimed to collect a broad spectrum of information from all municipalities in Lucania. The results obtained for the 230 recorded spontaneous plant species of the food category affirmed their association with the distinctive environmental contexts of the region. Many of these species were already cataloged in the regional flora, while some had been recently introduced and had since become naturalized. Although the actual number of species sampled may have been higher than documented, this research also unearthed historical and ethnic data related to the identified plants. Concerning the origins of these species, the majority hailed from the Mediterranean region, encompassing elements typical of both coastal and inland areas. An intriguing historical and social aspect emerged from this research: it underscored how the Mediterranean diet served as a common traditional element and a connecting thread among various cultures. Distinctive regional preparations in Basilicata are characterized by aromatic species like wild garlic (*Allium ampeloprasum*), nemoral species such as *Allium pendulinum* and *A. triquetrum*, wild fennel (*Foeniculum vulgare*), bay (*Laurus nobilis*), garden mint (*Mentha spicata*), oregano (*Origanum heracleolicum*), rosemary (*Rosmarinus officinalis*), thyme (*Thymus capitatus*), and more. Additionally, Mediterranean species continue to be used in winter and spring mixed salads (including *Achillea millefolium*, *Borago officinalis*, *Calendula arvensis*, *Valerianella carinata*, etc.) or incorporated into regional recipes featuring cooked vegetables (such as *Asparagus acutifolius*, *Beta vulgaris*, *Brassica* sp. pl.).

The ethnobotanical census conducted in Basilicata also unveiled the presence of plant species used for food from the region extending between southeastern Europe and Asia Minor, which have been documented since the Neolithic period in the Western world. Over time, as a result of different historical eras and transformations, various cultures have left their mark on the usage of wild plants, enriching the heritage of knowledge associated with them. While some plants have seen their utilization remain unchanged, others have been entirely abandoned or limited to phytotherapeutic applications. Certain species have been employed in response to specific challenges, such as famines, wars, or epidemics, and have persisted until today, albeit with declining usage, as they were replaced by new foods or designated for animal consumption. In recent times, changes in dietary habits have significantly reduced the consumption of wild plants, affecting not only their use in the culinary sector but also their broader applications and knowledge. Currently, oral traditions are primarily passed down by the elderly. In Basilicata, the historical records dating back to Roman times have highlighted the presence of plant species that have survived since Italic cultures in the Neolithic era. These species originate from the eastern Mediterranean and have been discovered in various contexts, including archaeological sites, tombs (such as those in Metaponto), references in classical literature by authors like Horace and Apuleius, and Neolithic and Apulo-Sannitic archaeological sites like Vaglio, Timmari, and Santa Maria d'Anglona.

The following plant species were identified: *Asparagus acutifolius*, *Brassica sp. pl.*, *Calamintha nepeta*, *Calendula officinalis*, *Cichorium intybus*, *Coriandrum sativum*, *Cynara cardunculus*, *Eruca sativa*, *Foeniculum vulgare*, *Fragaria vesca*, *Galium aparine*, *Lupinus albus*, *Malva sp. pl.*, *Medicago sativa*, *Melissa officinalis*, *Mentha pulegium*, *Myrtus communis*, *Nasturtium officinale*, *Parietaria officinalis*, *Rubus sp. pl.*, *Rumex crispus*, *Ruscus aculeatus*, *Ruta graveolens*,

Satureja ortensis, *Sinapsis alba*, *Sonchus oleraceus*, *Tamus communis*, *Thymus serpyllum* s.l., *Urtica dioica*, *Vicia sativa*. However, various events have affected other plant species as well. Some, like *Armoracia rusticana* (used for its antiscorbutic properties), *Lepidium graminifolium* and *sativum* (ingredients in green sauces), *Ruta graveolens* (used for flavoring despite its toxicity), *Nigella damascena* (used for flavoring), have seen alterations in their use over time. Certain species, having lost their original food function, have been redirected towards phytotherapy and homeopathy, as in the case of *Centaurea cyanus*.



The methods of consuming wild plants, influenced by the harvesting season and the optimal utilization for culinary purposes, often reflected a rather modest diet. This dietary simplicity is documented in historical recipe books, which even today showcase the traditional use of wild plants, particularly prevalent in small communities where foraging is easier, and where residents have inherited the associated knowledge.

The utilization of wild plants extends across various consumption categories, ranging from culinary herbs to ingredients for making liquor, among other examples. The comprehensive species census has facilitated the categorization of their uses based on the parts of the plant employed (see the table in the Appendix). One of the notable historical aspects in Basilicata that highlights the connection with traditions related to the use of medicinal plants is the Saracen Gardens of Tricarico [29]. These gardens represent a historical practice of cultivating medicinal herbs intensively on terraced outdoor plots for domestic, seasonal, and daily needs. The concept of the Hortus, which originated during the early Middle Ages, served as a response to combating widespread epidemics by providing sustenance and self-sustaining agriculture. Over time, this practice became integrated with small communities and rural residences in the inland regions of southern Italy. Between the late eighth and ninth centuries, in addition to the well-preserved ancient settlements such as Abriola, Tursi, Tricarico, and Pietrapertosa, which were places where Arab populations settled after migrating from Sicily to the Italian mainland, there were also cities like Acerenza and Potenza. In these cities, the influence of these migrating populations is evident in various aspects, including architecture and language. Regarding this historical context, the Saracen Gardens of Tricarico have become the focus of ethnobotanical studies. These studies aim to uncover the knowledge of medicinal herbs that were used both during the Arab period (9th-10th century) and the Arab-Norman period (11th-12th century) in the region of Lucania. The in-situ research provided information on 63 different plants, each serving various purposes including food (20 species), forage (3 species), medicinal (11 species), dyes (9 species), aromatics (17 species), and textile (13 species). During the Arab-Norman period, several medicinal plants were introduced in addition to those already known, leading to a total of around twenty new plants being introduced between the 9th and 12th centuries.

Among these were pistachio and rice, with rice considered "medicinal" for treating gastrointestinal disturbances. Alfalfa and fenugreek, initially imported as medicines, are now primarily used as forage. The Arab-Norman era also marked the rediscovery of medicinal herbs that had been used by the Greeks and Romans but had fallen out of use during the period of barbarian invasions. Family gardens saw the return of food plants like chard (*Beta vulgaris*), artichoke (*Cynara scolymus*), and cumin (*Carum carvi*). Additionally, textile plants such as hemp, flax, and cotton were cultivated near streams and mills, while dye plants like madder, woad, and safflower made a resurgence. Presently, the most commonly used plants are for food purposes, although some are still occasionally utilized in regional pharmacopeias. For example, the jujube tree (*Zizyphus jujuba*) and, among aromatic plants, coriander (*Coriandrum sativum*) are still used, particularly in the Val d'Agri region. Between May and August 2012 and January 2013 [30], an area within the Middle Val d'Agri was the focus of research aimed at gathering knowledge about the traditional uses of wild edible herbs and their therapeutic applications. Interviews were conducted with approximately 58 individuals, 74% women and 26% men, with ages ranging from 33 to 96, who possessed information about the customary uses of these plants. This research identified 52 plant species representing 23 botanical families. Of these, only six species were characterized by both culinary and medicinal uses: *C. intybus*, *Sonchus* spp., *F. vulgare*, *Borago officinalis*, *Papaver rhoeas* L., and *B. vulgaris*. In the traditional cuisine of the Middle Val d'Agri, wild plants played a significant role in various local dishes, in legume soups for example alongside *B. vulgaris*, *B. officinalis*, and *C. intybus*, or they were cooked in a pan with eggs and homemade cold cuts. Wild plants also served as fruits or flavorings in other recipes.

Some of these plants had therapeutic uses, *F. vulgare*, for instance, was used to aid digestion or prepared as an infusion with other plants to alleviate intestinal gas. *Glycyrrhiza glabra* was employed to combat excessive foot sweating, while *A. acutifolius* and *C. intybus* were considered beneficial for kidney and liver health. Certain species that were primarily used for food in the past also had medicinal applications. They were used to create decoctions from aerial parts, roots, fruits, or were ground and applied locally. Examples include *A. rusticana* (anti-rheumatic), *C. vitalba* (oral anti-inflammatory), *C. cardunculus* (anti-rheumatic and digestive), *L. nobilis*, *F. carica*, *G. glabra*, *M. domestica*, and *Z. jujuba* (sore throat), *Rubus* spp. and *P. spinosa* (hepatoprotective), *S. marianum* (laxative), *S. oleraceus* (anti-gastritis), and *P. rhoeas* (mild sedative). The variations in popular nomenclature for the same species, even in closely adjacent areas, presented challenges in associating botanical names. For example, *Clematis vitalba* was referred to as "vitacchia" in Aliano and "gramollino" in Castronuovo S. Andrea and Roccanova. Similarly, *Sonchus* spp. was known as "sivun" in Sant'Arcangelo but "cardell" in Roccanova and San Martino d'Agri.

Between April-June 2002, October-November 2002, and April-June 2003, further research was conducted to explore the traditional uses of wild, uncultivated plants in everyday diets. This research was centered in the small town of Castelmezzano [31], chosen for its regional characteristics, including low urban population density (the region had the lowest urban population percentage at 17% during the period 1997-1999; ISTAT 2000) and the highest male life expectancy (75.7 years during the period 1991-1995; ISTAT 2000).

These factors were believed to increase the likelihood of finding surviving traditions related to the use of local wild plants.

An anthropological and ethnobotanical analysis was undertaken, and questionnaires were administered to 86 elderly individuals, mostly women from the small community. They were invited to recall the historical uses and traditions associated with the wild herbs that are still present today, with the help of fresh and dried specimens for reference. As has occurred in other regions of the South and the Mediterranean, changing socio-economic conditions have led to decreased consumption of wild herbs. These plants are now often linked to the negative connotations of a past marked by extreme poverty. However, during specific times of the year, such as spring, the use of wild plants remains prevalent in various culinary preparations. These dishes, based on wild species, are also considered homemade remedies, reflecting the traditional belief that food and medicine share common ground within the culture.

The stories from Castelmezzano revealed uncommon food-medicines, such as wild asparagus sprouts, which, when boiled and consumed with eggs, are considered to have diuretic properties. However, a unique medicinal value is attributed to the sprouts of the pungitopo plant (*Ruscus aculeatus*). These sprouts are boiled and then cooked with bread and dairy products, believed to alleviate and prevent liver problems.

Similarly, thistle salads (*S. oleraceo*) are thought to be a remedy for gastritis. In terms of economic evaluation, the study also looked at the species sold in markets near the municipality of Castelmezzano. Fennel and wild asparagus are found in small unofficial selling areas, whereas species like *S. oleraceus*, *B. officinalis*, *P. rhoeas*, and *C. vesicaria* are less common.

Notably, there is a clear divergence between the local ethnobotanical pathways and those of the Arbereshe communities [32]. The Arbereshe are Albanian settlements that have been present in Southern Italy for over 500 years, including parts of Basilicata, particularly in the Vulture and Pollino areas.

These regions are significant in terms of biodiversity, including medicinal herbs. This highlights that, beyond environmental factors, aspects such as culture and language play crucial roles in the collection of wild herbs. Additionally, adaptation and hybridization processes have allowed for the presence of species and varieties from other countries. In Arbereshe taxonomy, the plant kingdom is divided into three forms. For example, the term “liakra” refers to edible herbs and, in plural, is equivalent to leaves. Gathering places are distinguished by eco-zones, ranging from hedges (gardhe) to forests (pill), wetlands (ndë ujë), countryside (dheju/niqark), and even olive groves and vineyards (vreshtë). The contribution of each space to the collection of wild herbs is not uniform. The vineyards and olive groves are more frequently visited due to their proximity to inhabited areas and the coexistence of cultivated and semi-cultivated species. Most of the liakra is consumed in various mixed preparations, with rare exceptions during holiday celebrations such as Christmas and Easter, where they hold particular significance in traditions. Different types of herbs also correspond to social differentiations, as seen in the saying: “I cicuti si 'i mangianu'i cornuti 'l cardedi si 'i magianu'i porceddi 'l losani si 'i mangianu'i puttani 'l cicori si 'i mangianu 'i signori,” which translates to “The cicuti are eaten by the cuckolded. The cardedi are eaten by the small pigs. The losani are eaten by the whores. The chicory is eaten by the lords” (V. Teti, 1992).

The investigations carried out in the Arbereshe communities, Vulture [33], [34], which date back to the 15th and 16th centuries (in the towns of Ginestra, Zhurian, Barile, Barili, and Maschito, Mashqiti), were centered on understanding the dietary, medicinal, and magical uses of traditional wild plants. This study involved 51 individuals, mostly women, aged between 47 and 94, and took place between March and June 2000 to 2001.



In addition to the questionnaire, a herbarium was subsequently introduced to aid in the identification and botanical classification of the species mentioned and described by the participants. One unique aspect of the study was the inclusion of interviews with six female healers and one male healer who were experts in magical-therapeutic rituals aimed at curing and healing certain diseases. In Arbereshe culture, there is a clear distinction between edible and inedible herbs. While these herbs used to be an almost exclusive source of sustenance in the past, they continue to constitute a significant portion of the diet today, contributing positively to the family's economy. The collection areas, although diverse, are perceived as "mental" spaces and landscapes. In Arbereshe culture, space follows a precise mental order that dictates differentiated collection practices, regardless of the presence of multiple species in the same territory.

This reflects a symbolic classification system that also considers socio-economic changes related to new work patterns and variations in territorial ownership structures. The choice of locations for collecting medicinal herbs, which are the same as those for edible plants, is rooted in symbolism. It does not conform to any specific classification criteria, relying instead on the randomness of species search. This suggests that the collection space coincides with the place where the perceived harm or ailment originated.

In Lucanian belief, illness is intricately linked to the specific place from which it originates—an actual place that also exists prominently in the realm of the mind, deeply intertwined with mythical imagination. It lacks cognitive elements, even though the remedy lies within a particular botanical species.

This blending of space, wild herbs, and imagination carries significant implications, particularly in the treatment of "ailments" like the arch evil and wind evil, as described by De Martino (1959, 1975) in his studies on Lucanian demonology.

For both "evils," the recipes detail the usage procedures, along with their variations, involving "healing" herbs (such as *Ruta graveolens*, referred to as "rute" in the Arbereshe language for arch evil, classified as hepatitis; *Sambucus nigra*, known as "shtog" in Arbereshe; *Parietaria judaica*, called "bar qene"; and *Malva sp.*, referred to as "mëlag" for dermatitis and the associated redness and itching). However, there are medicinal species for which the preparation phases of the "pharmaceutical form" hold symbolic significance, following a fixed procedure. A notable example is *Marrubium vulgare*, known as "marruxh," employed for treating various types of ailments, with the belief that "la marruggia destroys every evil."

In essence, a harmonious coexistence of physical and mental spaces is evident, where herbs, deeply rooted in the physical realm, gracefully transition between the realms of symbolism and reality. The Pollino massif, located between Basilicata and Calabria and lending its name to the National Park, boasts abundant biodiversity, encompassing a diverse array of wild plants that have served various remedies and purposes throughout history.

Even within the protected boundaries of the Pollino Park, an Arbereshe community spanning the municipalities of San Costantino Albanese and San Paolo Albanese diligently conserves and imparts a rich heritage encompassing both food and biodiversity. Here, the significance of aromatic and medicinal herbs undergoes a renaissance through various cultural events, providing vital support to the local economy, which increasingly relies on promotional activities.

For example, during the "Cross and Basil" festival [35], which commemorates various aspects of the San Paolo Albanese (Shën Palji) community, visitors have the opportunity to participate in a guided tour of the "Ka kronjezit" botanical garden.

Originally established as a forest nursery in the 1920s, it has since been transformed into a space dedicated to observation, study, and the preservation of ancient plant species, unique flowers, rare plants, and traditional local fruits. One remarkable plant found in this region is the Pilgrim or Peregrine Peony [36], known as "Banxhurna" in Arbereshe, located on Mount Carnara, it has long been recognized for its therapeutic properties in Southern Europe and Asia. The seeds were believed to alleviate teething pain in infants when worn around their necks, while the petals and roots were thought to be effective against epilepsy and malaria. Awareness of the rich diversity of plants and wild herbs in the Pollino area grew in the 1960s when a road opened from San Paolo Albanese, later serving as the access route to Alessandria del Carretto, facilitating easier access to Bosco Capillo and Mount Carnara (Annibale Formica, *la filiera delle erbe officinali tra produzione e turismo* aprile 2019). While it led to an influx of collectors seeking oregano and wild fennel, which locals used to flavor soups, sausages, and taralli, as well as to maintain social harmony, it also sparked renewed interest in ancient cultures and the cultivation of essential, medicinal, and culinary plants. In the 1980s, these endeavors received support through funding as part of the Val Sarmento Mountain Community socio-economic development program.

In 2014, the municipality of San Costantino Albanese took the initiative to introduce visitors to the herbaceous, arboreal, and shrubby plants found in the Pollino National Park area by establishing the Museum of Ethnobotany [37]. This museum is housed within the tourist facility known as "Casa Parco." Among its diverse exhibits, you'll discover a text authored by Professor Pasquale Scutari titled "The Names of Plants in the Albanian Community of Lucanian Pollino." This text serves as a compilation of the Arbereshe phytological lexicon, not only elucidating the meanings and uses of these plants but also emphasizing their therapeutic benefits. It highlights the historical and cultural importance of a region as naturally significant as the Pollino National Park.

Moreover, the Pollino area reveals additional historical and cultural dimensions related to the use of medicinal plants, exemplified by the community of Carbone [38]. This community maintains strong ties to the Italo-Greek monastery founded in 1041 by Eastern monks, and their influence permeates dietary practices and daily life rituals, particularly in agricultural traditions associated with the cultivation of coriander and medicinal herbs. Coriander, believed to have been introduced to the small Lucanian municipality by Byzantine monks, has earned recognition as a Traditional Agri-food Product (PAT). It is employed as a spice to enhance the flavor of dishes, utilizing its leaves, and as an antioxidant and bacteriostatic ingredient. Further evidence of coriander's presence has come to light in the Jonic hinterland, specifically within the municipality of Pisticci, which is home to two Basilian settlements, San Basilio and San Teodoro. Additionally, traces of coriander have been found in the municipality of Colobraro, where a Basilian cenobium once thrived. In contemporary ethnobotanical research, the Ethnobotanical Conservatory of Castelluccio Superiore, situated in the province of Potenza, serves as a reliable hub, serving as a pivotal role in the preservation and systematic documentation of plant species while fostering a deeper connection between plants and humanity through educational initiatives such as dissemination and ethnobotanical education. A distinctive characteristic of municipalities like Castelluccio Superiore, which can also be observed in other regions of Italy, is the presence of terraces or hanging gardens referred to as "misule." These terraces were meticulously carved into the steep terrain of the town to establish cultivation spaces in close proximity to residences. In antiquity, the "misule" found within the historic center functioned as areas where Basilian monks cultivated a variety of plants for their personal consumption, including medicinal varieties. Subsequently, this practice was adopted by the local residents, who managed water resources with precision by utilizing channels and conduits to irrigate these terraces. Today, these terraces remain in use for the cultivation of vegetables and medicinal plants.

Among the more recent developments that, while not directly linked to the ethnobotanical studies conducted in the Lucanian territory, serve as a testament to a deeply entrenched tradition that has gained international recognition, is the creation of a blend of 32 herbs which gave birth to one of the most renowned liqueurs, Amaro Lucano. Since its inception in 1894, except for a period during World War II when the supply of herbs was disrupted, this historic artisanal laboratory has steadily expanded, eventually leading to the industrialization of production in the latter half of the 1950s and the global acclaim of the liqueur. In 2021, the company received the prestigious certification of "Historic Brand of National Interest," an accolade bolstered by the "secret recipe" comprising over 30 meticulously selected herbs. These include Roman Wormwood, Gentle Wormwood, Clary Sage, Yellow Sweet Clover, Holy Thistle, Bitter Orange, Gentian, Angelica, Elder, Rue, Aloe, and essential oil of Cinnamon. From an ethnobotanical perspective, Calabria stands out as one of the most extensively researched regions, especially in recent years, with a particular focus on the central-northern area. This heightened interest is attributable to the region's rich history, influenced by various cultures and peoples that have inhabited it over the centuries.

Calabria, situated within the historical region of Magna Graecia [39], was home to numerous medical schools in ancient times, drawing inspiration from philosophical, religious, and secular ideologies. The Greek historian Herodotus (VI-V century B.C.), in chapter 131 of the third book of Histories, extolled the physicians of Crotona, ranking them as the foremost in the world and even placing them above the renowned doctors of the medical schools of Cnidus and Cos. It was from the medical school of Crotona that the science of medicine originated.

Distinguished physicians such as Calliphon, Alcmaeon, and Democedes were associated with this school, establishing the gold standard for other medical institutions in Magna Graecia, which were founded in Calabria, Sicily, Apulia, and Campania.

Locri, in particular, played a pivotal role in the annals of medicine, with the physician Philistion of Locri (4th century B.C.) serving as the chief representative of the Sicilian medical school at the court of Dionysius II of Syracuse. Another notable figure in the realm of phytotherapy and homeopathy was Saint Francis of Paola (1416-1507). His use of medicinal plants continued to be practiced by Calabrian communities until the 1950s and has since been rediscovered and validated by modern phytopractic medicine, affirming the therapeutic properties of these plants.

Coltsfoot (*Tussilago farfara* L.) is used to treat coughs, using both its roots and flowers. Polypody (*Polypodium vulgare* L.) is employed to alleviate hepato-biliary insufficiencies, combat internal parasites, and relieve constipation. Chervil (*Anthriscus cerefolium* L.) is applied to treat contusions, insect bites, inflammation of the eyes caused by sun and wind, and chilblains. A decoction of chervil is used to alleviate skin redness in infants, hepatic colic, rheumatism, gout, and menstrual pains. Wormwood (*Artemisia absinthium* L.) serves as the aromatic base for vermouth liqueur and is also a principal ingredient in absinthe distillate. Nettle, both common (*Urtica dioica* L.) and small (*Urtica urens* L.), is known for its medicinal properties, its use as an agricultural antiparasitic, and its role in the textile industry. Centaury (*Centaurea* L.), encompassing around 700 annual, biennial, or perennial species, was traditionally used to address lack of appetite and difficult digestion, with lesser centaury (*Centaureum erythraea*) being a common remedy.

Saint Francis gained notoriety for his miraculous abilities, which led him to the French court of Louis XI, who was seriously ill. Similar events had occurred with the king of Naples, recounted in the folk songs of elderly Calabrians, where Saint Francis was celebrated for his compassion toward the poor. Starting from the second half of the last century, research into plant uses has aimed to reconstruct the ethnobotanical heritage of the region, spanning various areas, with a particular focus on the central-northern territory, encompassing both food and medicinal applications.

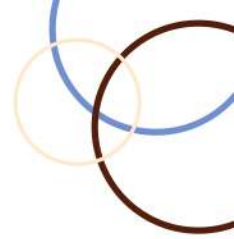
Between 2016 and 2017, a study was conducted in the province of Vibo Valentia in south-western Calabria [40], exploring an area previously uncharted. The study relied on the memories of elderly individuals, who serve as custodians of knowledge at risk of disappearing. In these communities, there is a strong connection to the rural world, as small towns have deep roots in traditionally managed agricultural contexts.

In the specific region of Poro and Preserre in Calabria, situated in the province of Vibo Valentia, we selected 36 witnesses whose ages ranged from 29 to 89 years. These individuals were either natives of the area or long-term residents, possessing extensive knowledge about the plants under investigation and their common uses. The interviews were conducted on-site and encompassed an in-depth exploration of various plant species targeted for analysis. Additionally, a collection of samples was gathered to facilitate the precise classification of the plant materials. Each interviewee's information, recorded on a card, included general details about them. Furthermore, the accompanying information encompassed comprehensive data such as the scientific, dialectal, and common names of the plants, their respective botanical families, reference numbers, photographs, collection locations and dates, biological forms, chorological types, and information regarding their uses and purposes. This information covered aspects such as the specific plant part used, methods of administration, preservation techniques, and the direct or indirect applications as described by the interviewee, which included medicinal, aromatic, artisanal, cosmetic, ornamental, culinary, veterinary, recreational, magical-religious, and other uses. Details concerning the type of plant collection, collection sites, collection frequency, and any information on personal or commercial cultivation practices and techniques were also documented.

The data processing, compared with ethnobotanical uses documented in literature, not only for Calabria but also encompassing Southern Italy and foreign regions, has resulted in the cataloging of 50 plant species categorized into 31 families and came from approximately 116 interviews. Through the research, it became evident that traditional knowledge about the uses of various plant species is gradually eroding, particularly within the age group of 61-80 years, which primarily consists of retirees. This group was followed by laborers and individuals directly involved in cultivation, with a notable representation of women. The dominance of medicinal use, which once prevailed over culinary and artisanal applications, has now shifted towards culinary purposes. Notably, species like *Spartium Junceum* L. (used for artisanal, medicinal, religious, and veterinary purposes), *Sambucus nigra* L. (utilized for medicinal, culinary, and cosmetic applications), and *Arundo donax* L. (employed for artisanal, recreational, and medicinal uses) were found to have the highest number of applications. *Cychorium intybus* L. emerged as the most frequently mentioned species for both culinary and medicinal use. The research uncovered previously undocumented and intriguing applications, such as the historical use of *Cannabis sativa* L. for alleviating children's stomachaches and *Petroselinum crispum* (Mill.) for mechanically stimulating infants in cases of prolonged constipation. Additionally, there were instances of these plants being integrated into religious traditions. In summary, nature has long served as a wellspring for sustenance, healing, and addressing everyday challenges. However, it is equally evident that this relationship has evolved over time, partly due to advances in pharmacy and medicine, alongside the inevitable loss of knowledge among subsequent generations. Currently, there is a renewed interest in many plant species earmarked for commercialization as "typical local products." This resurgence has led to the collection and sale of wild plants, accompanied by labeling and packaging processes. These initiatives aim to create a robust economy centered around innovative foods, with a focus on nutraceutical and nutritional aspects.

In specific regions of Campania, where efforts have been made to rediscover the traditional use of plants, the Cilento and Vallo di Diano Park [41], influenced by Greek and Roman cultures, had approximately 160 different plant types from various plant families such as Graminaceae, Leguminosae, Rosaceae, Compositae, and Labiatae by the late 1980s. Between 2006 and 2007, interviews were conducted with both male and females aged 40 to 90. These interviews, some of which involved structured questionnaires, aimed to document the common uses of plants, including their medicinal applications and the diseases they were used to treat. The findings were then compared with previous research conducted in Campania and neighboring regions, with the goal of identifying both similarities and differences in plant use and traditions. This research led to the discovery of new applications for plants in phytotherapy. For instance, *Buglossoides purpurocaerulea* (L.) was found to be effective in treating coughs and respiratory ailments, locally referred to as "erva 'lla tossa." Furthermore, *Brachypodium rupestre* (Host) Roem. & Schult. was identified for its hemostatic properties. People possessed a strong understanding of both the therapeutic benefits and potential risks associated with these plants. Certain plants, such as *Bellevalia romana* (L.) Sweet and *Mercurialis annua* L., were used in rituals, particularly during Good Friday and other religious ceremonies in early summer.





2.2 GREECE

The practice of phytotherapy in ancient Greece [15], [16][17] was fully integrated into every tradition and celebration, becoming part of daily life. In Greek mythology, deities and medicinal plants played vital roles in sacred ceremonies, encompassing the use of both culinary and medicinal herbs. This tradition was further complemented by scholars who meticulously documented their use in treating serious diseases. When expanding into new territories, the focus extended beyond acquiring wealth in the form of gold to include herbs, spices, and perfumes destined for the well-being of their citizens. Hippocrates, the renowned Greek physician, emphasized the importance of balance in the four bodily humors (blood, phlegm, yellow bile, and black bile) and famously stated, "Let food be thy medicine and medicine be thy food." This underscores the central and pivotal role that plants and diet played, serving as both sustenance and a pathway to a healthy lifestyle. Aristotle expanded upon this theory of the four humors, incorporating the four natural elements (fire, air, water, and earth), each possessing distinct characteristics. These principles served as guidelines for physicians of that era, enabling them to identify bodily imbalances based on a patient's symptoms. Phytotherapy was then directed toward restoring this balance; for example, oregano's warm and dry qualities were employed to treat colds. Greek medicine established the system of phytotherapy on the foundation of the four qualities, four humors, and four elements, a culmination of clinical knowledge amassed over generations of Greek physicians. While the flora of contemporary Greece may have evolved, potentially leading to the extinction or significant modification of many plant species, Greek botany of the time did not categorize plants into groups or distinguish between individual plants.

Furthermore, a single name could encompass a wide range of plants with no apparent similarities aside from external appearance. In the context of the flora mentioned in the Corpus Hippocraticum, it is plausible that Hippocratic physicians possessed a specific lexicon and practical experience that allowed them to differentiate between plants, even without relying on precise taxonomy. Nevertheless, comparative analyses with modern herbal medicine have revealed that the use of herbs documented in Hippocratic texts aligns with contemporary usage, either directly or as therapeutic adjuncts.

Greece boasts a rich diversity of wild plants, many of which are used to make herbal teas. One of the most famous is mountain tea, consisting of 17 different species and subspecies. In ancient times, Dioskourides employed it as a remedy for wounds, a daily refreshment, and an energy booster. This tea is derived from plants within the Sideritis family, and its name originates from the Greek word "sideros," which means "iron." Even today, this tea [42] is traditionally harvested, typically between May and July, with the timing varying depending on the species (such as *Sideritis Perfoliata* from Mount Athos, *Sideritis Clandestina* from the Peloponnese, *Sideritis Euboea* from the island of Euboea, and *Sideritis Scardica* from Mount Olympus). It primarily thrives in the Mediterranean region at altitudes ranging from about 1000 to 1500 meters. This elevation is crucial for concentrating essential oils, although not all mountain teas share this characteristic. It is a protected, indigenous plant with minimal water requirements, thriving in challenging conditions, which has led to its remarkable adaptability and exceptional therapeutic properties. However, it's important to highlight that *sideritis* is one of the species at risk of extinction due to excessive harvesting over time.

A recent hypothesis suggests that at least 30% of rare and endangered Greek plants, many of which possess medicinal and/or aromatic properties, face the risk of extinction (Krigas et al., 2014). Within the Sideritis species, wild populations of *Sideritis eubea* on the island's territory have been classified "endangered" (Kokkini and Karousou, 2009). Mountain tea is known for its toning, warming, and detoxifying properties. Aromatic plants [43], specifically thyme and oregano, especially in dry form, are used in most Greek dishes, from salads to meat and fish preparations, giving the typical Mediterranean flavour and delivering antioxidant benefits. When infused, oregano is believed to alleviate respiratory issues, while thyme possesses antimicrobial and antiseptic properties and can help with muscle pain. Diosmos, a type of mint, (δυσόμοσ in Greek), grows in the mountains and wet areas and often cultivated in pots, combined with dill and spring onions, serves as a typical seasoning for spring season dishes. Greek saffron, (Krokos Kozanis) stands out due to its aroma and coloring properties, surpasses other varieties by 45 points and is considered one of world's finest saffron types, prized for its intensity, therapeutic and gastronomic properties. The extensive use, from cooking to pastry, from pharmacy to the production of liqueurs, cheeses, and painting (used by the Byzantines), earned the designation of Protected Designation of Origin. Its use as a flavouring and colouring agent (*Crocus sieberi*) dates back to Homer, highlighting its historical significance. In Greece, there are approximately 20 native species of *Crocus*, known as "Krokos" both in Cythera and elsewhere. The intriguing components of this plant, aside from its leaves and roots, are the flower's stigmas. These stigmas have various medicinal properties; they are considered emmenagogues, may have abortifacient effects, serve as diuretics, act as antispasmodics, stimulate the appetite, and function as tonics.

Camomile (*Chamomilla recutita*), widespread throughout the country, is used for its calming properties and in perfumery. Hippocrates was the first to report on the properties of chamomile, considering it an emmenagogue and a remedy against hysteria. The name, derived from its smell (earth apple), becomes Chamomili in Cythera, while in the rest of Greece it is known by the variations Chamomili, Chamomilo, Chamomilia, Iouloudi Agiou Georgiou, Panairitsa, Kamilaki. Camomile serves as an antispasmodic, sedative, and analgesic; it is used to treat burns, boils, eczema; it has antiallergenic properties, stimulates the appetite, acts as an excitant, aids digestion, counters diarrhea, serves as a bactericide, emmenagogue, induces sweating, and acts as an antipyretic.

Helichrysum italicum, known since the Greco-Roman era and the Middle Ages as a medicinal plant, was traditionally used for treating respiratory, rheumatic, and allergic ailments. Today, it has found its way into culinary applications, with its dried leaves enhancing the flavor of vegetable dishes and white meats. In Greek households, helichrysum sprigs or weaves are often displayed as symbols of good luck due to the lasting nature of its flowers, aptly called "perpetuini," which endure even after blooming. These flowers are used to represent love's immortality in wedding ceremonies and were once used to crown the heads of the god Apollo and the goddess of wisdom and war, Athena. The use of medicinal herbs is a prominent practice on the Greek islands, where a rich diversity of healing plants can be found in forest undergrowth, agricultural and fallow lands, as well as in urban gardens and orchards. For example, the island of Cythera [44] boasts around 723 plant species, many of which possess medicinal properties. Sage, a key ingredient in Cythera's popular beverage known as Faskomilia or Faskomilea (referred to as Alifaskia, Faskomilo, Faskos, Sfakies in other parts of Greece), is best harvested in June and dried in the shade to preserve its flavor. This herb, utilized for its flowers and leaves, has toning, sedative, and stimulating properties.

It is effective for neurotic conditions, depression, dysmenorrhea, and is commonly used as a gargle for pharyngitis and hoarseness. In Crete, sage pomifera is used as a spice, where 2–3 leaves, when added to pork or lamb sauce along with honey, create a dish with a pleasantly exotic taste. Capers, known since antiquity as a seasoning, often grow spontaneously on walls, stony grounds, and rocks. Known as Kappari throughout the island and Greece, this plant is harvested from May to August and possesses diuretic, kidney disinfectant, and tonic properties. It also stimulates the appetite and combats arteriosclerosis. In Greece, rosemary (*Rosmarinus officinalis*) is commonly referred to as dendrolivanon, meaning "tree incense." It is often used as an incense substitute due to its purifying qualities and its ability to ward off "evil spirits."

In Cythera, it is frequently found in household gardens and goes by names such as Losmari and Dentrolivano (while other parts of Greece call it *Dentrolivano*, *Rosmari*, *Lasmari*, *Rozmarini*, *Arismari*, *Arismares*, *Dyosmarini*).

Rosemary serves as a cardiotonic, cholagogue, expectorant, pulmonary antiseptic, antidiarrheal, and emmenagogue. The beaches of Cythera are home to an abundant population of Sea Fennel (*Crithmum maritimum*) from May to October, known as Kritamo in the region. In other parts of Greece, it is also called Kritamo or Almyra and is used as an appetite stimulant and aphrodisiac.

2.3 SERBIA

Exploring the use of medicinal plants according to Serbian customs [45] and traditions delves into the country's rich historical and cultural legacy, which has been deeply shaped by influences from both the East and the more advanced Western civilizations. Similar to practices in other parts of the world, ancient beliefs in magical rituals were interwoven with the use of plant-based remedies to ward off malevolent disease spirits. The natural world, particularly the reverence for trees, occupied a prominent position in the folklore. Trees, with their ability to rejuvenate annually and their enduring physical presence, symbolized the concepts of immortality and eternal life. Trees were frequently linked to the divinity of the god of thunder and lightning, Perun, whose name signifies "the forested mountain" or oak, stemming from Perkwunos (Perkūnas). The Latin term "perk(w)u" signifies oak. Trees were perceived as the axis connecting the earthly realm to the underworld. Sacred prayer sites often sought shelter under the expansive branches and abundant canopies of oak trees, where crosses were carved onto their bark. This tradition endures to this day, signifying the sanctity of tree trunks, and extends to other species such as hazel, mulberry, apple, pear, and especially lime trees.

The advent of modern European medicine in Serbia corresponds with the establishment of the Studenica monastery in 1190, a momentous milestone in the nation's cultural heritage. Subsequently, the construction of the Hilandar monastery in 1198 further advanced and propagated this cultural movement. Sava of Serbia (Rastko Nemanjić), the first Serbian Orthodox archbishop and the brother of the first king, Stefano Prvovenčani, is credited with copying medical and biological charts. He also founded the first hospital within the Hilandar and Studenica monasteries, following the model established in Constantinople.

The medieval period was marked by a prolific production of documents. "The Acts of Hodoš," an ancient Serbian secular medical codex dating back to the 14th century (Katić 1990a), references the use of various national and foreign medicinal herbs, including cumin (*Carum carvi*), aloe (*Aloe vera*), thyme (*Thymus vulgaris*), flax seeds (*Linum usitatissimum*), and coriander (*Coriandrum sativum*). "The Hilandar Medical Codex 517 (Anonymous 1989)" details the utilization of plants such as the camphor tree, iris, and hellebore, among many others (Tucakov 1997). Other noteworthy documents include "The Witchcraft Book" of Dečani, therapy notes found in Typikon of the Spell Book No. 54, and various Bosnian records. The medieval period characterizes Serbian medicine, akin to Italian and French medicine, by the incorporation of witchcraft and divination practices. Various influences from foreign doctors, medical writers, surgeons with limited medical knowledge, shepherds, and warriors introduced constraints to the field. These influences were accompanied by the use of drugs and spices imported from tropical and sub-tropical regions in Asia and Africa. The cultivation and utilization of medicinal and healing plants were primarily entrusted to monasteries, which grew and employed 16 sacred medicinal herbs as the primary raw materials for crafting remedies to treat diseases. The development of these practices received an additional impetus from the various wars that occurred on Serbian territory. The arrival of the Turks in the 15th century prompted the population to seek refuge in the mountains and monasteries. In these sanctuaries, the field of medicine deepened its understanding of plants and their therapeutic properties. The Enlightenment era ushered in a pivotal period of heightened awareness regarding the medicinal attributes of plants, propelled by knowledge disseminators like Zaharije Stefanović Orfelin (1726–1785), credited with authoring "The Big Serbian Book of Herbs."

Within the pages of this comprehensive work, he fastidiously documented approximately 500 plant varieties, offering their Latin nomenclature, common designations, and invaluable insights into their practical applications.

The proliferation of knowledge in this realm was further enriched through diverse literary forms, including epic poetry hailing from the Kosovo and post-Kosovo epochs of the Ottoman era. These literary creations, often rooted in folklore, constituted the primary conduit for knowledge transmission. They exhibited a growing awareness of the diverse effects of various plants, notably within specific regions of the Serbian territory. For instance, astute observations were made concerning the incorporation of certain plants into wine, resulting in a range of side-effects. Substances like belladonna (*Atropa belladonna*), henbane (*Hyoscyamus niger*), absinthe (commonly referred to as "deadly word," *Artemisia absinthium*), and the seeds of American Pokeweed (*Phytolacca americana*) were recognized for their capacity to amplify hallucinogenic experiences when blended with wine.

Other plants, found in traditional and folk poems, are mentioned for their venomous nature (such as wormwood, not only for its bitterness but also for its lethal effects when taken in large quantities; corn cockle, *Agrostemma githago*, and the corn lily, *Veratrum* spp., are described as two extremely poisonous plants known to the Serbian people, Čajkanović1994). Some are celebrated for their beauty, youthfulness, love, and health benefits, like the rose. Others are revered for their protective powers, capable of withstanding anything, and their calming properties, like valerian, *Valeriana officinalis*. Much of the knowledge related to medicinal plants is linked to the second half of the 20th century and the collection carried out by the university professor Jovan Tucakov in his "Herbal Therapy" study, first published in 1973. This guide is still widely used by most Serbian families who practice self-medication, often combined with conventional pharmacological therapy.

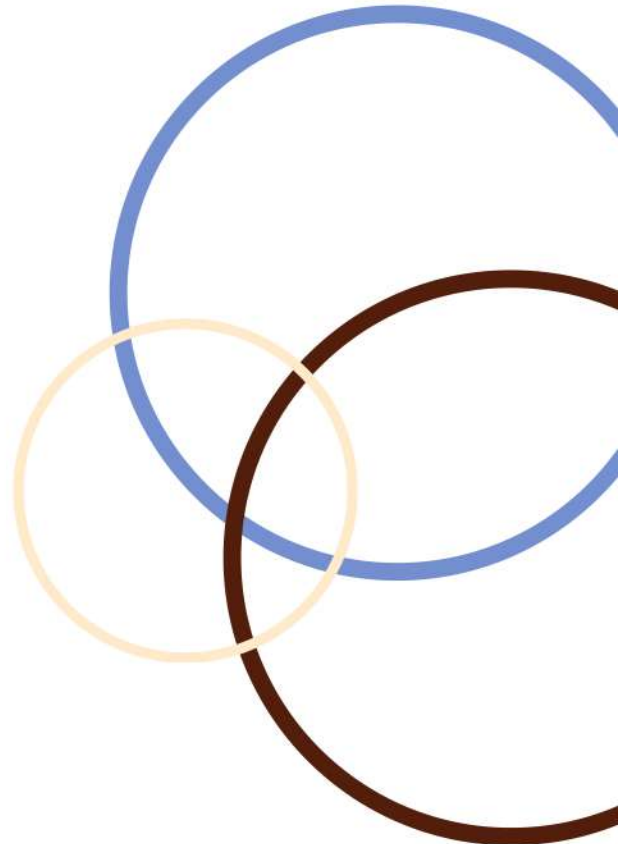
This practice developed due to the prolonged underfunding, limited modernization, and lack of attention to healthcare needs within the country's healthcare system. The profound interest in the field of ethnomedicine involving medicinal plants has prompted ongoing monitoring of the use of various plant species to assess changes over time, through comparison with previous studies in different areas.

The most recent research conducted in 2015 by researchers from the "Dr. Josif Pancic" Institute for Medicinal Plants utilized semi-structured questionnaires to collect data, evaluating a range of information to represent the current scenario and any variations that have occurred. The comparisons made between current and previous data, in relation to Dr. Jovan Tucakov's guide [46] (although the methodology used in his publication was not explained and the four studies were conducted in the immediate vicinity of the research area), have revealed both a decrease in the number of plant species used for therapeutic purposes and a reduction in the scope of application, however, for some species, new areas of use have emerged. This latter aspect could serve as a path to explore, considering the significant market potential and technologies, the introduction of new species and varieties through scientific research, and the growing number of producers for whom the cultivation of medicinal plants is becoming the primary activity. In reality, the interest in cultivation faces obstacles due to limited investment in agricultural production and a scarcity of literature on the subject. Currently, there is a demand for diverse aromatic and medicinal plants beyond those traditionally known and those gathered from the wild, such as linden and nettle, among others. This demand is substantiated by scientific research aimed at meeting the requirements of both domestic and foreign markets, which are receptive to the growth of this sector. This growth should be nurtured within the broader context of local agricultural production.

Furthermore, the remarkable diversity of flora [47] in the region encompasses over 700 species classified as medicinal, constituting approximately 17.29% of the total flora. These species are divided among 420 officially registered plant varieties, with 280 available on the market.

Serbia benefits from favourable environmental conditions, coupled with soil quality and low-input agricultural practices, resulting in high-quality medicinal herbs. These herbs contain valuable constituents and possess an appropriate composition of active substances.

However, it's important to highlight the significant collection of wild plants, primarily concentrated in the southeastern part of the country. This has necessitated legal protection measures for various endangered species.

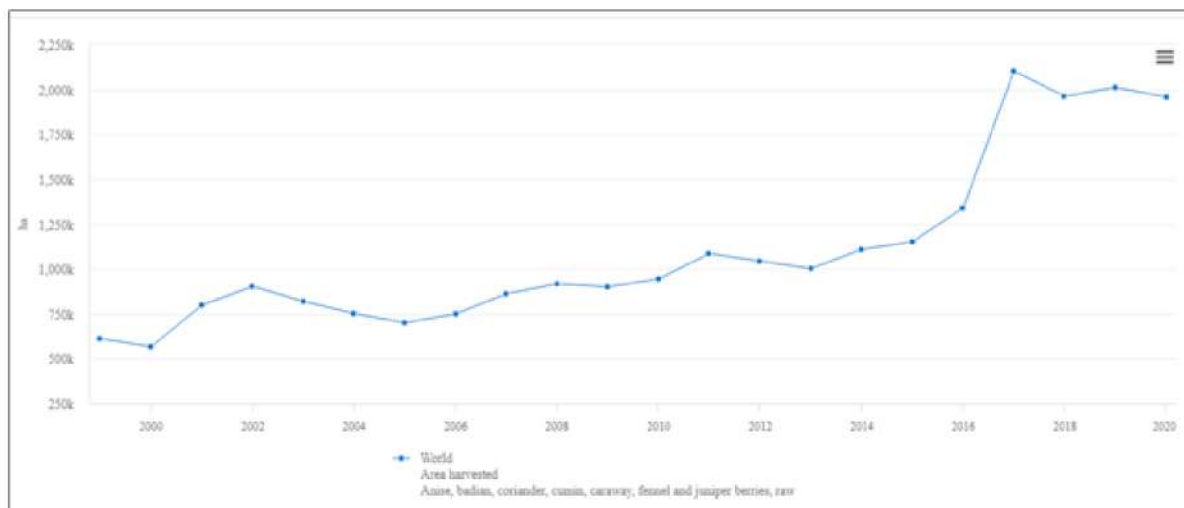


3. MEDICINAL PLANTS SOCIO-ECONOMIC ASPECTS

3.1 Surface area and production of medicinal plants at an international level

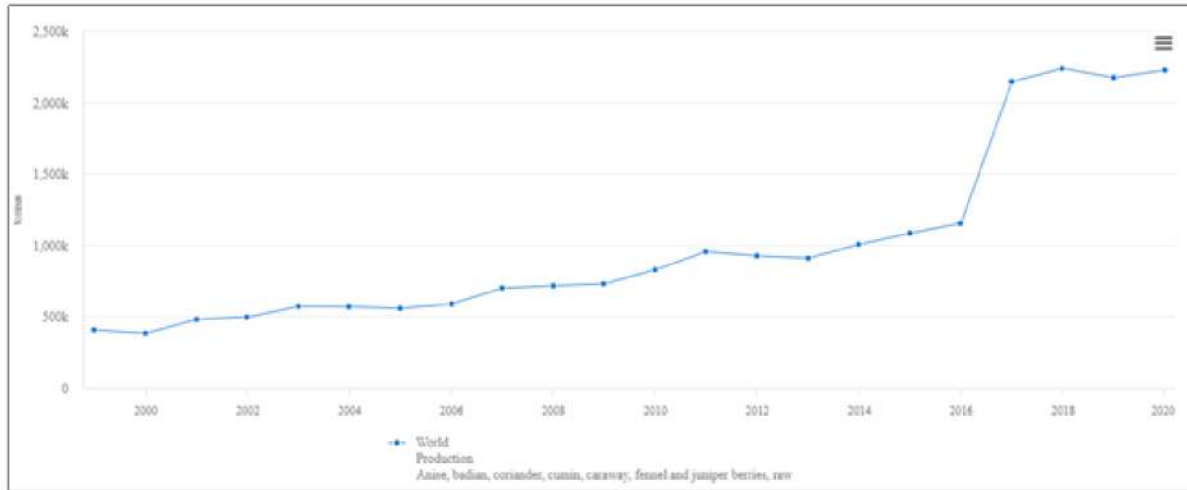
There is a considerable lack of data on the study of medicinal plants from both a quantitative and qualitative perspective. According to the Food and Agriculture Organization (FAO) [48] data, there has been a global increase in cultivated areas and production of medicinal plants between 2000 and 2020 (Fig.1- Fig 2).

Fig. 1 - Trend of areas cultivated with medicinal plants (ha): the global scenario (2000-2020)



Source: Faostat, 2020

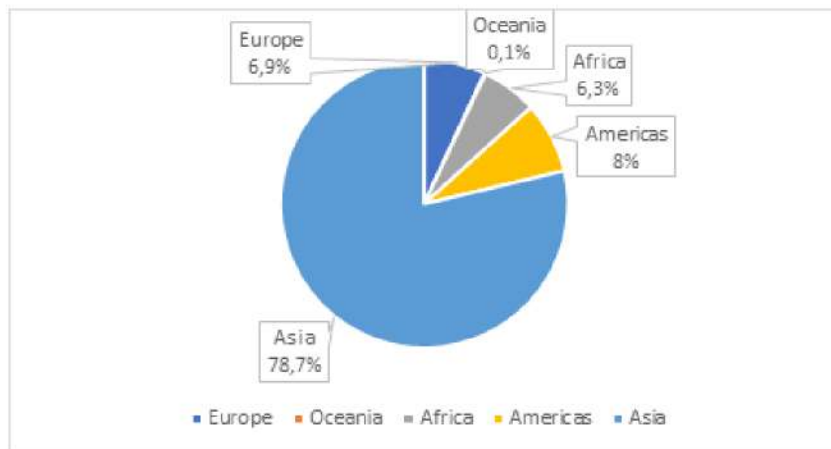
Fig. 2 – Worldwide Medicinal Plants Production Trends (t) : worldwide (2000-2020).



Source: Faostat, 2020

The production dynamics indeed reflect the increasing trend in the areas, which has been recording a significant growth for both data since 2016. In terms of production, the Asian continent (Fig.3) emerges as the major producer (78.7% of the total), followed by America (8%) and Europe (6.9%). Meanwhile, the distribution of various spices is almost widespread across different areas (Fig.4). [49]

Fig. 3 Production (%) by continent (2020)



Source: Faostat, 2020

The medicinal plant market data presented in May 2022 at the biennial FIPPO Forum (Italian Federation of Medicinal Plant Producers - 14 associates and 1800 hectares cultivated throughout Italy) [50] [51], depicted a situation that is still not perfectly quantifiable due to the complexity of the sector. However, estimates are available: 750 thousand tons of dried raw materials that, in terms of market value, translate into 30% held by China and India, followed by Egypt and Morocco.

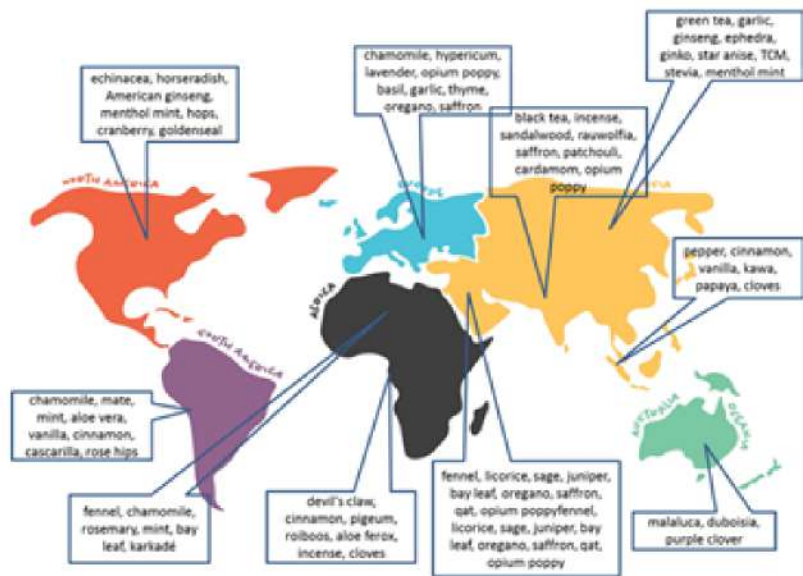
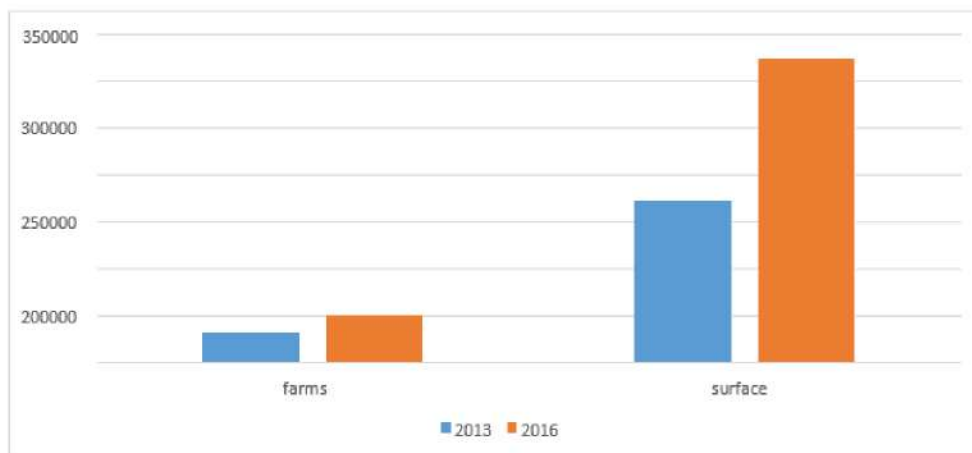


Fig. 4. Distribution of the main spices by continents.

Source: FIPPO

Based on the 2016 Eurostat data [52], over 320,000 hectares across Europe are devoted to the cultivation of medicinal and aromatic plants (MAPs). This signifies a relatively modest sector, but one that has experienced significant growth, with a notable increase of 87.5% compared to 2013. Similarly, the number of companies operating in this sector has also risen, expanding from around 32,000 to 50,000. Notably, there is a higher concentration of these companies in Poland, with a total of 16,260 businesses. Poland also leads in terms of the largest area allocated to medicinal plants, with over 103,000 hectares. Italy follows closely behind with 6,240 companies, while Bulgaria boasts 5,600 companies engaged in this sector.

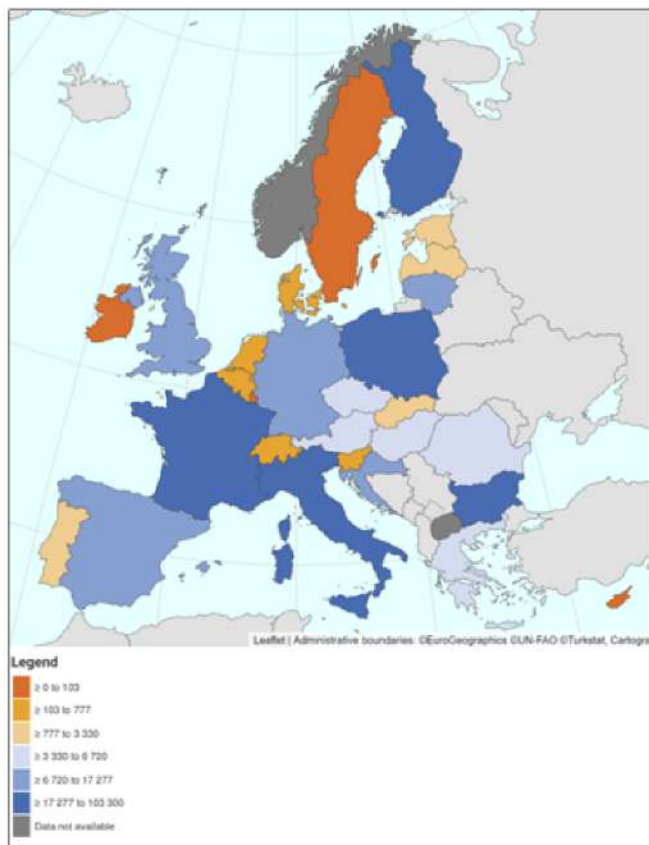
Fig. 5 - Area (ha) and number of MAPs companies in Europe, (2013/2016)



Source: Elaborated by CREA from Eurostat Data 2016

In summary, the cultivation of medicinal plants (Fig. 6) is heavily concentrated in a select group of countries. Poland (with 103,300 hectares), Bulgaria (55,830 hectares), France (40,850 hectares), Italy (24,160 hectares), and Finland (20,770 hectares) collectively account for 75% of the total area allocated to medicinal plants. From a production perspective, as of May 2022, according to data from FIPPO (Federation of European Medicinal and Aromatic Plants), the European market generates between 400,000 and 450,000 tons of dried herbs and plants, along with over 100,000 tons of essential oils as raw materials.

Fig. 6 - Distribution of areas cultivated with medicinal plants in the EU (2016)



Source: Eurostat Data 2016

Currently [50], the potential of the sector is constrained by rising energy costs and ongoing climate change. The significant increase in methane and diesel costs, ranging from 70% to 120%, has had a cascading effect on processing, transformation, and drying expenses, indirectly influencing agricultural input costs, packaging, transportation, and storage. This, in turn, has led to a 40% increase in the costs of medicinal products. To mitigate the risk of decreased demand or customer resistance due to these challenges, alternative energy and technological sources, especially for drying and dehumidification processes, could provide a viable solution.

Furthermore, the persistent climate conditions, marked by increasingly frequent extreme events such as prolonged droughts, early and late frosts, and torrential

rains, have led to crop reductions and losses, impacting the sector across the board. From 2015 to 2021, the European continent experienced significant agricultural damage due to various climatic challenges. In Germany, prolonged drought adversely affected the cultivation of lemon balm and other perennial leafy plants. Italy faced similar issues, with perennial leafy plants suffering losses due to extended periods of drought and intense spring rains. Poland and Latvia endured extreme temperatures of -20°C without snow, leading to significant crop damage. In France, the production of essential oils declined by approximately 30% as a result of these climatic adversities. In light of these challenges, there is a growing emphasis on energy efficiency and emission reduction in agricultural practices across Europe. New opportunities are emerging in the cultivation of resilient and adaptable crops. One notable example is the *Camellia sinensis* plant, or the tea plant. Despite its origins in Southeast Asia, it is being increasingly cultivated in Europe for its natural antimicrobial properties and adaptability to diverse climate conditions. These ongoing adaptations underscore a proactive approach to mitigate the impact of climate change on the continent's agriculture.

3.1.1 Future trends

For the current period, up to 2025, the international market is expected to:

- Maintain a strong demand for aromatic and medicinal plants from both the formulation or food industry and consumers
- Maintain the growth rate of the industry in the coming years
- Increase pressure towards the conservation of natural populations



- Shift to cultivation of aromatic and medicinal plants over collection from nature
- See global price increases
- See an increase in world exports

Fig.7 - Estimated future trend in international prices of aromatic and medicinal plants (average export price in \$/kg)

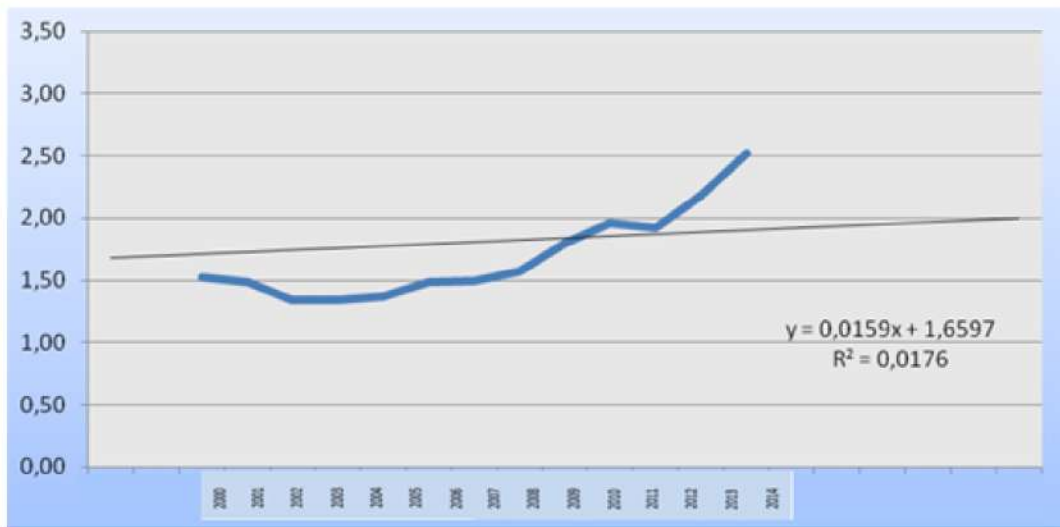


Source: UNCOMTRADE and own editing

As can be seen from the graph, the prices of aromatic and pharmaceutical prices increased significantly for the period 2007-2008. Therefore, a similar development is expected for the period up to 2025. It is evident from the graph that the price for the next few years is expected to move above \$10/kg exceeding \$12/kg. This price can be considered highly satisfactory for growers worldwide since ten years ago (2005- 2008) the average export price was below 8 \$ / kg. Of course, this development will not leave the pharmaceutical and food industry unaffected, as increased prices for aromatic and medicinal plants will mean strong pressure on production costs.

An increase in production costs, even if the industry's productivity rates remain stable, will impose higher prices on finished products, undoubtedly affecting demand from final consumers. On the other hand, increased global prices may create additional pressures on existing populations of wild aromatic and medicinal plants. This pressure from over- harvesting or mis-harvesting will be more pronounced in developing countries where wild plant collection is a profitable activity.

Fig.8 - Estimated future trend in the value of world exports of aromatic and medicinal plants (in billions of \$)



Source: UNCOMTRADE and own editing



3.1.2 Opportunities and risks

The increased demand for aromatics and pharmaceuticals can, among other things, be attributed to:

- A strong interest from North American and European consumers in using natural products for health care
- The development of research activities towards the utilization of aromatic and medicinal plants
- The development of the cosmetics and pharmaceuticals industry with aromatic and medicinal plants as ingredients
- The development of the food industry towards the production of food products with aromatic plants as ingredients.
- The growing consumer interest in haute cuisine where the use of aromatic plants is widespread
- The shift of the chemical industries towards the production of products (e.g. household insecticides) using plant-based raw materials.

The opportunities and risks of the market can be summarised by categories as follows:

- **In natural populations of aromatic and medicinal plants**
 - ✓Risk of extinction of rare plants
 - ✓Problematic supply chain
 - ✓Inadequate storage conditions that adversely affect product quality
 - ✓Export restrictions/prohibitions

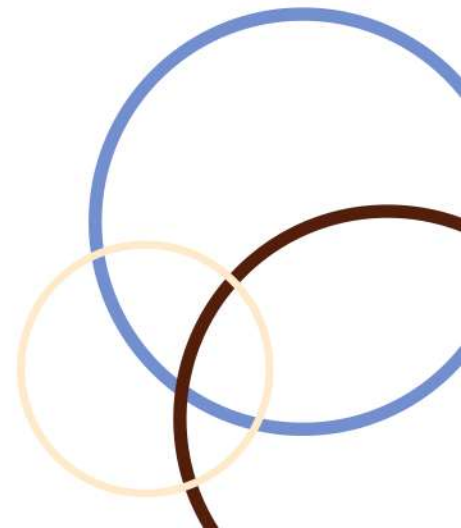
- ✓Difficult quality assurance
- ✓Favourable price of medicines/nutrition or health care preparations

- **On crops in mountains and lowland areas**

- ✓Variable production quality
- ✓Non-stable active substance content
- ✓Insufficient active substance content
- ✓Seasonality in production not meeting stable seasonal demand from industry
- ✓Risk of natural disasters/reduced harvests
- ✓Cost of quality certification

- **In the cultivation of aromatic and medicinal plants in closed type units**

- ✓Increased production costs
- ✓Adverse energy balance for the production unit
- ✓Stable quality of finished products
- ✓Less variation in active substance/essential oil content
- ✓Lower costs for quality control and quality assurance
- ✓Optimised growing conditions
- ✓Production regardless of the season or weather
- ✓Safety from natural disasters





3.2 Medicinal plants in Italy

3.2.1 Italian Legislation on Medicinal Plants

Law No. 99 of January 6, 1931, titled "Regulation of the Cultivation, Collection, and Trade of Medicinal Plants," provided comprehensive regulations for the cultivation, collection, and trade of these products. It also explicitly referenced the laboratories where these products underwent various processes (drying, grinding, maceration, distillation, extraction of active ingredients) [61]. Indeed, the terms "officina," "opificina," and "laboratorio farmaceutico" represented places where plants underwent various processes to prepare them usable for various purposes, including herbal remedies, pharmaceuticals, cosmetics, and also liquor production, among others.

The 1931 law categorized plants as 'officinal' if they appeared in pharmacopoeias (Fig. 9). These were the plants that pharmacies were expected to stock. In contrast, the herbalists' selection was based on popular usage and deliberately excluded poisonous plants, which were listed separately.⁷

Fig.9 List of Medicinal Plants

R.D. 26 May 1932, n. 772
List of the plants declared medicinal.

Common name of the plant	Botanical name	Used parts
Aconito *	Aconitum Napellus L.	Leaves and
Adonidi *	Adonis spec. var.	Whole plants
Angelica	Angelica	Seeds and
Arnica	Arnica montana L.	Flowers and
Artemisia	Artemisia vulgaris L.	Foalic. flowers
Assenziogentile	Artemisia portica L.	Aerial parts
Assenzio maggiore	Artemisia	Parts, aerial
Assenzio pontico	Artemisia vallesica	Aerial parts
Assenzio romano	V. Assenzio maggiore	Parts, aerial
Bardana	Lappa major D.C.	Roots
Belladonna *	Atropa Belladonna L.	Forfù
Brionia *	Bryonia dioica lacq. .	Roots
Calamo aromatico	Acorus calamus L.	Roots
Camomilla comune	Matricaria	Flowers
Cardosanto	Carbenia benedicta	Aerial parts
Centaurea minore	Erytraea Centaurium	Flowering grass
Cicuta maggiore *	Conium Maculatum	Forfù
Colchico *	Colchicum	Bulbs and seeds
Coloquintide	Citrullus Colocynthis	Fruits
Digitale *	Digitalis purpurea L.	Fugl
Dulcamara	Solanum Dulcamara	Doorjambes
Elleboro bianco *	Veratrum album L.	Roots
Enula campana	Inula helenium L.	Roots
Erbarota	Achillea Herbarota	Aerial parts
Farfara	Tussilago Farfara L.	Flowers
Fellandrio	Oenanthe	Seeds
Frangula	Rhamnus frangula L.	Cortexia of the
Frassino da manna	Fraxinus spec. var.	Manna
	Artemisia Mutellina	Aerial parts
	Artemisia spicata	Roots
Genepi	Artemisia glacialis L.	Fottù

	Artemisia nana Gaud	Roots
Genziana	Gentiana lutea L.	Roots
Giusquiamo *	Hyoscyamus niger L.	Aerial parts
Imperatoria	Pencedanum	Somnula tiuntc
Issopo	Hissopus officinalis	Amount
Iva	Achillea Moschata L.	Spore
Lavanda vera	Lavandula officinalis	Somnula tiuntc
Lavanda spigo	Lavandula latifolia	Roots
Licopodio	Lycopodium	Foglie e
Limonella	Dictamnus albus L.	Twigs
Liquirizia	Glycyrrhiza glabra L.	Seeds
Melissa	Melissa officinalis L.	Aerial parts
Pino mugo	Pinus pumilio	Twigs
Psillio	Plantago Psyllium L.	Leaves and
Polio montano	Teucrium montanum	Bulbs
Sabina *	Juniperus Sabina L.	Fruits
Saponaria	Saponaria officinalis	Seeds
Scilla marittima *	Urginea maritima	Forfù
Spincervino	Ramnus Cathartica	Flowers
Stafisagra	Delphinium	Roots
Stramonio *	Datura Stramonium	Flowers
Tanaceto	Tanacetum vulgare	Flowering grass
Tarassaco	Taraxacum	Roots
Tiglio	Tila species	Flowers
Timo volgare	Thymus vulgaris L.	Flowering grass
Valeriana	Valeriana officinalis	Roots



Since the 1930s, this list has undergone several revisions, mainly to remove certain plant species and replace them with ones that are more accessible and easier to store. Throughout this extended period, various regions and autonomous provinces have also introduced local laws governing cultivation and initial processing. These laws aimed to address the evolving requirements of agricultural operators and the unique features of their regions without conflicting with the century-old law and its subsequent changes and additions.

Hence the urgency for new regulations in line with the modern needs of agriculture, the advancement of cultivation techniques and technologies, the expansion of markets for medicinal plants, and the new policies aimed at biodiversity conservation, energy efficiency, and the modernization of agricultural infrastructure, etc.

Legislative Decree no. 75 of May 21, 2018 [62],[63] , the Consolidated Text on the cultivation, collection, and primary processing of medicinal plants, represents the most recent regulation of the sector, not only addressing legislative gaps by aligning national legislation with international standards but also moving beyond the concept of a "niche" sector. It recognizes the pivotal role of technological advancements and market trends by focusing on biodiversity, energy efficiency, and the modernization and mechanization of agricultural structures. The reform acknowledges the evolving and progressive needs of the sector, shifting the perspective from local to international and, especially, European contexts. It is driven by the food and pharmaceutical industries, new dynamics like organic farming, and emerging challenges such as sustainability and biodiversity. The Consolidated Text encompasses various significant aspects:

1. *Definition of Medicinal Plants*.⁸ The most comprehensive description of "medicinal plants" aligns with their diversified uses. Specific regulatory references for each sector (food, cosmetics, phytosanitary) fall under the decree following an assessment of compliance with the requirements specified in relevant regulations. The concept of new introductions provides the opportunity to gradually expand the species designated for medicinal use based on evident technical-applicative criteria. This concept also includes aromatic and medicinal plants (MAP - Medicinal and Aromatic Plants), which encompass algae, macroscopic fungi, and lichens, all having the same intended uses. Furthermore, the list of cultivated medicinal species identifies those subject to production processes, supported by the decree to meet market needs and, consequently, the needs of industry operators.
2. *Definition of Primary Processing Activities*. The decree specifies the essential activities necessary for production needs, including washing, defoliation, sorting, assorting, peeling, drying, cutting, selection, and pulverization of dried herbs. It also encompasses obtaining essential oils from fresh plants directly on the agricultural farm, if this activity requires the use of freshly harvested plants and plant parts. Additionally, "any activity aimed at stabilizing and preserving the product for subsequent stages of the supply chain" is included. Perishability, preservation, and minimal value addition guide the criteria for defining "primary processing activities," which are aimed at preparing the product for immediate use by subsequent user/processing companies after leaving the agricultural farm.

⁸ By medicinal plants we mean the so-called medicinal, aromatic and perfume plants, as well as algae, macroscopic fungi and lichens intended for the same uses. Official plants also include some plant species which, in consideration of their properties and functional characteristics, can be used, even following transformation, in the product categories for which this is permitted by sector legislation, subject to verification of compliance with the requirements of compliance required.

3. *Definition of Cultivation, Harvesting, and Primary Processing.* The reform provides a clear definition of these activities, categorizing them as "agricultural" (excluding those involved in the production of narcotics and psychotropic substances). This clarification goes beyond the previous law, which assigned the handling of medicinal plants to only three roles: gatherer, herbalist, and pharmacist.

4. *Scope of Application of the Decree.* In order to protect public health, sales to the end consumer and activities following primary processing remain subject to specific sector regulations. This also includes defining the competencies of the herbalist. The exclusion from the decree of extemporaneous food preparations sold loose and not prepackaged, allowed not only for pharmacists but also for those holding the title of herbalist, clearly delineates the areas of operation for various roles, referring to sector-specific regulations.

5. *Definition of Harvesting, Collection, and Primary Processing of Wild Medicinal Plants.*⁹ In line with the conservation of local biodiversity, the regulation of the "harvesting" of wild medicinal plants grown spontaneously in various regions is entrusted to the Regions/Autonomous Provinces, referring to Directive No. 92/43/EEC concerning the conservation of natural and semi-natural habitats as well as wild flora and fauna. Wild harvesting and primary processing, on the other hand, must take into account the depletion of areas and therefore require a deep understanding of the environment and its development. It is considered akin to organic production methods, aligning more closely with the characteristics of the agricultural sector.

⁹ DM 29551 del 24 gennaio 2022 "Elenco delle specie di piante officinali coltivate nonché criteri di raccolta e prima trasformazione delle specie di piante officinali spontanee"

The activity of wild harvesting of spontaneously grown plants, algae, macroscopic fungi, and lichens intended for use as ingredients in medicinal products follows the provisions of "Good Agricultural and Collection Practice (GACP)."

In summary, the main objectives of the Decree, which embraces the conclusions of the Medicinal and Aromatic Plants supply chain table established in 2013, aim to protect biodiversity and promote the development of the primary sector. It introduces new rules for the cultivation and processing of medicinal herbs into cosmetic and food products, provides appropriate training for operators in the supply chain, maintains a strong focus on the development of the circular bioeconomy, and invests in new employment opportunities, especially for young people.

3.2.2 Leading data on the cultivation of medicinal plants in Italy

According to 2016 Eurostat data, Italy has allocated 24,160 hectares to the cultivation of medicinal plants 10, distributed among 6,240 enterprises. A review of the period from 2013 to 2016 reveals a significant expansion in this sector; the land area committed to cultivation surged by 215%, while the number of companies involved in this domain grew by 110%. Regions in Italy showing positive growth in the cultivation of medicinal plants include Liguria and Veneto in the north, all central regions, and Campania, Puglia, and Basilicata in the south.



Conversely, Lombardy, Friuli Venezia Giulia, and Emilia Romagna have experienced a decline. Sicily, in particular, has seen a notable decrease, with a 31% reduction in the number of companies engaged in this sector since 2013.

In Italy, the distribution of land for cultivating medicinal plants is regionally diverse. The northern and central regions of the country account for 71% of the total area designated for these crops. In contrast, southern Italy contributes 25% of the cultivated areas. The remaining land allotment is found in the Islands, with Sicily being a significant contributor. This geographical distribution highlights the varied focus and investment in medicinal plant cultivation across different Italian regions.

Table 1 – Comparison of the regional distribution of companies and surfaces invested in medicinal plants, 2013/2016

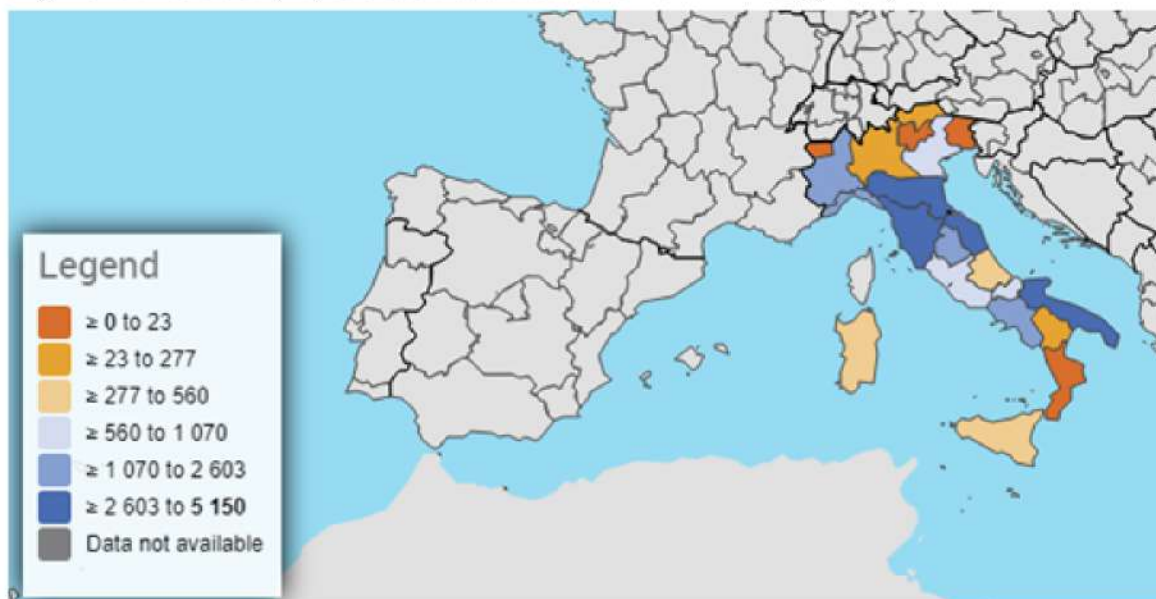
	EUROSTAT 2013		EUROSTAT 2016	
REGION	FARMS	SURFACE	FARMS	SURFACE
Piemonte	260	960	350	1.070
Valle d'Aosta	0	0	0	0
Liguria	370	410	620	1.070
Lombardia	110	110	50	90
Trentino Alto Adige	50	10	70	30

Veneto	200	260	310	780
Friuli-Venezia Giulia	20	0	0	0
Emilia-Romagna	780	1.560	380	2.810
Toscana	80	1.450	300	2.670
Umbria	140	260	310	2.470
Marche	280	1.620	1190	5.140
Lazio	30	60	260	980
Abruzzo	50	110	100	350
Molise	60	260	180	560
Campania	30	80	380	1.670
Puglia	50	330	760	3.430
Basilicata	0	0	20	130
Calabria	10	20	180	20
Sicilia	420	160	290	460
Sardegna	30	0	490	430
ITALIA	2.970	7.660	6.240	24.160

Source:
Elaborated
by CREA
form
Eurostat
Data 2016

The distribution of companies involved in the cultivation of medicinal plants varies across Italy, with the Marche region taking the lead. It is home to 21% of the total number of companies nationwide. Puglia, with 14%, and Emilia Romagna, with 12%, follow suit, meaning that these three regions together host 47% of the total companies in this sector. In terms of land area dedicated to this cultivation, Marche again stands out, encompassing 19% of the national total. Puglia, Emilia Romagna, Tuscany, and Umbria collectively make up an additional 49% of the total national area designated for medicinal plants, bringing their combined coverage to 68% of the country's total. This data highlights the significant role these regions play in Italy's medicinal and aromatic plants sector.

Fig. 10 - Surface area (ha) dedicated to the cultivation of MP in Italy (2016)



Source: Eurostat, 2016

The 2016 Eurostat data facilitated a detailed examination of both the scope and distribution of companies, segmented by classes of Utilized Agricultural Area (UAA), within the "Aromatic, Medicinal, and Culinary Plants" category in Italy. Fourteen percent of companies specializing in medicinal plants are categorized within the 2 to 5 hectares UAA class, and they manage 6% of the total area designated for medicinal production in the country. In the smaller UAA class, specifically for areas up to 2 hectares, there is a slightly higher concentration of companies, accounting for 15% of the total. However, these companies only occupy 2% of the national total area designated for the cultivation of medicinal plants. This data highlights the disparity in the distribution of land among companies of different sizes within this sector.

The remaining 5 UAA classes collectively encompass almost 71% of the companies that use over 90% of the national area designated for the cultivation of medicinal plants. Three classes, in particular, stand out: the 20 to 50 hectares UAA class is represented by 20% of the companies, spread over 23% of the national area; the 50 to 100 hectares UAA class includes 6% of the companies distributed over 13% of the total area; and finally, the over 100 hectares UAA class, although representing only 5% of the companies, occupies 26% of the national area. The following table shows the percentages related to the number of companies and areas.

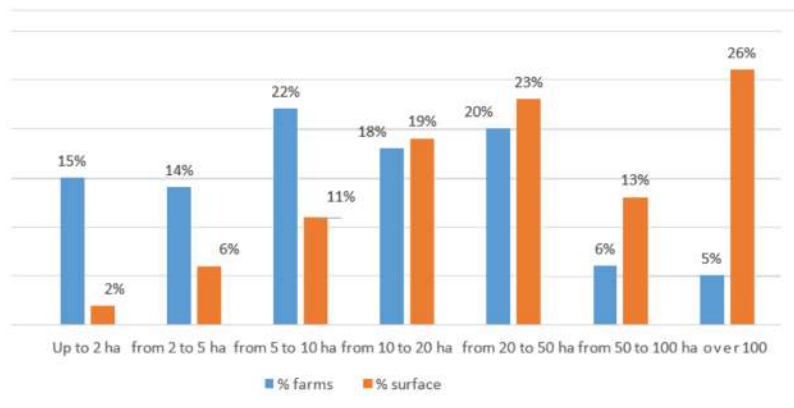


Fig. 11 – Companies (%) and cultivation areas (%) of M.P. divided by UAA classes

Source: Elaborated by CREA based on 2016 Eurostat data

From relevant sector data, the importance of organic production in the medicinal plants' supply chain is too significant to overlook. This method of cultivation has seen a substantial rise in recent years and as of 2016, it constitutes over 20% of the entire area allocated for the growth of medicinal plants.

An analysis of data comparing areas devoted to organic farming between 2009 and 2021 reveals a steady increase, with acreage expanding from 2,803 hectares in 2009 to 7,131 hectares in 2021 (Source: Sinab, 2021).

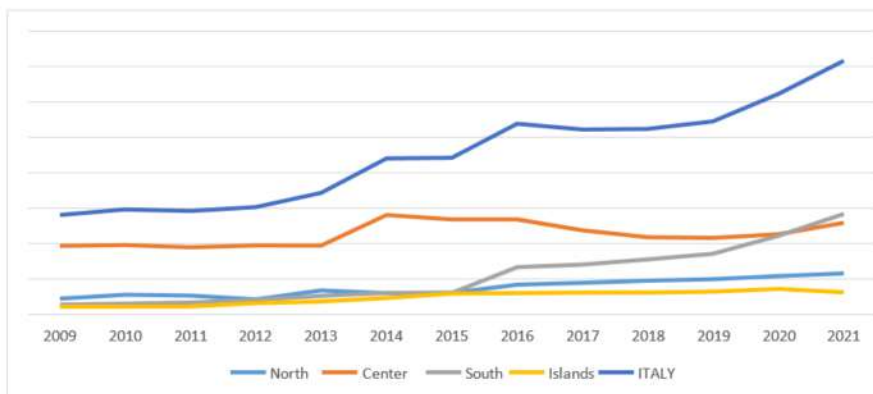


Fig. 12 - Trend of areas devoted to organic medicinal plant farming by territorial scope (2009-2021)

Source: Elaborated by CREA based on data from Sinab (2021)

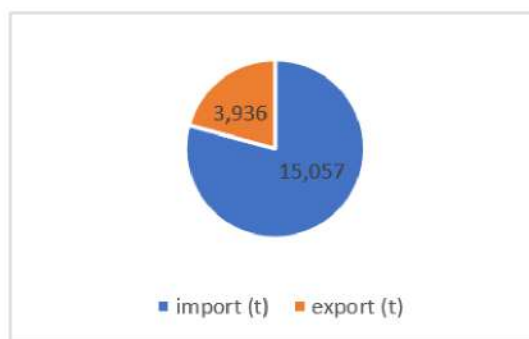
In 2021, every region in the nation witnessed a growth in lands designated for organic farming (Fig.12), with the exception of the islands, where there was a marginal decline, as indicated by the data. Concurrently, the southern part of the country boasts the most extensive area dedicated to the cultivation of medicinal plants, encompassing a total of 2,827 hectares.

According to UN-Comtrade data [53], Italy bought over 82 million dollars worth of medicinal and aromatic plants, weighing 15,057 tons, in 2021. However, it sold plants worth 40 million dollars, weighing 3,936 tons.

Fig. 13 - Import/Export of MPs (\$) Italy, 2021



Fig. 14- Import/Export of MPs (t) Italy 2021



Source: Elaborated by CREA based on 2021 data from UN-Comtrade

In summary, since the early 2000s, Italy has nearly tripled its production and export value of medicinal plants and doubled its imports. The trade of spices and aromatic plants has also almost doubled. Thanks to rich herbal traditions, Italy leads globally in using medicinal herbs for cosmetics, and is a significant consumer of tea and infusion herbs. In 2020 alone, Italy imported 6,583 tons of tea and produced 2,900 tons of infusions and herbal teas.



3.2.2.1 Medicinal Plants in Basilicata

The growth of medicinal and aromatic plant farming in Basilicata is notable, marking a specialized area that local producers and supply chain operators are expanding. According to the 2023 "Report on the Lucanian Companies in the Medicinal Plants Sector: Analysis of the Main Technological and Training Needs" by CREA, part of the MEPLASUS project, there are nearly 100 farms engaged in cultivating these plants. These companies are scattered throughout the region, with a higher density in the central area. Additional clusters are found in the Pollino area and the north-western part of the region. Altogether, about 320 hectares are dedicated to cultivating medicinal plants.

Only 13% of the companies surveyed are primarily engaged in growing aromatic and medicinal plants, as well as spices. Most medicinal plant production comes from seed companies, making up 64% of the total. Olive-growing companies contribute 13%, and other types of businesses, like citrus and livestock, account for 10%.

3.2.3 The Medicinal Plant Supply Chain in Italy

Italy's medicinal plant supply chain is complex, involving diverse producers, suppliers, and transformers, as well as a mixed retail and consumer segment [54]. These plants are grown by both specialized and general agricultural companies or are collected as wild species, though the latter is becoming less common. There are various ways agricultural companies bring these products to market:

producing and selling fresh products (fresh system), potted plants or carry out seed reproduction;

performing some initial phases of the derivative product supply chain (processed chain) within their structure or that carry out complete supply chain processes.

In the industrial stage, companies process and sell products made from agricultural raw materials. These can be either semi-finished goods or completed items ready for consumers. Within this sector, there is a noticeable focus on food items and products aimed at health and wellness. Wholesalers are pivotal at various points in the supply chain. The retail stage features an array of sale points. Pharmacies and large-scale distributors are gaining prominence, a shift from the previous reliance on herbalists and traditional food retailers.

Consequently, participants in the medicinal plants supply chain range from spontaneous collectors and agricultural companies to fully integrated firms. Wholesale traders, industrial enterprises, and retail operators are also integral parts of this chain, all leading to the final consumers.

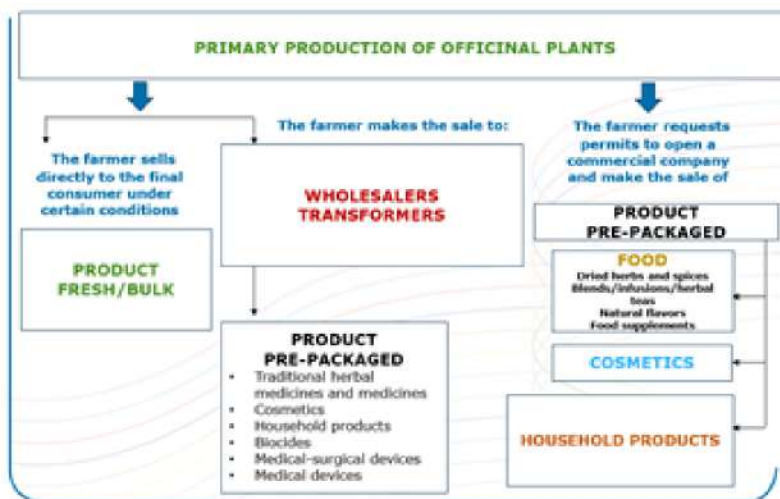


Fig. 15 Medicinal Plant Supply Chain

Source: Elaborated by Sabrina Giuca, CREA

Retail channels have evolved over the years, expanding beyond herbalists and pharmacies. Now, pharmacies and parapharmacies, wellness centres, company sales outlets, and even unconventional spaces like hair salons, beauty centers, fitness centers, and restaurants have become established points of sale.

3.2.3.1 The Medicinal Plant Supply Chain in Basilicata

The Basilicata market for medicinal plants is multifaceted, catering to the production of fresh plants, spices, and essences for making liqueurs, as well as essential oils for cosmetics. Those operating in Basilicata include:

The Irsina Sud-Officinale Cooperative of (MT) stands out, with 16 hectares of irrigated lands in the Bradano river plain. They are a national frontrunner in producing medicinal plants using certified organic and biodynamic methods. Bioplanta, another Lucanian company, processes and markets the plants grown by Sud-Officinale, including the extraction of essential oils.

Lucana Officinali Soc. Coop., founded in 2016, oversees around 70 hectares of land, primarily within the protected bounds of Pollino National Park, and is certified for supply chain traceability under the ISO 22005 standard. EVRA Italia srl, based in Lauria (PZ), processes all of Lucana Officinali's produce and also handles wild plants. At EVRA, active ingredients are extracted and approximately thirty varieties of medicinal plants are converted into premium-quality products.

F.L.E.O., a partnership of 53 members, is dedicated to fostering a solid network among companies involved in the production, processing, and transformation of medicinal herbs across the region. It operates on two distinct streams: one supplies medicinal plants to Lucano 1894 s.r.l., the maker of the renowned Amaro Lucano, which incorporates a variety of Lucanian medicinal herbs in its recipe.

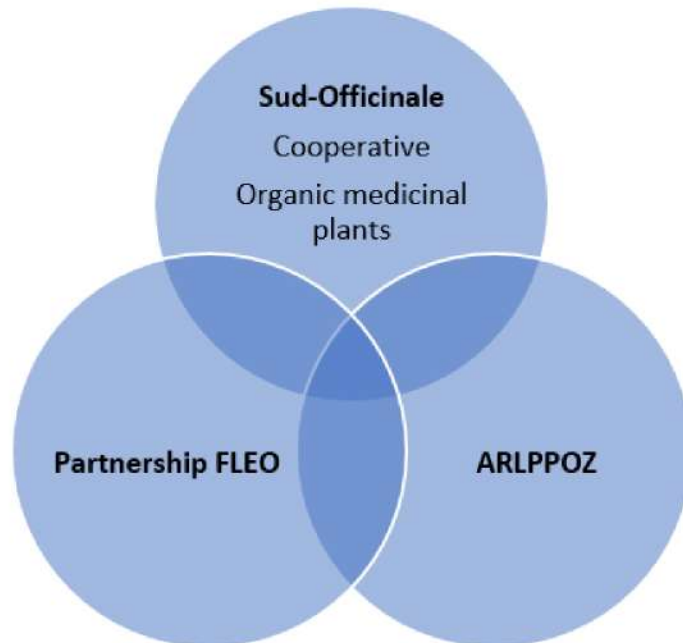


The second stream involves companies that produce condiment plants and supply them to the SpeSì distribution center. After processing, SpeSì markets these products under its own brand.

The Association of Lucanian Producers of Medicinal Plants and Saffron (ARLPPOZ) comprises forty members who are dedicated to the cultivation of medicinal plants and saffron in the Lucania region.

Basilicata serves as an experimental ground for testing and implementing local development models leading to job creation and socio-economic expansion. The escalating interest from agricultural firms, combined with the engagement of Lucanian farmers in national and regional research initiatives, has transformed the Lucanian micro-supply chain into a powerhouse of productivity, technology, and organization [55].

Fig. 16 The Lucanian Medicinal Plant Production System



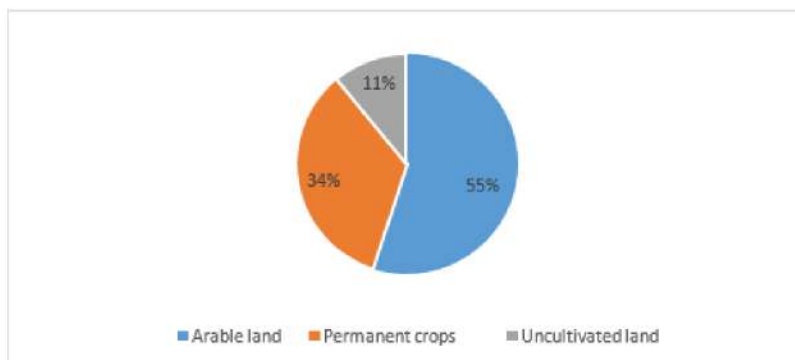
The collective expertise encompassing medicinal plants, drawn from national and regional research institutions, universities, schools, and agricultural companies, has played a pivotal role in shaping and elevating the supply chain. However, there is room for improvement, particularly in innovative approaches within the regional landscape to bolster economic sustainability in this sector. This can be achieved by integrating diverse activities, including a stronger focus on tourism, to complement existing efforts.

3.3 MEDICINAL PLANTS IN GREECE

Greek agriculture is distinguished by the presence of 685,000 agricultural enterprises, predominantly small-scale, with an average Utilized Agricultural Area (SAU) of 6.6 hectares as of 2016, marking one of the smallest averages in the European Union. Only Romania (3.7 ha), Cyprus (3.2 ha), and Malta (1.2 ha) have enterprises with a smaller average size [56]. Notably, rural locales constitute 94% of Greece's geographical landscape.

Arable crops occupy 55% of the SAU, while 34% is dedicated to permanent crops, and the remaining 11% is left fallow.

Fig. 17 – Agricultural areas by use in Greece



Source: Elaborated by CREA based on data from Hellenic Statistical Authority (2019)

Greece's agricultural landscape is primarily covered by maize, wheat, sunflower, sugar beet, soy, potatoes, apples, plums, and grapes. The sector is a significant economic driver, contributing 4.3% to the nation's Gross Added Value (GVA) - a figure that's roughly 2.4 times larger than the average in the EU-27.

Greece's strategic geographical position, complemented by its diverse landscapes and a combination of edaphic and climatic conditions, enhances its biodiversity and plant endemism. Interactions with various biotic factors further accentuate this. Such a rich environment is especially conducive for the adaptation of aromatic and medicinal plant species, bringing therapeutic, economic, and environmental advantages [58].

Greek flora boasts a wealth of notable species, including oregano, thyme, sage, anise, fennel, chamomile, bay, mint, lavender, and melissa. The list is further embellished with distinct products like Chios mastic, Kozani saffron, Cretan dittany, and Syrian sideritis.

In recent years, Greece has experienced a substantial growth in the cultivation and production of medicinal plants. Data from Eurostat, updated in 2016, reveals that over 3,300 hectares are now dedicated to this purpose, representing a 30.5% increase since 2013.

The industry of aromatic, medicinal, and culinary plants in Greece has seen a notable surge in the number of operating companies. Data from Eurostat in 2016 shows a rise to 2,900 enterprises, up from 1,880 in 2013, marking an increment of 1,020 companies.

Kentriki Macedonia is the area most suited for the cultivation of these plants, with 43% of the land dedicated to medicinal plants located there. However, the highest number of companies is recorded in the Dytiki Macedonia area. This development highlights the country's growing emphasis on and investment in the cultivation and production of aromatic and medicinal plants, given their economic and health benefits.

Fig. 18 Agricultural land dedicated to the cultivation of MPs in Greece

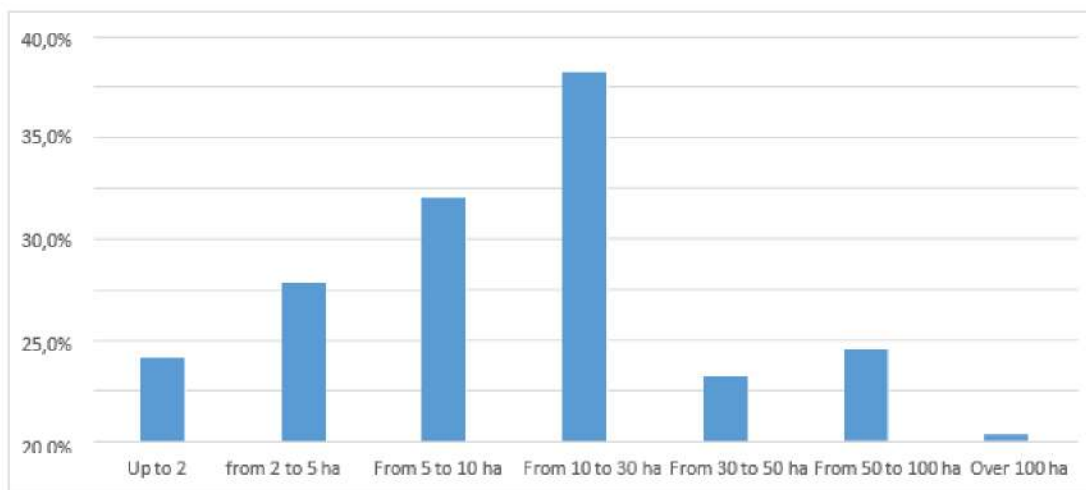


Source: Eurostat, 2016

The most commonly cultivated medicinal crops in Greece include hop, rosemary, coriander, rose, thyme, mastic, anise, oregano, sea buckthorn, capers, chamomile, maple, basil, mint, marjoram, sage, dittany, mountain tea, and honeysuckle. Oregano occupies the most extensive areas, accounting for approximately 40% of the total cultivated areas (Hellenic Statistical Authority, 2018). An examination of 2016 Eurostat data reveals a detailed breakdown of farm sizes in Greece cultivating medicinal plants.

Farms with a Utilized Agricultural Area (SAU) ranging from 10 to 29.9 hectares constitute 36.4% of the total. Those with an SAU of 2 to 9.9 hectares make up just over 47%. There are 210 farms falling within the 30 to 49 hectares SAU class, accounting for 6.3% of all farms. Those with an SAU between 50 to 99 hectares represent 9%, while a mere 0.63% have an SAU exceeding 100 hectares.

Fig. 19 – Distribution of Medicinal Plant Companies (%) by SAU Classes in Greece



Source: Elaborated by CREA based on data from Eurostat 2016.

The expansion of Greece’s medicinal plant industry gained prominence in 2017 with the introduction of the “Strategic Development Plan for the Cultivation, Processing, and Marketing of Aromatic and Medicinal Plants in Greece” (par.3.3.2) by the Greek Ministry of Agriculture.

This detailed plan outlines a series of initiatives and tactics to enhance the competitive evolution and sustainable practice of growing, processing, and distributing aromatic and medicinal plants throughout the country.



3.3.1 Current situation of Greek exports

Greek exports are notably weak in comparison to the global market, accounting for less than 0.1% of worldwide exports for the period from 2000 to 2014.

Table 2: Greek export trend (2000-2014)

YEAR	WEIGHT	Change (%)	VALUE	Change (%)
	(in tonnes)		(in \$)	
2000	418573		837146000	
2001	464662	11.0	929788662	11.1
2002	395017	-15.0	790824034	-14.9
2003	378820	-4.1	758776460	-4.1

2004	384552	1.5	770642208	1.6
2005	378224	-1.6	758339120	-1.6
2006	323747	-14.4	649436482	-14.4
2007	607745	87.7	1219744215	87.8
2008	341459	-43.8	685649672	-43.8
2009	242691	-28.9	487566219	-28.9
2010	347975	43.4	699429750	43.5
2011	300322	-13.7	603947542	-13.7
2012	583288	94.2	1173575456	94.3
2013	391155	-32.9	787395015	-32.9
2014	326304	-16.6	657176256	-16.5

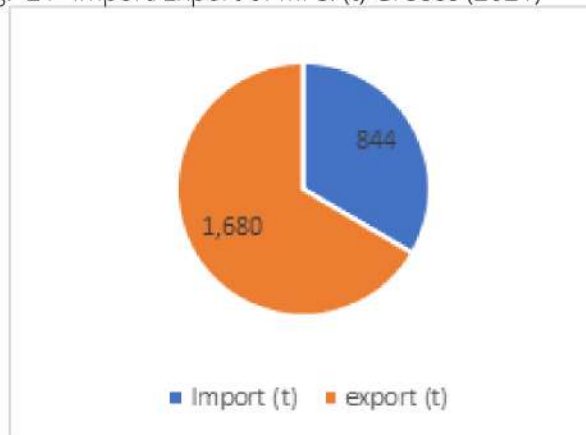
Source: UNCOMTRADE

In terms of economic data, a significant number of medicinal plants are exported to major destinations such as Germany, Switzerland, the United States, Canada, and Russia. According to UN-Comtrade data, in 2021 Greece imported 844 metric tons of medicinal and aromatic plants, valued at 3.8 million dollars, while its exports, valued at 8.6 million dollars, accounted for a flow of 1,680 metric tons.

Fig.20 Import/Export of MPs (\$) Greece (2021)



Fig. 21- Import/Export of MPs. (t) Greece (2021)



Source: Elaborated by CREA based on data from the UN-Comtrade, 20

3.3.2 Strategic Development Plan for the cultivation, processing and marketing of Aromatic and Medicinal Plants in Greece: some aspects

3.3.2.1 Purpose

The purpose of the National Strategic Plan is to define the measures and actions that will be implemented for the competitive development, on a rational and sustainable basis, of the cultivation, processing and marketing of Aromatic and Medicinal Plants (MAPs) in the country.

The development policy of the MAPs can be summarised as follows:

1	Increasing the competitiveness of Greek MAPs in the international environment (increased production, improved quality, competitive prices)
2	Research and application of modern production methods and development of new products
3	Development of a system for the control and protection of plant genetic material (native and cultivated)
4	Standardisation of products based on internationally accepted standards of cultivation, processing, standardisation and marketing
5	Submission of products to common trademarks, in order to group quantitative and qualitatively standardized, concentration of competitive quantities in international trade

6	Coupling production with research on the uses of NSAIDs in Pharmaceuticals, cosmetology, food industry, etc.
7	Research on the use of NPS substances in the food industry
8	Promotion of organic production of OFFs and processed products these
9	Education and training of new producers in cultivation and processing of the OFs
10	Manufacturing technology systems and applications - Training processes and applications from interested parties

3.3.2.2 Overview of aromatic and medicinal plants: description of the current situation at the breeding and growing stage

The production for marketing of propagating material is carried out by seed-producing and nursery undertakings, while marketing is carried out by marketing undertakings. The aforementioned enterprises must be registered in the register of enterprises, as defined in Decree No1153/16620/04-02-2014 (B ' 616).

The marketing of Propagating Material of Aromatic and Medicinal Plants is regulated by Ministerial Decision No 7594/115508/12-09-2014 "Technical Regulation on Marketing of Propagating Material of Aromatic and Medicinal Plants" (B' 2663). These provisions shall apply to propagating material originating in other Member States, third countries or domestically produced, which is placed on the market. The propagating material currently used for the cultivation of NTFPs in Greece usually comes from nurseries, which have either obtained the seed from abroad, or from native plants of Greece, or use a mother material as a source. This material is essentially plants which are reproduced by asexual propagation, or in a native way (by seed). In a sexual propagation, that is, new plants are created using the asexual method of reproduction, usually by misting and using rooting hormones. In most of the cases of In some cases, seed is being traded, but also plants, without identity and traceability, and possibly unclear properties.

- **Cultivated areas, varieties, sources of supply of material**

Due to the lack of certified propagating material in Greece, the supply is necessarily made by recognized seed companies abroad. This solves the problem of the stability of characteristics in similar markets (you turn to the same company or market again and you do not have to gain their acceptance, and they have special characteristics - higher contents of essential oils or substances). In 2022, the cultivated areas of MAPs in Greece amounted to 60,000 acres. Of these, the largest area is devoted to oregano (11 000 hectares). Other species that are currently cultivated on fairly large areas apart from oregano are lavender, mountain tea (*Sideritis sp.*), crocus or saffron (*Crocus sativus*), and to a much lesser extent sage (*Salvia fruticosa* and *Salvia officinalis*), *melissa officinalis*, *crithmum maritimum*, mint (*Mentha spicata*), chamomile (*Matricaria chamomilla*), etc.

- **Production organisation, farming practices, organic farming**

The farmer or grower before taking any other action should have a plan of how to organise his production. Organizing production is not only planting and growing in the field, but also storage and preservation, and other actions that must be taken if the material is not sold in the form of the product that was harvested and dried. The grower, if he intends to proceed with processing, should have organize all this production in a flow, to be fully informed to avoid mistakes and to have a sequence of procedures that will lead to the production of an acceptable product. As far as cultivation practices are concerned, there is a lot of know-how, published in reputable books or international literature, but t h e r e must be qualified personnel (agronomists, technologists, etc.) for crop monitoring and advising. Some practices are known which are usually acquired by the growers from their own experience, but this is not enough without the corresponding training. There is a lack of organised form of practical assistance from responsible bodies that should support the farmers, as well as a lack of rules for species cultivation. As far as organic farming is concerned, it is not widely developed, although many farmers choose this way of farming. There is no practical but only general knowledge, while this sector seems to have a future in our country.

- **Yields, quality characteristics, problems of growers**

The yields of cultivated MAPs in Greece, according to studies, field experiments and results of pilot crops, as well as data from producers, are high, provided that the right conditions are met and the necessary cultivation care is taken.

There is a lack of information on the required controls of the growing environment (soil, water, etc.) that contribute to the subsequent quality of the PMPs, but also on post-harvest controls (microbial load, residues, heavy metals, chemical analysis of ingredients, etc.), which are required depending on the market.

On the issue of crop yields and the quality characteristics of the products produced, research institutes, universities and targeted research by specialised researchers can play a catalytic role. Problems are identified on information and awareness issues, such as disease control and in particular on organic farming. Also, in the processing of raw materials, drying and separating from the dew the part of the plant that is usable and the part that is not is treated as waste. The corresponding machines are not easy to obtain, especially for the small farming should be strengthened so that they can use it together.

- **Description of the current situation for the processing, processing and marketing of Greek products**

The harvesting of MAPs today is done either manually with the use of simple tools, knives, shears, trimmers, etc., or with modified grain machines, e.g. harvesters, etc. For specific crops where harvesting of only part of the plant material is required, such as chamomile, lavender, etc., specialised machines are used (for chamomile harvesting, there are few machines and they are mainly imported from abroad). Specialised harvesting machines are needed for large-scale crops so that the costs can be recouped. In many cases, producers also resort to their own patents for use in the harvesting of AFH. Due to the fact that the areas under cultivation in Greece are very small compared to other crops, there are relatively few specialised harvesting machines.



3.3.2.3. Research and innovation

On the issue of biodiversity and the recording of NFIs, in various geographical areas of the country, numerous projects (bachelor, master and doctoral theses) have been carried out in Universities, TEI, research institutions, in the framework of programmes and studies, or by national institutions, most of which have already been digitized and can constitute valuable material for the utilization of the plant species of the Greek flora.

At the same time, many published papers, in Greek and international journals, on a large number of plant species of the Greek flora, concern the reproduction and conservation of native NSPs, chemical composition of native populations (chemotypes), biological activity, pharmacological activities, use of advanced techniques in the isolation of secondary metabolites, innovative treatments, etc. However, it is worth noting that no research has ever been funded on the primary production of AFPs in Greece (creation of Propagating Material, cultivation, etc. which is now considered fully necessary).

3.3.2.4 National strategic Plan (NSP): objective

The development of bio-zones for certain species, together with native flora protection zones, form the basis for the protection and exploitation of species' adaptability. Thus, the development of a single electronic Geographic Information System for all crops including aromatic and medicinal and native species is a timely and essential tool for biodiversity protection and sustainability of agriculture. At present a unified system and register of recording of native species in conjunction with a Geographical Information System does not exist.

Therefore, the presence of important plant species remains undetermined and is often at risk of extinction due to environmental disasters or human interference. Measures of a general and specific nature should be studied on the basis of developments and the conditions-problems and implemented institutionally, for the protection of native flora and especially of intellectual property rights raised by illegal exploitation (responsibilities of the Ministry of Agriculture and Forestry, Ministry of Environment and Natural Resources).

- **Utilization and conservation of specific priority species**

The floral wealth of Greece can be utilized in this way in a sustainable manner (i.e. to ensure the continuity of the production of goods and products from the floral wealth without, however, reducing its productive potential due to the reduction of natural reserves) and not to exhaust the natural reserves through the indiscriminate and unplanned collection from nature. A significant number of Greek plant species contain volatile compounds, mainly belonging to the group of terpenes and phenolics, which are responsible for their aromatic properties. Plant genera belonging to the *Lamiaceae* (*Acinos, Calamintha, Origanum, Mentha, Satureja, Salvia, Teucrium, Sideritis, Thymus, etc.*), the *Asteraceae* (*Achillea, Artemisia, Helichrysum, Matricaria, etc.*), the *Umbelliferae* (*Athamanta, Carum, Foeniculum, Seseli, Tordylium, etc.*), the *Umbelliferae* (*Athamanta, Carum, Foeniculum, Seseli, Tordylium, etc.*) and the *Asteraceae* (*Athamanta, Carum, Foeniculum, Seseli, Tordylium, etc.*), but also genera in smaller plant families, are of particular interest, both from a research point of view and in the field of applications and/or exploitation.

As far as the biological properties of both Aromatic and Medicinal Plants are concerned, these are mainly due to the non-volatile components (non-volatile terpenes and phenolic derivatives), based on their use. However, while aromatic species are easily grouped on the basis of their organoleptic properties, the same is not true for medicinal species. Bioactive plant metabolites with known activities or significant future potential may be 'potentially' present in any plant species, thus making it interesting and potentially exploitable from a pharmaceutical point of view. In particular for endemic species of Greece (they do not exist anywhere else on the planet), it goes without saying that their existing or future medicinal properties constitute a unique and exclusive phylogenetic resource of Greece, so they must first be protected and the legislative framework for their exploitation and marketing must be defined.

- **Expansion of NTFP crops, in a rational and sustainable way, with a primary focus on the final product and market specifications**
- Identification of priority species.

It is a fact that the biggest disadvantage today for the export of PAPs (which is the main route of absorption of the products) is the small area of crops in Greece, and therefore the small quantities offered to international trade. The expansion of crops, in order to make the result, it must be done in a rational way, and with an orientation towards the markets the respective industries and the products produced. Thus, a survey of the European and international market is essential and will provide the necessary useful information to the prospective producers, processors, for: identify the main players in the specific market-industry product by type and sector.

-mapping of the marketing structure of the respective AFS raw materials and the individual components. In particular, an inventory of regulations and requirements at national and international level.

-search for prices for different products and types of PFIs in international trade, and which of these items are high value-added.

-identifying, as far as possible, future trends and needs for AFS items and products. Based on the above, the producer should investigate whether his own growing conditions are favourable and for which species. At the same time, the cost be calculated for the production of the competitive for international trade. The same applies to processed - packaged products, essential oils, extracts.

Cultivation (growing conditions, variety - Propagating Material) and post-harvest handling must be in accordance with the specifications of the markets for the products to be produced(organoleptic characteristics, chemical composition/levels of active ingredients, purity, certifications, etc.).

a. Definition of the priority MAPs species:

According to the Strategic Planning objectives, the species should be defined according to the demand-tendencies of plant species in international markets, the value-added products and the competitiveness of Greek ones, with the main criterion being the country's comparative advantage (also linked to Regional objectives and the dynamics of local products).

The main priority species proposed are: oregano (*Origanum vulgare ssp hirtum*), mountaintea (*Sideritis sp.*), chamomile (*Matricaria chamomilla*), melissa (*Melissa officinalis*), Dittany (*Origanum dictamnus*), Sage (*Salvia fruticosa*, *Salvia officinalis*), Lavender (*Lavandula angustifolia*, and *Lavandin*), Thyme species

(*Thymus sp.*), Rosemary (*Rosmarinus officinalis*), St. John's wort (*Hypericum perforatum*), Cistus, species of *Satureja*, *Crithmum maritimum*, *Thymbra capitata* (Island Thyme), *Rosa canina*, *Vitex agnus castus*, etc.

b. Production of quality, standardised, high value-added products

Aromatic-Pharmaceutical native plant species can be cultivated with the ultimate goal of optimal production of high value-added products, such as dry dew, high quality essential oils, flavourings, edible products.

For large-scale SFM crops to be successful, the crop products produced must be of high quality, with the lowest possible inputs. For this reason, the relevant sectors, trends and quality standards need to be investigated.

c. The main industrial sectors that use PMRs and their products are:

- Flavouring and spices - infusions sector
- Key trends in the flavourings market
- Increasing globalisation and national food
- Preference for flavourings and herbs as natural products
- Healthy lifestyle - healthy diet
- Organic products
- AFP products have a significant market share in prepackaged, semi-prepared foods (pizzas, sauces, juices, etc.), organic foods and beverages (organic flavourings, herbs, infusions) and spice blends.

The following herbs, which are used as seasonings, are among the most commercially available in the EU market: parsley, marjoram, oregano, thyme, thyme leaves, rosemary, basil, mint, tarragon, sage

- **Plant-based health food products (bio-functional foods)**

There is a growing demand for such products. NSAID products are used in them, and most often they are considered dietary supplements. (http://ec.europa.eu/food/safety/labelling_nutrition/supplements_en).

- **Perfumes and aromatic substances**

Essential oils are used as perfumes (food and beverage industry, perfumes, cosmetics, pharmaceuticals). Some are used as phyto therapeutic drugs and in alternative therapies such as aromatherapy. 90% of the world's production is used as flavourings (perfumes, food, beverages, cosmetics). The largest consumers are: USA, Germany, France, Germany, UK and Japan. For species of interest to Greece, essential oils of citrus, eucalyptus, peppermint, lavandin, spearmint, oregano, sage, thyme (*T. vulgaris*), basil, marjoram, chamomile, sage, laurel, rose and hyssop are among the essential oils produced in large quantities worldwide. The prices of essential oils vary from cheap - citrus essential oils to very expensive (rose oil). For aromatic plant cultivation for the production of essential oils, the cultivation - harvesting - processing must be fully mechanised in order to be able to compete with countries with low production costs.

- **Pharmaceuticals and phytotherapeutics**

Compounds derived from plant materials are used as raw materials for the production of semi-synthetic drugs. More than 25% of the world's medicines are derived from natural sources. Phytotherapeutic products are pharmaceutical preparations in the form of extracts, infusions, tinctures, etc., derived exclusively from medicinal plants, using appropriate processes.

In all cases, they are titrated products, with a known composition in terms of the active ingredients they contain.

Regarding the above mentioned genera (see Utilization and conservation of specific priority species) it should be emphasized that the following species are primary material for phytotherapeutic drugs based on the monographs of the European Medicines Agency (www.ema.eu): *Ypericum perforatum* L., *Origanum dictamnus* L., *Salvia fruticosa* Mill., *Salvia officinalis* L., *Sideritis scardica* Griseb.; *Sideritis clandestine* (Bory & Chaub.) Hayek *Sideritis raeseri* Boiss & Heldr. , *Sideritis syriaca* L.; *Thymus vulgaris* L., *Thymus zygis* L.

Therefore, special emphasis should be placed on the cultivation of these species in order to meet the needs of the domestic and European pharmaceutical industry.

For the cultivation - production of raw materials for use in pharmaceutical products, this is mainly done on a contract basis with pharmaceutical companies. This ensures reliable and stable absorption of the product, which must have stable characteristics in terms of its active ingredients and is subject to strict controls at all stages of production. For this reason, specific varieties are grown, or selected Propagating Material. The same applies to the production of raw materials for cosmetics.

- **Cosmetics**

Cosmetic and personal care products use a wide range of ingredients of natural origin: oils, waxes, essential oils, gums, extracts, pigments, etc., are used for various actions, such as hydration, perfuming, antioxidant action, etc. Among the AFPs used: rosemary, peppermint, rose, aloe, calendula, citrus essential oils, etc.

- **Plant protection products**

Products and extracts are used to control insects, pathogens, weeds, etc.

Some well-known plant extracts come from coniferous species, thyme, eucalyptus, mint, oregano etc. For the selection of the cultivated AFP species, the prospective producer should know the final product - market, e.g. whether it is intended for essential oil, the variety - chemotype that grows it should be known. That is, whether oregano has the specifications for quality oregano oil (carbacrol content), whether it grows lavender (linalool and linoleic acetate content) or lavandin (differences in their chemical composition and their respective market).

If it is a product intended for the pharmaceutical industry, the specifications, as defined by international organisations (ISO etc.), pharmaceutical companies, or by companies that have their own standards, must also be known.

Especially for pharmaceutical and cosmetic products, traceability is absolutely essential. In the EU, traceability of raw materials, record keeping and compliance with GAP (Good Agricultural Practice) and GMP (Good Manufacturing Practice) principles are becoming increasingly necessary and most pharmaceutical and cosmetic companies require it. In this way, quality and safety are ensured.

The importance of GAP (Good Agricultural Practice) and GMP (Good Manufacturing Practice) is also evident from the fact that organisations such as WHO, EMEA and EUROPAM have issued relevant guides.

For pharmaceutical and cosmetic products, quality is a function of many parameters: the country of origin, the climate, the individual cultivation, the chemical composition of the plants and the content of specific ingredients, as well as the extraction method used. There is relevant legislation in the EU on the production and marketing of primary plant material for industrial use. Individually, there may be regulations and requirements at national level, or from industry.

In particular, for pharmaceutical uses, there is the relevant European legislation http://ec.europa.eu/health/human-use/herbal-medicines_en, as well as the European Medicines Agency's Committee for Herbal Medicinal Products (HMPC), which issues relevant Monographs for traditional herbal medicinal products.

All procedures for the production of pharmaceutical products must follow GMP, and in particular Directive 91/356/EEC, and its updates.

Similarly for cosmetics, there is relevant European legislation and regulations (<http://ec.europa.eu/growth/sectors/cosmetics/#top>).

The REACH regulation also applies to chemicals, which applies to several components of POPs, such as extracts and essential oils.

In addition, some companies may also require additional certifications from producers or growers, such as certifications regarding the collection of native plants, and in the case of cultivated plants, organic certification cultivation.

In the case of crops grown in developing countries, certifications given by various organisations such as (FLO), International F International (SAI).

There are also relevant ISO Quality Standards for AFS. In particular, ISO 9001:2001 and ISO 9001:2008, for quality management, and corresponding ISO standards for individual plants.

In general, quality is a set of characteristics that AFP products must meet in order to meet the requirements of the industry - end products.

For pharmaceutical products in particular, quality controls relate to the compliance of the product with known standards (concentration of active substances and related controls), mainly those of pharmacists, applicable to the respective drugs.

For flavourings, relevant controls are carried out throughout the entire production, processing, packaging, etc. Relevant guidelines have been issued by the Codex Alimentarius - Code of Hygiene Practice for Spices and dried aromatic herbs, while a revision of the standards is imminent and consultations are ongoing, including on oregano, which is of particular interest to Greece.

- **Promotion of marketing and exports**

The main concern of Enterprise Greece, the national body responsible for extroversion, and other export bodies, is to increase the number of exports to the EU exports and attracting foreign investment, which are important factors for the sustainable development of the country.

For 2017, the organisation has selected priority countries in which it will organise active investment attraction activities (B2B, participation in exhibitions, organisation of conferences/workshops and implementation of specialised actions), including in the sectors of new technologies, agri-food, environmental technologies, supply chain, pharmaceuticals and medical services.

It also plans an integrated program for the promotion of high value-added products and services, including the invitation of buyers and importers from major foreign markets, the organization of business meetings (B2B), the organization of business missions and the organization of events in foreign countries for the promotion of Greek products, the invitation of journalists and food bloggers for the promotion of Greek gastronomy, the organization of Greek weeks in selected super markets, the organization of a series of events

The AFS sector is absent from such activities, as its organisation is very loose and its presence on the market is very small.

- **Priorities for achieving the objectives of the National Strategic Plan**

- a. Recording, classification and conservation of native NTFPs of Greece**

- **Inventory of native MAPs in Greece**

Greece, in relation to its size, has particularly rich plant genetic resources and an extremely high number of different plant species (6,500 species) of which about 20% are of aromatic-medicinal value. In order to obtain propagating material of indigenous species, it is essential to carry out botanical collections for those species that are preserved in existing collections or do not cover representative populations. The collection, cataloguing and study of existing knowledge from floral literature concerning the Greek flora is essential. More specifically, for the identification of plants in their natural environment, basic information concerning (a) morphological description of the different species, (b) their distribution area, (c) different habitats where they grow, altitudinal range and substrates on which they occur, (d) period their flowering and fruiting. On the basis of the above, research missions are organised with the participation of specialised scientists and technicians in order to identify target plants in the natural environment and to collect living material from them in the form of seeds, bulbs, cuttings or whole living plant individuals.

The creation of a database, which will be under the supervision of the Ministry of Rural Development and Food and which will collect all the material from the scattered studies that have been done so far, is essential.

✓Classification of native MAPs with the aim of creating Greek NTFP varieties for priority species or specific clones (chemotypes)

It is difficult to distinguish the species of certain genera that are cultivated or collected from wild populations. Typical cases :

- **Sideritis L.** Many species of this genus (e.g. mountain tea) are native to Greece. In addition, many species includes subspecies with limited distribution which may have qualitative and quantitative differences in their constituents. *S. clandestina* Hayek is endemic to southern Greece (Peloponnese), *S. perfoliata* is native to northern Greece, *S. raeseri* Boiss.& Heldr. and *S. scardica* Grieseb grow in Northern and Central Greece and finally *S. scardica* Grieseb is native in Northern Greece and *S. scardica* Grieseb is native in Central Greece. *S. euboea* Herd. and *S. syriaca* L. occur exclusively in Evia and Crete.

- **Origanum vulgare L.** includes three subspecies in Greece: subsp. *hirtum* (Link) Letswaart, subsp. *viridulum* (Martin-Donos) Nyan and subsp. *vulgare*. Of these, only subspecies *hirtum* is considered to be an essential oil-rich plant, while the other two are relatively poor. In addition, *Origanum onites* L. is an essential oil-rich species, which is very similar to the essential oil of *O. vulgare* subsp. *hirtum*. *O. onites* is a species found in abundance on the Aegean islands and Eastern Crete, where it is used as oregano.

It should also be mentioned that *Thymbra capitata* (*Coridothymus capitatus*) (L.) Reichenb. Fil. (thyme) and *Satureja thymbra* L. (thurible) are essential oil-rich plants with a high carvacrol content and could be included in the oregano harvested.

- **Mint** collected from wild populations could be *M. aquatica* L., *M. arvensis* L., *M. longifolia*, *M. suaveolens* Ehrh *pulegium*, etc.
- **Salvia** in Greece includes, among others, the commercially important *S. officinalis* L., *S. sclarea* L., which are native only in Northern Greece and *S. fruticosa* Miller, which is endemic to Central and Southern Greece, the Aegean islands and Crete. The most likely is that all of the sage harvested is *S. fruticosa*, the so-called Mediterranean or Greek sage, which is very rich in essential oil (up to 7% o/b) with 1,8-quinol as the main component (up to 60% of the essential oil).

✓ **Conservation in Gene Banks (GBs) or Botanical Gardens (BGs)**

Initially, plant genetic resources maintained in the Genetic Material Banks, Botanical Gardens and botanical collections in Greece can be exploited, which have valuable genetic material that can be given to research and academic institutions for improvement projects.

It is worth noting that the cultivation and improvement of aromatic and medicinal species preserved in TGIs, botanical collections and B.C., will contribute decisively to the protection of the environment and to the limitation of indiscriminate collection from nature, thus reducing the risk of extinction of many native species of aromatic medicinal plants.

The Balkan Botanical Garden of Kroussia (BBKK), the Department of Aromatic Medicinal Plants, and the ELGO-DIMITRA, as well as other institutions such as MAICH, Universities and some botanical gardens in Greece collect, preserve and reproduce species of Greek flora with aromatic, medicinal, apicultural and ornamental use. Some of them the above mentioned institutions have available Multiplication Material in limited quantities.

b) Establishment of a framework for the collection, pilot production and sustainable use of the country's native and/or endemic flora - Amendment of legislation.

- **Conducting** a study, as mentioned above, to obtain timely and targeted information on the marketing and international markets and trends of PSAs. In particular, data on international markets such as: types of PAPs traded - varieties or chemotypes, products (dry dew, essential oils), packaging, specifications, prices, etc.
- **Amend** legislation and establish a framework for the collection, conservation, sustainable use and benefit from access to the country's endemic flora, setting out the conditions for the collection of genetic material from nature and cultivation of endemic plants, so that there is a risk of erosion of natural populations by transferring species and genetic material to remote places with different biodiversity. In practice, it is advisable to implement and supplement where necessary the National Strategy for Biodiversity Conservation that already exists (Ministry of Environment, Energy and Climate Change) in cooperation with the Ministry of Agriculture, Forestry and Environment.
- **Strengthening** actions for the collection, recording, protection, conservation, documentation and characterisation of native NTFPs (Genetic Material Banks, botanical collections and Gardens). Exploitation of all published work on the recording of NTFPs in different regions of Greece.
- **Production** of certified propagating material and creation of Greek varieties

It is necessary to create Greek varieties for priority species with high demand, especially Greek oregano (*Origanum vulgare* ssp *hirtum*), chamomile (*Matricaria recutita*), sage (*Salvia fruticosa* and *Salvia officinalis*), mountain tea (*Sideritis* sp.), but also for other species, if priority is given and the conditions are met: research potential, resources, market demand, etc. This will eventually contribute to certified Propagating Material (PM) of the respective species, and will reduce the massive imports of foreign PM, as well as the mixing of species and chemotypes, in nurseries. The work of creating varieties, as is well known, is a long one, and has already proceeded at ELGO-DIMITRA (Institute of Genetic Improvement and Plant Genetic Resources / Department of Aromatic and Medicinal Plants) for above species. The next stage in the creation of varieties is their registration in the National Catalogue of Aromatic Medicinal Plant Varieties and then the certification of the P.Y.

In addition, following an investigation, files of applications for plant variety protection can be submitted to the CPVO for certain priority species of NTFPs and to protect clones (chemotypes) derived from asexual reproduction and kept as mother plants in approved nurseries.

- **Strengthening research** for priority species in all sectors (primary production, processing-innovated products).
- **Education - training**, in all Regions, with a training of trainers training programme and then beneficiaries, which can be developed jointly by ELGO-DIMITRA, Universities, TEI, Producers Associations, Industrialists Association, etc.

It is necessary and essential to train and inform producers about the practices applied in order to enhance the quality and quantity of products.

Training in organic farming is also necessary in order to strengthen certified production.

- **Creation of experimental plantations**

It is proposed to implement pilot schemes for the cultivation of selected plant species. A prerequisite for this is the mass breeding of species, which can be done by nurseries in order to the required number of plants is produced. Cultivation can then be carried out in two stages. First, to study the growth of the plants in experimental fields and in the next phase to apply the results of the above research to large pilot fields in the area of origin of each species. The information will concern planting density, specific crop characteristics such as nutritional and irrigation needs, pest/disease susceptibility, correlations between soil and climatic parameters and quantitative and/or qualitative characteristics, as well as basic economic data for each crop. Through this study, practical production and marketing guidelines will be derived for the plants under study, which will facilitate the information and training for those interested in engaging and investing in this type of farming.

- **Production of certified wild propagating material**

The ultimate objective is to develop breeding protocols and to maintain selected priority mother plant species in approved nurseries which will contribute to a more integrated cultivation of the selected plant species.

Applied research will therefore focus on the selection of suitable biotypes, development of breeding and cultivation protocols, and all this know-how will be transferred to producers.



3.3.2.5 Strengthening competitiveness

• **Simplification of administrative procedures; Licensing**

The licensing of a business dealing with Aromatic and Medicinal Plants, depending on whether it is only cultivating or processing or processing, or whether it reaches the final product, i.e. packaging and selling, requires certain conditions. The Services of the Ministry of Rural Development and Food can help to simplify the licensing process by providing information to the interested party intending to start such a business ,on the conditions required in order to obtain the license, in order to obtain the plants, grow them, process them and get to the point in the production process where they are needed.

Quite demanding is the packaging plant license for which it is almost necessary to have a certification according to ISO 22000, based on the which can place on the market a product packaged in accordance with the requirements of the legislation.

• **Growing**

✓ Propagating material

It is important to ensure the identity and traceability of propagating material. Its origin, such as genus, species or place of origin and the production process must be known. When the material is certified, it can be counted as value added to the final product.

✓ Control system and labelling

The control system must be well organised and cover all stages of production from the moment they enter the nursery to become productive material, right through to cultivation. At present, controls are inadequate, with the result that the consumer is not protected. It is proposed to amend the Marketing Regulation so that plants delivered from nurseries are accompanied by an "identity card", i.e. the full botanical name, origin, and other relevant information.

In the case of endemic, rare or endangered species (e.g. *Sideritis syriaca*, *Sideritis clandestina*, *Sideritis athoa*, etc.) should the nursery material be produced only under specific authorisation from the competent authorities, and evidence of how the genetic material was obtained.

As regards labelling, it must be accompanied by a corresponding production code for the product, indicating the specific way in which the product is grown, processed and standardised. It protects the final consumer from any risk, particularly to his health, which may come from a material which is to be consumed.

✓ Traceability

If the producer belongs to a network of growers, the recipient of the production (processing company) could implement a control system in line with AGRO 2 standards. In organic farming the problem does not exist, as long as the producer has chosen this farming system consciously and not out of necessity and the controls are real.

The disadvantage is the increase in production costs (certification costs/yearly transition).

✓ Species cultivated/ Production processes

In order to start the implementation of the Strategic Development Plan for Aromatics and Medicinal Plants should initially define certain species, which should be the necessary procedures for their production and then this action should be a good example so that the same procedure can be followed for other species. For example, oregano, sage, mountain tea and thyme are among the most common Greek species. So from the seed or plant or part of the plant collected from nature to the final product, there should be a code, a flow and a detailed description of the processes that will give the consumer the right product.

✓ Good Farming Practices / Growing Guide Edition (Collection, processing, storage)

Good farming practices already exist in various documents and can and should be followed by farmers. As far as the publication of a Growers' Guide per species is concerned, it is requested and should be made programs that include these species with some specifications and with some assumptions from the beginning, so that the growers can achieve the best possible results, quantitatively and especially qualitatively.

✓ Production of organically grown AFPs

Organic products have significant potential for development in our country and some areas could be designated as organic production areas without this being mandatory for all producers. Farmers should be encouraged to produce organic products, which need support from relevant procedures or structures to enable them to have a better market treatment.

As long as the production procedures are followed in an appropriate manner, all necessary codes and all institutionalised practices, the production of organic products could increase as these products are sold at a better price than conventional ones.

✓ Increase in production

It can be achieved when a number of factors are assessed such as:

- suitability of the land
- planting distances
- frequency and quantity of irrigation
- season, amount and ratio of nutrients added through fertilisation
- harvest frequency and/or harvest stage

✓ Reduction of production costs

It can be achieved by increasing the productivity of farms by increasing the area cultivated per farm (with the necessary mechanisation of cultivation). It is important to mention the classical demands of farmers for a reduction in the price of agricultural oil, reduced prices for electricity, better lending conditions from banks for agricultural enterprises.

- **Research and Production, Processing, Processing, Manufacturing, Distribution of Greek products**

a) Strengthening research and innovation and linking it to production

PMR research should aim to address the complex challenges and seize opportunities for the well-being of stakeholders involved in the collection, cultivation, trade of PMRs, or the production of related products. In this direction, the **Ministry of Agriculture** has set a priority to fund applied research to be implemented by ELGO DIMITRA, for priority NTFP species, in the primary production sectors described below. The main objectives of the research will be: the characterisation of the genetic material of the priority species using molecular tools in order to protect the existing National Genetic Resources and to ensure the quality of the products produced. The creation of improved genetic material (both wild and native) and its registration in the National Catalogue or the CPVO. Applied research on cultivation parameters of priority species. Funding and planning will be based on a five-year horizon in order to draw firm conclusions on the yields and economic viability of specific crops in our country.

a.1) Research in primary production

It should focus on the following areas:

- **Biotechnology and Biochemistry**

Biotechnology and biochemistry are very powerful tools for understanding the biochemical and molecular mechanisms and the regulation of the expression of genes and enzymes that control the synthesis of metabolites.

The field of genomics and proteomics helps to understand the regulation of important biosynthetic pathways in selected plants and to identify, characterise and clone genes associated with desired traits. The in vitro synthesis of bio-molecules will release pressure due to poaching in natural resources and protect species in their natural habitat.

The application of biotechnology has shown great promise in the following areas:

- The mass propagation of aromatic and medicinal plants high value plants, whit methods
- Molecular marker-assisted improvement for the development of varieties
- DNA fingerprinting of the genetic material of OFPs to protect intellectual property rights
- The correct identification of species with molecular markers (DNA Barcoding)
- The detection of adulteration of the drug raw material by the PCR technique
- The testing of genetic material for resistance to plant pathogens using molecular tools.

- **Propagating material**

- Creation of NTFP varieties and production of identified selected, wild or native propagating material for priority species. (previously mentioned)
- Research and investigation of variety registration and copyright registration for priority species, in the CPVO.

• **Cultivation of autochthonous plants**

- For the cultivation of native species where no expertise exists, applied research should focus on the selection of suitable biotypes, the development of breeding protocols, and the development of new breeding techniques.

cultivation and all this know-how to be transferred to the producers.

- Plant species breeding by developing species specific protocols is aimed at off-site conservation and research. The methodological approach to plant propagation depends on the nature of the material collected and carried out:

✓ Genetically (with sperm)

✓ Agnomatically (by cuttings, rhizome division, etc.): Widely applied in cases where the plant's specificities and biology require it. Particularly in the case of aromatic-medicinal plants and when selected clones should be retained is the most appropriate way to avoid genetic variation.

✓ Tissue culture: this is an asexual method and can be used in cases of aromatic species that do not root easily by conventional methods. Especially for aromatic-medicinal plants, the original parent material can be reproduced in vitro and then used to grow the plants in the field, a base material for the creation of high quality (elite) propagating material. This methodology, which is very expensive, is mainly applied to medicinal plants by specialised laboratories with the expensive equipment required.

• **Development of experimental plantations and pilot crops**

It is necessary to conduct applied research, according to international standards, on agro-technological parameters for optimizing the yields and quality of AFP, under Greek conditions, as well as their processing. It is proposed to implement pilot projects for the cultivation of selected plant species from the priority species. Particular emphasis will be placed on the study and dealing with enemies and diseases of priority species in cultivation, and in their organic production, as well as the creation of resistant varieties.

- **Monitoring of cultivation through an electronic environment**

- Geographical Information System**

It will provide direct information on the producer, the physical and chemical analysis of the soil, rational fertilization and irrigation. This electronic system may also be enriched with information on the stage of the production process in relation to production costs, yield and any problems encountered in the process of growing each species. In combination with developed fertilisation software for automated calculation of the nutrient requirements of each AFP, the team of scientists can intervene immediately and effectively to solve any problems that arise at any time.

- a.2) Applied research in the management of the produced essential oils**

It concerns the processing, where the drying and distillation of essential oils are of interest, which are the only processing of aromatic plants that are applied in our country, with few exceptions. The dried aromatic plants are used further, at best, only as animal feed.

Consequently a wealth of ingredients remain untapped. The increasing market demand for natural extracts requires a systematic study of the recovery of unused components. In this context, the:

- development of innovative applications and integration into commercial products
- product development for pharmaceutical/cosmetic uses
- product development for the food industry
- utilisation of by-products
- development of processing systems/mechanical equipment
- application of "green" technologies

NSAIDs are rich in "nutraceuticals", i.e. substances that promote health and have medical benefits, such as preventing and treating diseases. The incorporation of the plants themselves or their constituents (essential oils, antioxidants, polyphenols, bioflavonoids) into commercial products can increase the "natural" and "healthy" profile of the product, thus increasing consumer preference. Already in the cosmetics industry, the production of products with embedded natural ingredients with functional properties (e.g. Korres, Apivita has been flourishing for years. In contrast, the development of such innovative food products (functional foods) is very limited. Therefore, in the area of innovative food there is a very large scope for activity in terms of producing ingredients that can be used by existing industries to upgrade their products. Particularly important is the combination of AFPs and their ingredients with the products of the Mediterranean diet, which have a great appeal to consumers worldwide.

In addition, an important need of the food industry is to maintain and increase the shelf life of its products. To date, chemical preservatives have been used, many of which are suspected of being carcinogenic or toxic. Numerous scientific studies have shown that substances from NSAIDs can be used as food preservatives. A typical example are essential oils and antioxidants. So far the essential oils are used as flavouring ingredients in the food industry. However, recent studies have highlighted other properties of essential oils, such as their strong antimicrobial activities, which can be exploited in the field of food preservation. Furthermore, phenolic antioxidants, in addition to preventing cardiovascular and degenerative diseases, contribute to increasing the shelf life of fats.

Natural additives from NFIs can have multiple uses:

- ✓ upgrading an ingestion to functional
 - ✓ preserving the food or increasing its shelf life
 - ✓ improving its organoleptic value (taste odour)
 - ✓ compliance with legislation to eliminate synthetic additives
- As far as legislation is concerned, a European Union Community directive is coming to reinforce the requirement to use natural food additives. Community Directive (EC) (No 1129/2011), which comes into force on 1 June 2013, provides for the elimination of 200 synthetic food additives and a reduction in the permitted concentration levels of the remainder. The food industry is required to manage its needs, consumer demands and legislation by adopting the use of natural food additives, among which products from food additives can play a prominent role. To date, some distilleries for the production of essential oil have been installed in the plants that have been developed in Greece. There is an absolute need to optimise the production and standardisation of products.

In addition, however, the plant matter remaining after distillation is currently a by-product, the disposal of which poses an environmental problem. This by-product is rich in bioactive components (polyphenols, bioflavonoids) with antioxidant, antimicrobial and therapeutic activity and can be used for the recovery of these components. The increasing market demand for natural extracts requires the systematic study of the recovery of unutilized components and the optimization of the respective processes to commercially exploit the maximum of their components. Their further utilisation, beyond essential oil recovery, is feasible as it can lead to recovery efficiencies of up to 25 %.

The above treatment can obviously also be applied to the by-products of dry dew (as long as it is economically advantageous). Also the 'waste' from processing plants, whether distilleries or dry dew, could be used as fertiliser after appropriate treatment (and having excluded the possibility of mutual interference and destruction of the plantation receiving the fertiliser). They are also a pretty good feedstock for plants using solid fuel burners for their distillers or dryers (yes we are utilising our waste but we are also increasing our CO₂ footprint).

It is also proposed to include in the various funding frameworks targeted research topics for AFS, such as:

- applied research, according to international standards, on agro-technological parameters for optimizing yields, quality of AFF, in Greek conditions, reduction of inputs, etc.
- development of innovative applications and integration into commercial products development of products for pharmaceutical/cosmetic uses

- product development for the food industry
- utilisation of by-products
- development of processing systems/machinery application "green" technologies

b) regulations - simplification of procedures - incentives for manufacturing units

Today there are very few processing plants and therefore incentives should be given to create more throughout the Region to meet the needs of production and processing.

c) Standardisation of the production process

The corresponding text on good agricultural practices and the collection of native medicinal herbs is attached in the (Annex A) full version of the plan

d) Definition of a framework of quality controls at all stages

Definition of all controls required for the movement/marketing of PPPs - (phytosanitary controls, case of dry dew, extract/essential oil)

List of laboratories carrying out relevant analyses (soil, residue, microbial load, physico-chemical characteristics, compositional analyses of essential oils - determination of active ingredients, etc.).

Possibility of subsidising analyses for producer groups, associations, cooperatives, social enterprises.

e) Product quality assurance (Certifications - Steps)

Application of quality regulations depending on the product and sector. The first two are covered by the mandatory application of the ISO 22000 system in modifying companies of any size or even by producers who want to vertically integrate their production.

f) Establishment of producer and processor organisations

It is considered necessary to create, based on the new institutional framework, collective professional organizations - cooperatives, as the "collaborate" and "co-operate" in Greece have been discredited.

g) Enhancing marketing and promotion

Conditions required to ensure that the promotion and promotion of aromatic medicinal plant products can be guaranteed as far as possible.

- Ensuring sufficient quantity for promotion and the type of the final product to
- be promoted - displayed (leaves, dried, powder for beverage, oil, etc..).
- Compliance with the required European standards. There must be a certificate / certification.
- Identification of target markets

The establishment of an association of producers and professionals of aromatic - medicinal plants is considered necessary for the promotion and promotion of the final product in the target countries. To define new tools and actions, in addition to the existing ones, for the development and promotion of SFP products.



3.4 MEDICINAL PLANTS IN SERBIA

Serbia, with its favorable climate, good soil characteristics, and easy access to many water sources, possesses significant agricultural potential. The country spans the Balkan region (covering roughly 80%) and the Pannonian plain (about 20%). Over 65% of its expanse is arable land, with the bulk found in Vojvodina, nestled in the Lower Pannonia region.

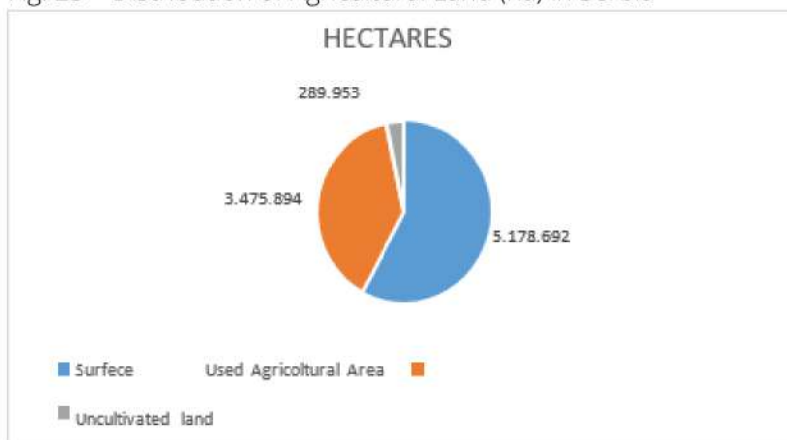
Vojvodina, located in the northeast, is the main agricultural hub, marked by medium to large production units and streamlined operations. The heart of fruit and vegetable production lies in the central region, especially around the capital, Belgrade, catering predominantly to the local market. In contrast, the agricultural sector in Serbia's southern region falls behind in competitiveness.



Fig. 22 – Political Map of Serbia

According to data from the Statistical Office of Serbia, in 2018, the total available agricultural land in Serbia is 5,178,262 hectares, with an Arable Land (SAU) of 3,475,894 hectares. Of this land, 18.7% is covered by forests, 5.5% consists of unused land, and 8.5% is classified as other types of land.

Fig. 23 – Distribution of Agricultural Land (ha) in Serbia



Source: Statistical Institute Serbia, 2018

The predominant crops in Serbia include corn, wheat, sunflower, sugar beets, soybeans, potatoes, apples, plums, and grapes.

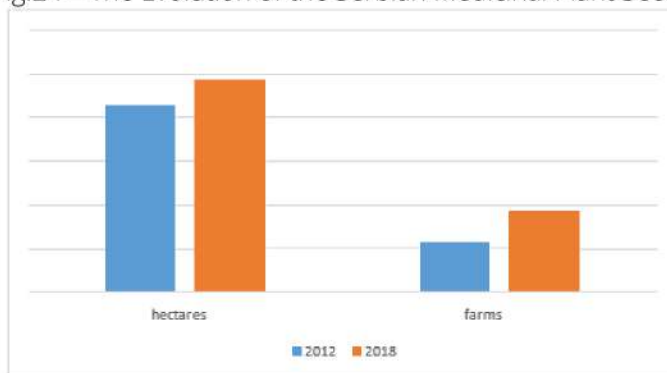
Nearly half of the 564,540 agricultural enterprises are smaller than 2 hectares and utilize only 10% of the total Arable Land (SAU).

In terms of biodiversity, Serbia is ranked among the top 158 centers in the world. More than 700 plant species with medicinal properties have been identified in its rich flora, with 400 species of medicinal plants recorded, of which 280 species are commercialized as industrial raw materials used for the production of medicines, cosmetics, hygiene products, spices, and various extracts.

Serbia's mountainous terrains are ideal for the cultivation and harvesting of medicinal plants, high quality attributed to an abundant and balanced composition of active ingredients. These regions reap the benefits of optimal environmental factors, including a favorable climate in terms of precipitation, temperature, sunshine, and humidity, along with superior soil quality. The prevalence of low-input farming, particularly in the hilly-mountainous areas dedicated to wild medicinal plant harvesting, ensures that the soil, air, and water remain untainted by pesticides, heavy metals, and synthetic fertilizers, preserving the pristine condition of these natural resources.

Serbia's medicinal, aromatic, and spice plants sector has seen a resurgence in recent years, marked by advancements in technology, standards, and market expansion. Data from the Statistical Office of the Republic of Serbia shows a noticeable progression in the industry between the 2012 census and 2018 records, both in enterprise numbers and cultivation area. Enterprises grew from 558 to 930, and cultivation hectares expanded from 2,134.49 to 2,430 over this period.

Fig.24 – The Evolution of the Serbian Medicinal Plant Sector (2012/2018)



Source: Elaborated by CREA based on data from the Serbian Statistical Office.

The region most suitable for the cultivation of medicinal and aromatic plants in Serbia is Vojvodina, where 86% of the dedicated area is concentrated. Here, crops such as chamomile (*Matricaria chamomilla*), lemon balm (*Melissa officinalis*), valerian (*Valeriana officinalis*), hybrid mint (*Mentha x piperita*), hyssop (*Hyssopus officinalis*), thyme (*Thymus vulgaris*), coriander (*Coriandrum sativum*), caraway (*Carum carvi*), lovage (*Levisticum officinale*), artichoke (*Cynara scolymus*), anise (*Pimpinella anisum*), marshmallow (*Althaea officinalis*), echinacea, and others are primarily cultivated.

In 2018, data on the Size of Agricultural Utilized Area (SAU) class revealed a varied landscape of agricultural businesses involved in cultivating medicinal plants. Nearly a third (29.5%) of these companies operated on up to 2 hectares of land, making up 3.5% of the total area designated for medicinal plant cultivation. A significant majority, over 59%, were situated on plots ranging from 2 to 30 hectares, utilizing close to 46% of the nation's total medicinal plant cultivation area. Larger scale operations were less common; those with 30 to 50 hectares made up 7.7% of companies and 27.9% of the total SAU. Companies with 50 to 100 hectares represented 2.3%, and those exceeding 100 hectares constituted 1.3%, yet the latter covered a sizable 23% of the total SAU.

Fig. 25 – Surface area dedicated to MPs (%) divided into SAU classes

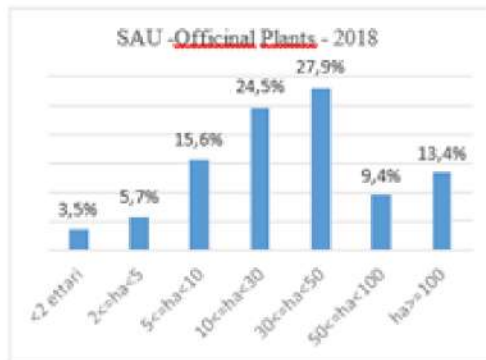
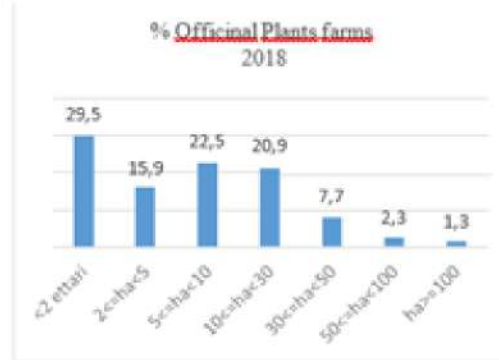


Fig. 26 - Companies engaged in the cultivation of MPs (%) divided into UAA classes



Source: Elaborated by CREA based on data from the Serbian Statistical Office.

Finally, according to UN-Comtrade data, in 2021, Serbia imported 1,034 metric tons of medicinal and aromatic plants valued at 3.6 million dollars, while its exports, worth 8.5 million dollars, amounted to 2,002 metric tons of plants.

Fig. 27 - Import/export of MPs(\$) Serbia (2021)

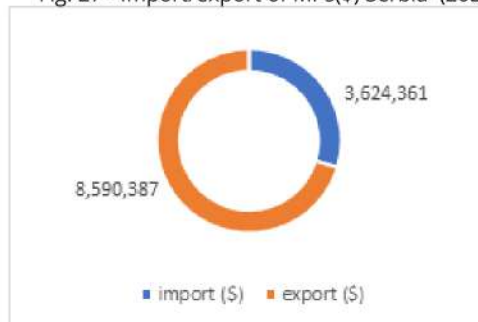
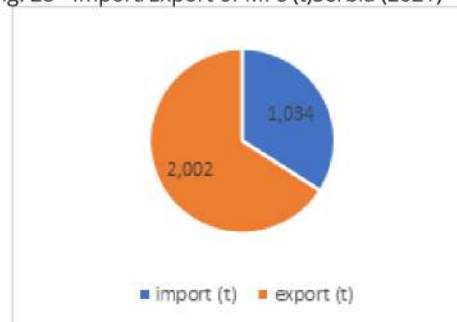


Fig. 28 - Import/Export of MPs (t)Serbia (2021)



Source: Elaborated by CREA based on data from UN-Comtrade (2021)

In 2021, Germany was the leading importer of Serbian medicinal and aromatic plants, receiving 901 metric tons. In contrast, Italy imported 82 metric tons. A comparison between 2017 and 2021 data highlights a 55.6% increase in imports by trade value and an approximately 87% surge in quantity. Export figures also rose, with a 25.5% increment in trade value and a 10.5% growth in quantity.

Fig. 29 - Import (var. %)
commercial value (\$) quantity (t), (2017-2021)

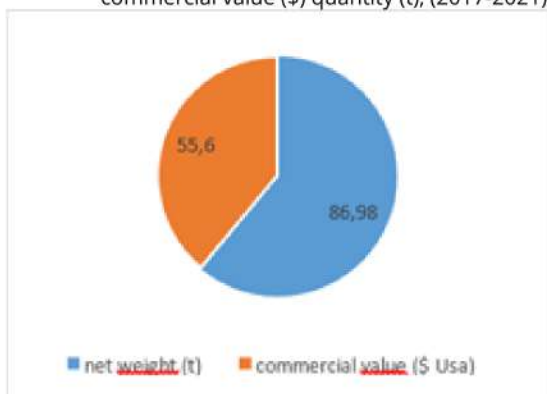
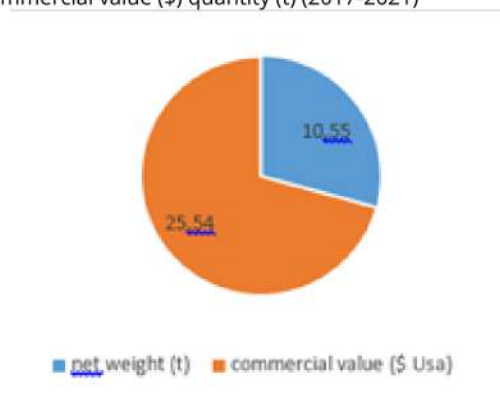


Fig. 30 - Export (var%)
commercial value (\$) quantity (t) (2017-2021)



Source: Elaborated by CREA based on data from UN-Comtrade (2021)



Source: Elaborated by CREA based on data from UN-Comtrade (2021)



CONCLUSIONS

Medicinal plants have historically held profound significance, with their social and economic impacts woven deeply into the fabric of human history. This has influenced the diverse use of numerous species over time, an evolution accelerated by the emergence of fields like ethnobotany. Today's applications of these plants are less about innovation and more a reflection of the extensive, detailed knowledge amassed over centuries. The intricate understanding of the myriad properties of these plants has been enriched continuously by the discovery of new species and bolstered by advancements in modern technology.

The multifaceted roles of medicinal plant production and its diversifying applications have magnified the sector's potential. A rising consumer demand for natural substances for therapeutic, cosmetic, health, and dietary applications drives this expansion. This demand is typically satisfied by harvesting known species, drawing collective attention to them. However, this method of sourcing has ignited concerns about diminishing biodiversity. Cultivation is seen as a solution to counteract the environmental impact of unchecked, excessive wild harvesting, which has morphed into a commercial activity in certain regions.

Genetic enhancement through sophisticated manipulation techniques has notably advanced the field of medicinal plant cultivation. For instance, in vitro cultures enable the rapid production of a large volume of plants, each mirroring the exceptional characteristics of a single specimen.

Genetic modification techniques, especially those silencing specific genes, are instrumental in eliminating undesirable traits. Such technological strides are pivotal in meeting the escalating demands of both the scientific fraternity and the expansive market.

Both Italy and Greece have embarked on diverse initiatives to invigorate and modernize the medicinal plant industry. Italy's recent legislative decree, which supersedes the 1931 law, and Greece's 2017 Strategic Development Plan for the Cultivation, Processing, and Marketing of Medicinal Plants, are chiefly tailored to re-imagine and re-strategize the sector in new directions. These reformative steps have arisen not just from the evolutionary trajectory that has seen the application of medicinal plants extend beyond conventional therapeutic uses but are also influenced by the need to safeguard popular consumption trends. Additionally, they are a response to emergent market demands catalyzed by the sector's expansion and the amplified requirements in diverse fields, including cosmetics and veterinary products. In summary, future prospects point to a complex interplay of various issues:

Market: This includes the global increase in prices and exports, as well as the support for the demand for aromatic and medicinal plants from the pharmaceutical and food industries, as well as consumers. Production: The transition from wild harvesting to cultivation stands as a pivotal element in the future trajectory of the sector. Environment: Increasing pressure to preserve the natural populations of these plants is emerging, highlighted by their intrinsic ecological importance. Economic: Sustaining the sector's growth trajectory in the upcoming years is a critical economic consideration.

A prominent concern in the sector is price dynamics. Forecasts for international prices of aromatic and medicinal plants predict a trend reminiscent of the 2007-2008 surge, where prices escalated from \$10/kg to \$12/kg. This anticipated rise will command the attention of the pharmaceutical and food sectors as they grapple with inflated production costs, though it promises substantial gains for producers. Assuming steady productivity, elevated production expenses will translate to higher retail prices, affecting consumer demand. This economic interplay intensifies the strain on wild medicinal plant populations, already vulnerable to overharvesting and illegal collection. This is particularly pronounced in developing nations where the lucrative nature of these activities exacerbates the issue.

In the context of sustainability, multifunctionality, and biodiversity, the sector continues to offer highly promising opportunities and contributes to the creation of employment opportunities that can counteract depopulation in mountainous areas, particularly among the youth. The goal is to revitalize regions capable of reconciling the need for a notably fragile presence in mountainous areas with individual success, thereby promoting sustainable socio-economic and environmental development. The systematic approach adopted by companies in cultivating medicinal plants stands out as a notable strength, enriching both product quality and the well-being of those engaged in the process. Corporate multifunctionality serves as an effective tool for elevating other actions within the company, structuring them to be as substantial as the primary function and enhancing their economic, environmental, and social impacts. Furthermore, when considering the benefits that the territory can accrue through the services provided by the company, which can extend to sectors such as tourism, recreation, culture, education, and more, it becomes natural to envision potential scenarios.

One plausible starting point for developing such a corporate path involves the identification and quantification of globally provided ecosystem services. This process requires knowledge and awareness, both from a business perspective and from various stakeholders, regarding the opportunities created for the community's well-being. This approach provides the business sector with a fresh outlook on the relationship between its activities and the environment, facilitating a clearer comprehension of the ongoing challenges amidst environmental degradation [58].

Ecosystem services are a valuable tool for integrating the multifaceted vision of agricultural production experiences, such as companies dedicated to cultivating medicinal plants. These companies are also inherently involved in the natural socio-territorial regeneration as part of their corporate mission. As biodiversity declines [59] and ecosystems become more fragile, the risk of losing certain ecosystem services, especially those linked to community well-being, has become increasingly apparent. Consequently, there is a growing need for an approach that comprehensively considers both agricultural and environmental systems, embracing cultural and ecological aspects. This strategic perspective is vital for ensuring social, economic, and ecological stability in the medium and long term, benefiting both companies and the broader public. The current programming period [60] outlines a set of objectives, where sustainability and inclusivity embark on a new trajectory, emerging as pivotal drivers of competitiveness, both within the sector and regionally.

APPENDICES

APPENDIX 1– Uses of medicinal plants in the province of Rieti (Lazio)

Nome botanico alberi e arbusti della prov. di Rieti	Principali usi secondo la letteratura	Usi reatini secondo la tradizione orale
<i>Aesculus hippocastanum</i> L.	Astringente, tosse, affezioni tendinee, varici, venotonico, antinfiammatorio, reumatismi, emorroidi, flebite, cellulite	Reumatismi, dolori articolari
<i>Arbutus unedo</i> L.	Astringente, diuretico, prostatiti e cistiti, depigmentante	Diuretico
<i>Artostaphylos uva-ursi</i> (L.) Spreng.	Diuretico, disinfettante delle vie urinarie, prostatite, cistite, gotta	Disinfettante vie urinarie
<i>Asparagus acutifolius</i> L.	Cistiti e infiammazioni delle vie urinarie	Diuretico o disintossicante
<i>Asparagus officinalis</i> L.	Diuretico, digestivo	Digestivo
<i>Buxus sempervirens</i> L.	Purgativo, sudorifero, antifebbre	Antifebbre
<i>Citrus limon</i> (L.) Burm	Digestivo, dissetante, antisettico	Digestivo
<i>Citrus sinensis</i> (L.) Osbeck	Antispasmodico, aperitivo, aromatico, digestivo, sedativo	Malattie da raffreddamento
<i>Cornus mas</i> L.		Disinfettante, cicatrizzante
<i>Crataegus monogyna</i> Jacq. subsp. <i>monogyna</i>	Calmante, antispasmodico, insonnia, aritmia cardiaca, ipertensione arteriosa, spasmi dell'apparato digerente	Coadiuvante diete dimagranti come sedativo, nella cura delle vertigini
<i>Cydonia oblonga</i> Mill.	Regolatore funzioni intestinali	Regolatore intestino
<i>Ficus carica</i> L.	Lassativo	Regolatore intestino
<i>Fraxinus ornus</i> L.	Lassativo, emolliente, bechico	Cicatrizzante

<i>Hedera helix</i> L. subsp. <i>helix</i>	Catarrhi cronici, vie respiratorie, gotta, reumatismi, nevralgie, cellulite, sedativo, analgesico	Antinevralgico, callifugo, contro acne
<i>Junglans regia</i> L.	Astringente, antiscrofoloso, antidiabetico, angine, tracheobronchiti, otiti, eczema, acne, antinfiammatorio pancreas	Cicatrizante, cura dell'acne
<i>Juniperus communis</i> L. subsp. <i>communis</i>	Diuretico, disinfettante urinario, stomachico, bronchiti, malattie da raffreddamento, vulnerario, lenitivo, antireumatico	Emmenagogo, calcoli renali
<i>Laurus nobilis</i> L.	Olio per la preparazione di pomate	Contro le punture di insetti, dolori addominali, gastrite, reumatismi, contusioni, slogature, aerofagia, calvizie.
<i>Lavandula latifolia</i> Medik.	Antisettico, vulnerario, antispasmodico, calmante per la tosse	Antitussivo, stomachico, per rinfrescare l'alito
<i>Malus domestica</i> (Borkh.)	Regolatore intestinale, malattie da raffreddamento	Problemi intestinali, malattie da raffreddamento, infiammazioni cutanee, malattie respiratorie
<i>Nerium oleander</i> L.	starnutatorio	Starnutatorio
<i>Olea europaea</i> L. subsp. <i>europaea</i>	Amaro, febrifugo, ipotensore, antispasmodico, ipoglicemizzante, nevralgia, diuretico, antisettico, vasodilatatore, antiossidante, pressione arteriosa, broncodilatatore, antipiretico, diuretico	Irritazioni da punture di insetti, per sciogliere i tappi di cerume, nelle bronchiti.
<i>Prunus avium</i> L.	Diuretico, lassativo, gotta	Gotta, lassativo, diuretico
<i>Prunus spinosa</i> L.	influenza	Malattie da raffreddamento
<i>Punica granatum</i> L.	Infezioni gastrointestinali, astringente, circolazione	Astringente
<i>Pyrus communis</i> L.		Fettine come cicatrizzante
<i>Robinia pseudacacia</i> L.	Purgante, colagogo	Dolori addominali
<i>Rosa canina</i> L.	malattie renali, della vescica, del diabete, lassativo, diuretico, malattie della pelle, cefalea	Dolori gastrici, coliche renali
<i>Rosa</i> sp. pl.		Cicatrizante
<i>Rosmarinus officinalis</i> L.	disturbi dispeptici, contro i reumatismi muscolari o articolari.	Digestivo, contro i reumatismi, calvizie, asma e malattie da raffreddamento
<i>Rubus ulmifolius</i> Schott	Malattie della gola	Disinfettante cicatrizzante, accessi dentari, contro l'acne, contro il mal di gola.

<i>Ruscus aculeatus</i> L.	Microcircolazione	Digestivo
<i>Salvia officinalis</i> L. (coltivata)	Aromatico, antidiabetico, emmenagogo, antidiabetico, antiossidante	Scopo digestivo, gastrite, acidità di stomaco, disturbi intestinali, mal di gola, sbiancante denti
<i>Sambucus nigra</i> L.	Diuretico, diaforetico, emetico, purgativo, malattie da raffreddamento	Cura ascessi, contro acne, per scottature e infiammazioni cutanee, dolori artrici, tosse, contusioni, pediluvi.
<i>Sorbus aucuparia</i> L.	Antidiarroico, astringente, antinfiammatorio	Frutti come lassativo mentre i frutti cotti come astringenti
<i>Thymus serpyllum</i> s.l.	Antisettico, diuretico, contro il meteorismo, per la microcircolazione	Digestivo, gonfiari addominali
<i>Tilia cordata</i> Mill.	Diaforetico, emolliente, antispasmodico, vie biliari, dispepsia	Tosse, bronchiti
<i>Tilia platyphyllos</i> Scop. <i>subsp. platyphyllos</i>	Diaforetico, emolliente, antispasmodico	Tosse, bronchiti
<i>Ulmus minor</i> Mill. subsp. minor		Disinfettante, emostatico
<i>Vitis vinifera</i> L.	Astringente, diuretico, disturbi della menopausa, cellulite	Problemi intestinali, tosse, raffreddore, coliche epatiche e renali

APPENDIX 2 – Uses of Officinal Plants in Basilicata

Nome botanico/ Famiglia botanica	Nomi popolari/ Parti utilizzate/ Principali usi	AREE DELLA BASILICATA			
		Media Valle dell'Agri	Castelmezzano	Arbereshe	Vulture
<i>Allium ampeloprasum</i> L/ <i>Liliaceae</i> s.l.	Nome popolare		u aglie – ardidde –		u aglie – ardidde –
	Parte della pianta utilizzata		bulbo		bulbo
	Uso culinario		frittata		frittata
	Uso medicinale		anticoolesterolemica, antiasmatica, antispasmodica, diaforetica, espettorante, vasodilatatrice, antisetica, febbrifuga, stimolante, stomachica, diuretica, tonica.		anticoolesterolemica, antiasmatica, antispasmodica, diaforetica, espettorante, vasodilatatrice, antisetica, febbrifuga, stimolante, stomachica, diuretica, tonica.
<i>Allium orsinum</i> / <i>Liliaceae</i> s.l.	Nome popolare				
	Parte della pianta utilizzata	foglie			foglie
	Uso culinario				
	Uso medicinale				Le foglie, commestibili, hanno le stesse proprietà stimolanti e curative dell'aglio

<i>Allium schoenoprasum</i> L./Amaryllidaceae	Nome popolare				
	Parte della pianta utilizzata	foglie			
	Uso culinario	aromatizzante			
	Uso medicinale				
<i>Allium sativum</i> L./Amaryllidaceae	Nome popolare				
	Parte della pianta utilizzata			bulbo	
	Uso culinario			schacciato e mangiato crudo	
	Uso medicinale			vermifugo	
<i>Allium cepa</i> /Liliaceae s.l.	Nome popolare				
	Parte della pianta utilizzata			bulbo	
	Uso culinario			cucinato	
	Uso medicinale			galattogogo	

<i>Arbutus unedo</i> L./Ericaceae	Nome popolare	gan'1			
	Parte della pianta utilizzata	frutta			
	Uso culinario	frutta fresca			
	Uso medicinale				
<i>Amaracia rusticana</i> Gaerm. Mey. et Scherb./Brassicaceae	Nome popolare	zattera			
	Parte della pianta utilizzata	radici			
	Uso culinario	aromatizzanti, frittate o con uova, formaggio e pasta			
	Uso medicinale				
<i>Amaranthus retroflexus</i> L./Amaranthaceae	Nome popolare		u pede "rosse"	Nen	
	Parte della pianta utilizzata		Giovani germogli	foglie	
	Uso culinario		Bollito e fritto	scottate e/o ripassate in padella	
	Uso medicinale				

<i>Anagallis arvensis</i> /Primulaceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Usata per la cura delle eruzioni cutanee e, secondo antiche credenze, per curare la malinconia.
<i>Anagallis foemina</i> /Primulaceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Usata per la cura delle eruzioni cutanee e, secondo antiche credenze, per curare la malinconia.
<i>Anchusa italica</i> RETZIUS/Boraginaceae	Nome popolare		u sucamele		
	Parte della pianta utilizzata		fiori		
	Uso culinario		Succhiato come spuntino		
	Uso medicinale				

<i>Anchusa officinalis</i> Boraginaceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Pur in presenza di diversi composti attivi è poco usata nel campo erboristico, è sostituita dalla borragine che presenta le medesime proprietà
<i>Apium nodiflorum</i> (L.) Lag./Apiaceae	Nome popolare	crescione		Shkafonë Shërpër (ta ëmbël) Thundëre	
	Parte della pianta utilizzata	foglie		parti aeree	
	Uso culinario	zuppa di verdure miste, saltata in padella		crude in insalata	
	Uso medicinale				
<i>Arbutus unedo</i> L./Ericaceae	Nome popolare		a grume		
	Parte della pianta utilizzata		frutti		
	Uso culinario		Crudo come spuntino		
	Uso medicinale				

<i>Armoracia rusticana</i> GAERTNER, MEYER ET SCHERB/Brassicaceae	Nome popolare	rafant	u rafane ^m		
	Parte della pianta utilizzata	radici			
	Uso culinario	aromatizzante fritte o con uova, formaggio e pasta	A crudo, macinato su fe ^m re ^m cidde ^m , con formaggio e salsa di maiale; cotto: rafanate ^m (nel periodo di Carnevale): torta di uova, formaggio, pezzetti di salsicce fatte in casa, e radice macinata di A. rusticana		
	Uso medicinale				
<i>Arum italicum</i> /Araceae	Nome popolare				
	Parte della pianta utilizzata				bacche e rizoma
	Uso culinario				
	Uso medicinale				Conosciuta sin dall'epoca romana come medicinale, la pianta è velenosa. L'ingestione provoca gravissimi disturbi, nonché l'avvelenamento, tuttavia la cottura annulla la sostanza velenosa (un composto analogo all'acido cianidrico)

	Parte della pianta utilizzata				tubercoli
	Uso culinario				
	Uso medicinale				Si presta per uso esterno come cura di dermatosi e scottature solari .
<i>Asparagus acutifolius</i> L./Asparagacee	Nome popolare	sparasc'	u sparace' (de' sparaogne)	Sparengjë Sparenj Sparën	
	Parte della pianta utilizzata	germogli	germogli		
	Uso culinario	fritto con uova e salame	Bollito, poi con uova strapazzate e tradizionalmente fritte in zugne (specialmente a Pasqua)		scottati, poi in frittate
	Uso medicinale	benessere dei reni (acqua di cottura fredda)	diuretico		
<i>Atriplex hortensis</i> L./Chenopodiaceae	Nome popolare		u jetone'		
	Parte della pianta utilizzata		Foglie; steli		
	Uso culinario		Bollito e fritto; immerso in uova e mais pasto, poi fritto in olio d'oliva		
	Uso medicinale				

<i>Bellavalia romana</i> Liliaceae s.l.	Nome popolare		u cipudde "ne" (bianche)		
	Parte della pianta utilizzata		bulbi		
	Uso culinario		bollito in acqua, e in salamoia in olio d'oliva, aromatizzare con peperoncino, aglio e menta		
	Uso medicinale				
<i>Beta vulgaris L. ssp. Marzima (L.)</i> Arcang./Amarantoceae	Nome popolare	iet'			
	Parte della pianta utilizzata	foglie			
	Uso culinario	da solo in zuppa o con fagioli			
	Uso medicinale				
<i>Beta vulgaris L. ssp. Vulgari (L.)</i> Arcang./Chenopodiaceae	Nome popolare		a jete		
	Parte della pianta utilizzata		foglie		
	Uso culinario		Bollito e fritto in olio d'oliva con peperoncino; u calzone "pe" le jete": foglie bollite, poi mescolate con formaggio, come ripieno per calzone		
	Uso medicinale				

<i>Borago officinalis</i> L./Boraginaceae	Nome popolare	burracoia	a vurrascine /a sucamele	Vërajnë	
	Parte della pianta utilizzata	foglie	foglie; fiori	foglie	foglie
	Uso culinario	da solo in zuppa o con fagioli, frittelle	Zuppa (con altre verdure), generalmente servito con ricotta essiccata macinata; risucchiato come merenda	scottate e/o ripassate in padella	
	Uso medicinale		Galattagogo	Galattagogo, ricostituente post- parto	Nella medicina popolare è ritenuta depurativa del sangue, diuretica e sudorifera, calmante per la tosse
<i>Brassica rapa</i> L. ssp. <i>Rapa</i> (DC.) METZG./Brassicaceae	Nome popolare		a cime / rape		
	Parte della pianta utilizzata		parti aeree		
	Uso culinario		bollita e frita		
	Uso medicinale				
<i>Calendula</i> <i>arvensis</i> /Compositae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario		l		
	Uso medicinale				potente antisettico, serve a preparare pomate dermatologiche Produce calendulina, gomma, olio essenziale, colorante, acido salicilico, mucillagine.

<i>Capsicum longum</i> L./Solanaceae	Nome popolare				
	Parte della pianta utilizzata			frutto	
	Uso culinario			seccati e fritti	
	Uso medicinale			febbrifugo	
<i>Cardus pinocephalus</i> L./Asteraceae	Nome popolare	cardone, scardunehi'			
	Parte della pianta utilizzata	steli			
	Uso culinario	bollito, saltato in padella			
	Uso medicinale				
<i>Carlina acaulis</i> L./Asteraceae	Nome popolare		a carrine		
	Parte della pianta utilizzata		ricettacolo florale		
	Uso culinario		Farcito con formaggio e uova; fritto		
	Uso medicinale				

<i>Carthamus caeruleus</i> L./Asteraceae	Nome popolare	cardone, scardunech'			
	Parte della pianta utilizzata	steli			
	Uso culinario	bollito			
	Uso medicinale				
<i>Capparis spinosa</i> L./Capparaceae	Nome popolare				
	Parte della pianta utilizzata	cucunci			
	Uso culinario	aromatizzante			
<i>Castanea sativa</i> MILL/Fagaceae	Nome popolare	a castagne ⁻			
	Parte della pianta utilizzata	semi			
	Uso culinario	Bollito con alloro e frutti di finocchio selvatico; arrostito			
	Uso medicinale				
<i>Chenopodium album</i> L./Chenopodiaceae	Nome popolare	u scene ⁻ sohe ⁻			
	Parte della pianta utilizzata	radici, germogli			
	Uso culinario	bollito e fritto			
	Uso medicinale				

<i>Chenopodium album</i> L./Chenopodiaceae	Nome popolare	Ljabot			
	Parte della pianta utilizzata	foglie			
	Uso culinario	bolite e ripassate in padella			
	Uso medicinale				
<i>Cichorium intybus</i> L./Asteraceae	Nome popolare	cicoria	a cicoire	Çikour	
	Parte della pianta utilizzata	foglie	Giovani spirali	rosette	
	Uso culinario	insalate, da solo in zuppa o con fagioli	Crudo: insalate miste; bollito; bollito, poi fritto con olio d'oliva, aglio, peperoncino, a volte salsa di pomodoro con verdure miste	scottate e/o ripassate in padella	
	Uso medicinale	benessere del fegato (acqua di cottura fredda) foglie cotte; lassativo		depurativo del sangue	
<i>Chondrilla juncea</i> L./Asteraceae	Nome popolare			Gjumë, Ngjumës	
	Parte della pianta utilizzata			rosette basali e giovani getti	
	Uso culinario			crudi in insalata; scottati e/o ripassati in padella	
	Uso medicinale				
<i>Citrus lemon</i> L./Rutaceae	Nome popolare				
	Parte della pianta utilizzata			foglie	
	Uso culinario			crudo	
	Uso medicinale			antidiarroico	

<i>Chenopodium album</i> L./Chenopodiaceae	Nome popolare	Ljabot			
	Parte della pianta utilizzata	foglie			
	Uso culinario	bolite e ripassate in padella			
	Uso medicinale				
<i>Cichorium intybus</i> L./Asteraceae	Nome popolare	cicoria	a cicoire	Çikour	
	Parte della pianta utilizzata	foglie	Giovani spirali	rosette	
	Uso culinario	insalate, da solo in zuppa o con fagioli	Crudo: insalate miste; bollito; bollito, poi fritto con olio d'oliva, aglio, peperoncino, a volte salsa di pomodoro con verdure miste	scottate e/o ripassate in padella	
	Uso medicinale	benessere del fegato (acqua di cottura fredda) foglie cotte; lassativo		depurativo del sangue	
<i>Chondrilla juncea</i> L./Asteraceae	Nome popolare			Gjumë, Ngjumës	
	Parte della pianta utilizzata			rosette basali e giovani getti	
	Uso culinario			crudi in insalata; scottati e/o ripassati in padella	
	Uso medicinale				
<i>Citrus lemon</i> L./Rutaceae	Nome popolare				
	Parte della pianta utilizzata			foglie	
	Uso culinario			crudo	
	Uso medicinale			antidiarroico	

<i>Clematis vitalba</i> L./Ranunculaceae	Nome popolare	grambullin', vitacchia	a vitacchie ⁻⁻⁻	Kurpär	
	Parte della pianta utilizzata	germogli	giovani germogli	giovani getti	
	Uso culinario	frittate, saltate in padella con aglio, uova e salame	Bollito, poi fritto con uova e formaggio (tradizionalmente fritto nel grasso di maiale, zugne ⁻⁻⁻)	bolite e ripassate in padella	
	Uso medicinale				
<i>Cirsium arvense</i> (L.) Scop./Asteraceae	Nome popolare	cardone, scardunech'			
	Parte della pianta utilizzata	steli			
	Uso culinario	bollito			
	Uso medicinale				
<i>Colchicum autumnale</i> /Liliaceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				La presenza di alcaloidi, come la colchicina, e flavonoidi conferisce proprietà antinfiammatorie. infatti è usata come rimedio efficace contro la gotta, ma anche contro la leucemia, con buoni risultati.

<i>Convallaria majalis</i>	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Usato per l'insufficienza cardiaca e l'enfisema polmonare, tutte le parti della pianta presentano tossicità, soprattutto a livello dei fiori e bacche. In profumeria si impiega la sostanza aromatica estratta dai fiori.
<i>Convolvulus arvensis/Convolvulaceae</i>	Nome popolare				
	Parte della pianta utilizzata				radici, foglie
	Uso culinario				
	Uso medicinale				Alla pianta sono attestate proprietà purgative e colagoghe
<i>Comus mas L./Comaceae</i>	Nome popolare	cumale'	u cumale		
	Parte della pianta utilizzata	frutta	frutta		
	Uso culinario	frutta fresca	Crudo come spuntino		
	Uso medicinale				

<i>Corylus avellana</i> L./Betulaceae	Nome popolare		a nocedde /a veddane		
	Parte della pianta utilizzata		Nocciolo		
	Uso culinario		Mangiato essiccato; mangiato arrosto		
	Uso medicinale				
<i>Cynara cardunculus</i> L. ssp. <i>Carduncolo</i> /Asteraceae	Nome popolare	cardone, scardunech'	a scalire		
	Parte della pianta utilizzata	steli	Steli		
	Uso culinario	bollito, saltato in padella	bollito e/o fritto		
	Uso medicinale				
<i>Crataegus monogyna</i> JACQ. and <i>Crataegus oxyacantha</i> L'	Nome popolare		a cerasedde		
	Parte della pianta utilizzata		frutto		
	Uso culinario		Crudo come spuntino		
	Uso medicinale				
<i>Crepia vesicaria</i> L./Asteraceae	Nome popolare		a maroglie	Cikoria spertè, Cikorione, Maroljè, Marosk, Liakra spertè	
	Parte della pianta utilizzata		Giovani spirali	rosette basali	
	Uso culinario		Crudo: insalate miste; cotto: bollito, poi fritto con olio d'oliva, aglio, peperoncino, a volte salse di pomodoro	bolite in miscela, poi passate in padella	
	Uso medicinale			depurativo sanguè	

<i>Cydonia oblonga</i> L./Rosaceae	Nome popolare		a cotugne		
	Parte della pianta utilizzata				
	Uso culinario		Bollito; cotugne arrostute; arrostito sotto cenere		
	Uso medicinale				
<i>Daucus carota</i> L./Apiaceae	Nome popolare		a (radicche) bastenarghe		
	Parte della pianta utilizzata		radici		
	Uso culinario		arrosto, bollito o fritto		
	Uso medicinale				
<i>Diplotassi tenuifolia</i> (L.) DC/Brassicaceae	Nome popolare				
	Parte della pianta utilizzata	foglie			
	Uso culinario	insalata, condimento per pasta, condimento per pizza			
	Uso medicinale				
<i>Echium vulgare</i> L./Boraginaceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Rimedio preventivo e medicamento per morsi di serpente. Calmante per tosse secche e rimedio per favorire l'espettorazione. Cataplasma emolliente per foruncoli e pustole

	Parte della pianta utilizzata	germogli			
	Uso culinario	frittate, saltate in padella			
	Uso medicinale				
<i>Eruca sativa</i> L./Brassicaceae	Nome popolare	a ruche			
	Parte della pianta utilizzata	foglie			
	Uso culinario	Crudo in insalata			
	Uso medicinale				
<i>Ficus carica</i> L./Moraceae	Nome popolare	fic	a fiche (a fiche pilusedde, a fiche canne tate, a fiche vuttate, a fiche lattarole)		
	Parte della pianta utilizzata	frutta	frutta		
	Uso culinario	frutta fresca	Crudo; essiccato		
	Uso medicinale				
<i>Foeniculum vulgare</i> Mill./Apiaceae	Nome popolare	finch'			
	Parte della pianta utilizzata	semi, foglie, steli			
	Uso culinario	aromi, liquori, misti			
	Uso medicinale	digestivo			
<i>Foeniculum vulgare</i> ssp. <i>piperitum</i> (Ucria) COUTINHO/Apiaceae	Nome popolare		u fenucchie salvacce	Fënoq (salvaC), Mbra jnë, Mërajnë	
	Parte della pianta utilizzata		giovani germogli	giovani germogli	

	Uso culinario		Bollito e poi servito con fave puro; bollito in miscele con altri selvatici verdi, poi servito con piatti diversi; zuppa di verdure anche con fagioli	crude in insalata; scottate e/o ripassate in padella	
	Uso medicinale				
<i>Fragaria vesca</i> L./Rosaceae	Nome popolare		a fra'ula		
	Parte della pianta utilizzata	frutta			
	Uso culinario	frutta fresca	crudo		
	Uso medicinale				
<i>Fumaria officinalis</i> /papaveraceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				In infusione, stimola la digestione e purifica l'organismo dalle tossine; ha un'azione sedativa ed ipnotica, tende a diminuire la pressione sanguigna. Per uso esterno nei casi di acne e foruncolosi giovanili.
<i>Glycyrrhiza glabra</i> L./Fabaceae	Nome popolare	rrarc	a gre "lizje"		
	Parte della pianta utilizzata	radici (I), foglie e fusto (II)	radice		
	Uso culinario	spuntino rurale (I)	crudo come snack		
	Uso medicinale	sudorazione piedi (II)			

<i>Humulus lupulus</i> L./Cannabaceae	Nome popolare	gupl'			
	Parte della pianta utilizzata	germogli			
	Uso culinario	fritto con uova e salame, zuppa			
	Uso medicinale				
<i>Iris germanica</i> /Iridaceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Utilizzato per disintossicare l'organismo. Aumenta la minzione, la produzione di bile, ha una blanda azione lassativa. In piccole dosi attenua causa e vomito. E' consigliabile non utilizzarlo in gravidanza. Il rizoma è usato nella concia dei vini ed in cosmetica per le ciprie, l'essenza è usata in profumeria.
<i>Lactuca serriola</i> L./Asteraceae	Nome popolare	scarola	a lactucastre ⁻		
	Parte della pianta utilizzata	foglie	giovani parti aeree		
	Uso culinario	insalata	cruda in insalata, bollita e/o fritt		
	Uso medicinale				
<i>Lactuca virosa</i> L./Asteraceae	Nome popolare	scarola			
	Parte della pianta utilizzata	foglie			
	Uso culinario	insalata, zuppa			
	Uso medicinale				

<i>Laurus nobilis</i> L./Lauraceae	Nome popolare	laur'			
	Parte della pianta utilizzata	foglie			
	Uso culinario	aromatizzante			
	Uso medicinale				
<i>Leontodon crispus</i> s VILL./Asteraceae	Nome popolare		u muse 'de pecore		
	Parte della pianta utilizzata		giovani spirali		
	Uso culinario		Zuppa, in miscela con altre verdure; crudo: insalate miste; cotto: bollito, poi fritto con olio d'oliva, aglio, peperoncino, a volte salsa di pomodoro		
	Uso medicinale				
<i>Leopoldia comosa</i> (L.) Parl./Asparagaceae	Nome popolare	cipullun',	u cipudde 'ne' (rosa)		
	Parte della pianta utilizzata	bulbi	bulbi	bulbi	
	Uso culinario	sottaceto, in padella	bollito in acqua, in salamoia e poi fritto con uova; dopo macerazione a freddo, acqua per qualche giorno, bollita e poi frita con peperoni secchi e uova; bollito e servito con vin cutte'; cipudde 'ne' sott'olio; aromatizzare con peperoncino, aglio e menta	tagliato, macerato in acqua e poi fritto	
	Uso medicinale	lenitivo del bruciore agli occhi (sfregando le tempie)	febbrifugo		
<i>Lycium europaeum</i> L./Solanaceae	Nome popolare			Dris a Krisht	

	Parte della pianta utilizzata			giovani getti	
	Uso culinario			scottati e ripassati in padella	
	Uso medicinale				
<i>Lotus corniculatus/Papilionaceae</i>	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Regolatore del battito cardiaco, forte diuretico.
<i>Lupinus albus L./Fabaceae</i>	Nome popolare				
	Parte della pianta utilizzata				semi
	Uso culinario				cucinati o in salamoia
	Uso medicinale				antidiabetico
<i>Malus domestica BORKH./Rosaceae</i>	Nome popolare		a meledde (a limoncedde, a maciate che, a meledde rosse, a pume banane)		
	Parte della pianta utilizzata		frutto	frutto	
	Uso culinario		Mangiato crudo; bollito; meledde arrostita; arrosto sotto la cenere	cotto	
	Uso medicinale		depurativo intestinale		

<i>Malus sylvestris</i> Malino/Rosacee	Nome popolare	pomo silvestro	a melede ⁻ agriste ⁻		
	Parte della pianta utilizzata	frutta	frutto		
	Uso culinario	frutta fresca	Bollito; arrostita all'acquavite		
	Uso medicinale				
<i>Malva Sylvestris</i> /Malvaceae	Nome popolare				
	Parte della pianta utilizzata			foglie	foglie ,fiori
	Uso culinario			zuppa	Foglie e fiori essiccati impiegatu per la preparazione di tisane
	Uso medicinale			Favorisce le contrazioni del parto	Proprietà emollienti, lassative, contro le infiammazioni delle vie urinarie, nel catarro cronico e contro la tosse nelle congiuntiviti, nei dolorosi ascessi, nel mal di denti e per favorire l'uscita del pungiglione di api.
<i>Mentha pulegium</i> L./Lamiacee	Nome popolare	piliesc'	piliesc'		
	Parte della pianta utilizzata	foglie	foglie		
	Uso culinario	aromatizzante	aromatizzante		
	Uso medicinale				
<i>Menta spicata</i> L./Lamiacee	Nome popolare				
	Parte della pianta utilizzata	foglie	foglie		
	Uso culinario	aromatizzante	aromatizzante		

	Uso medicinale				
<i>Mespilus germanica</i> L./Rosaceae	Nome popolare	nespulè	nespulè		
	Parte della pianta utilizzata	frutta	frutta		
	Uso culinario	frutta fresca	frutta fresca		
	Uso medicinale				
<i>Morus alba</i> L. and <i>M. nigra</i> /Moraceae	Nome popolare	cieus	u ciuz neure ⁻ /u ciuz bianche ⁻		
	Parte della pianta utilizzata	frutto	frutto		
	Uso culinario	frutta fresca	crudo come snack		
	Uso medicinale				
<i>Muscari sp. pl.</i> /Liliaceae s.l.	Nome popolare		u cipudde ⁻ ne ⁻ (neure ⁻)		
	Parte della pianta utilizzata		bulbo		
	Uso culinario		Fritto con uova; dopo macerazione a freddo, acqua per qualche giorno, bollita e poi frita con peperoni secchi e uova; bollito e servito con vin cutte ⁻ ; cipudde ⁻ ne ⁻ sott'olio; bollito in acqua, e in salamoia in olio d'oliva, aromatizzate con peperoncino, aglio e menta		
	Uso medicinale				
<i>Nasturtium officinale</i> L./Brassicaceae	Nome popolare			Shèrpè, Shèrpèr (ta fortè)	

	Parte della pianta utilizzata			foglie	
	Uso culinario			crude in insalata	
	Uso medicinale				
<i>Onopordum acanthium</i> L./Asteraceae	Nome popolare	cardone, scardunech'			
	Parte della pianta utilizzata	steli			
	Uso culinario	bollito			
	Uso medicinale				
<i>Onopordum illyricum</i> L./Asteraceae	Nome popolare		u cardone		
	Parte della pianta utilizzata		radici		
	Uso culinario		bollito poi fritto		
	Uso medicinale				
<i>Orchidea rosa</i> /Orchidaceae	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Pianta usata per le proprietà antinfiammatorie
<i>Origanum heracleoticum</i> L./Lamiaceae	Nome popolare		a n' gane		
	Parte della pianta utilizzata		cime fiorite		
	Uso culinario		Aromatizzante per diversi piatti		

	Uso medicinale				
<i>Origano volgare</i> L./Lamiaceae	Nome popolare	arigan		Rigan	
	Parte della pianta utilizzata	foglie		cime fiorite	
	Uso culinario	aromatizzante		aromatizzanti	
	Uso medicinale				
<i>Papaver rhoeas</i> L./Papaveraceae	Nome popolare	paparina	a paparine /u scatte /botte	Lujëkuq	
	Parte della pianta utilizzata	foglie	foglie	rosette basali	
	Uso culinario	zuppa di verdure miste	Crudo: insalate miste; zuppa con altre verdure, cotto: bollito, poi amaro con l'oliva olio, aglio, peperoncino, talvolta pomodoro salse	crude in insalata; bollite con i fagioli	
	Uso medicinale				Il decotto dei petali di papavero è considerato un efficace sedativo
<i>Pastina sativa</i> L./Apiaceae	Nome popolare	rraro pastanaoc'			
	Parte della pianta utilizzata	radici			
	Uso culinario	con uova, imburrate e fritte			
	Uso medicinale				
<i>Picris hieracioides</i> L./Asteraceae	Nome popolare	spruin'	u sprusce /ne	Sfruzhën	
	Parte della pianta utilizzata	foglie	Giovani spirali; foglie	rosette basali	
	Uso culinario	zuppa di verdure miste	Crudo: insalate miste; zuppa con altre verdure; bollito, poi amaro con olio d'oliva, aglio, peperoncino, a	scottate e/o ripassate in padella	

			volte salse di pomodoro		
	Uso medicinale				
<i>Portulaca oleracea</i> L./Portulacacee	Nome popolare	purchiazzi'	a perchiazze	Burdulak, Përçak	
	Parte della pianta utilizzata	foglie	parti aeree	foglie	
	Uso culinario	insalata	cruda in insalata	insalata	
	Uso medicinale		depurativo del fegato		
<i>Primula vulgaris</i> /Primulaceae	Nome popolare				
	Parte della pianta utilizzata				fiori
	Uso medicinale				Con qualità diuretiche ed antinfiammatorie, viene impiegata contro le bronchiti croniche e le tossi ostinate. L'infuso dei fiori ha azione calmante per gli stati ansiosi e di insonnia
<i>Prunus cerasus</i> L./Rosaceae	Nome popolare		a cerase (a cerase maciatiche, a cerase neure)		
	Parte della pianta utilizzata		frutto		
	Uso culinario		mangiato crudo		
	Uso medicinale		antigastrite		
<i>Prunus domestica</i> L./diverse varietà locali	Nome popolare		le prune pi (a cascicavedde, a prunedde)		

	Parte della pianta utilizzata		frutti		
	Uso culinario		Mangiato crudo		
	Uso medicinale				
<i>Prunus dulcis</i> (MILLER) D.A. WEBB/Rosaceae	Nome popolare		a melle "la		
	Parte della pianta utilizzata		nocciolo		
	Uso culinario		Mangiato crudo; essiccato; aromatizzare sanghe "nacce" e friselle		
	Uso medicinale		antidiarroico		
<i>Prunus spinosa</i> L./Rosaceae	Nome popolare		u trignone"		
	Parte della pianta utilizzata	frutto	frutto		
	Uso culinario	frutta fresca	crudo come snack		
	Uso medicinale				
<i>Pyrus communis</i> L./Rosaceae	Nome popolare		a pere" (u spadone de virne", a muscaredde")		
	Parte della pianta utilizzata		frutto	frutto	
	Uso culinario		Mangiato crudo; essiccato; bollito; arrostito; all'acite":sott'aceto	crudi o al forno	
	Uso medicinale			depurativo intestinale	

<i>Pyrus pyraster</i> (L.) Du Roi/Rosaceae	Nome popolare				
	Parte della pianta utilizzata	frutto			
	Uso culinario	frutta fresca			
	Uso medicinale	Diuretico; impiegato per guarire calcoli renali			
<i>Quercus virgiliana</i> (TEN.) TEN/Rosaceae	Nome popolare		a lianne castagnare		
	Parte della pianta utilizzata		nocciolo		
	Uso culinario		arrosto		
	Uso medicinale				
<i>Reichardia picroides</i> (L.)/Asteraceae	Nome popolare		u pane grizzitidde	buk , Bukë Ljepër	
	Parte della pianta utilizzata		Giovani spirali		
	Uso culinario		Crudo: insalate miste; zuppa con altre verdure; bollito, poi amido con olio d'oliva, aglio, peperoncino, a volte salse di pomodoro	crude in insalata; scottate e/o ripassate in padella	
	Uso medicinale				
<i>Robinia pseudoacacia</i> L./Fabaceae	Nome popolare	cagg'			
	Parte della pianta utilizzata	fiori			
	Uso culinario	spuntino rurale, frittelle			
	Uso medicinale				

<i>Rosa canina L./Rosaceae</i>	Nome popolare				
	Parte della pianta utilizzata		pseudofruti		petali, acheni
	Uso culinario		crudo come snack		
	Uso medicinale				Le petali che avvolgono gli acheni, setolosi, funzionano da ottimo vermifugo. Con i petali si usa fare una bevanda leggermente lassativa e rinfrescante ed anche l'acqua di rose, utile per gli occhi arrossati e stanchi, come rinfrescante e leggero astringente per la pelle del viso
<i>Rosmarinus officinalis L./Lamiaceae</i>	Nome popolare				
	Parte della pianta utilizzata	foglie			
	Uso culinario	aromatizzante			
	Uso medicinale				
<i>Rubus spp./Rosaceae</i>	Nome popolare	rivital'	le ci'uz (de re've'tale)pl		
	Parte della pianta utilizzata	frutto	frutto		
	Uso culinario	frutta fresca	crudo come snack		
	Uso medicinale				
<i>Ruscus aculeatus/Liliaceae</i>	Nome popolare		u sparace (de fruscitidde)		
	Parte della pianta utilizzata	germogli	Giovani germogli		

	Uso culinario	fritto con uova e salame	Bollito e consumato tradizionalmente con pane e panna acida da latte di vacca podolica		
	Uso medicinale				
<i>Sambucus nigra</i> L./Adoxaceae	Nome popolare				
	Parte della pianta utilizzata	fiori			
	Uso culinario	liquore, frittata, frittella			
	Uso medicinale	mal di stomaco (decocto insieme con camomilla)			
<i>Scolymus hispanicus</i> L./Brassicaceae	Nome popolare			Kardunxhelje, Rëkolje	
	Parte della pianta utilizzata			foglie	
	Uso culinario			bollite, poi ripassate in padella	
	Uso medicinale				
<i>Sinapis alba</i> L./Brassicaceae	Nome popolare	sinap'			
	Parte della pianta utilizzata	foglie			
	Uso culinario	zuppa di verdure miste, saltata in padella			
	Uso medicinale				
<i>Sinapis arvensis</i> L./Brassicaceae	Nome popolare	ass'n	a la'ssane	Sënap	
	Parte della pianta utilizzata	foglie	giovani parti aeree	giovani parti aeree	
	Uso culinario	zuppa di verdure miste, saltata in padella	bollito e fritto	scottati e ripassati in padell	
	Uso medicinale				

<i>Sisymbrium officinale</i> (L.)/Brassicaceae	Nome popolare			Liapèzan	
	Parte della pianta utilizzata			foglie	
	Uso culinario			bolite, poi ripassate in padella	
	Uso medicinale				
<i>Sonchu spp. (oleraceo L.)/Asteraceae</i>	Nome popolare	Rrèshed/sivon'	u sivone ⁻		
	Parte della pianta utilizzata	rosette basali/foglie	Giovani spirali		
	Uso culinario	crude in insalata, scottate e ripassate in padella/zuppa di verdure miste, saltata in padella	crudo in insalata		
	Uso medicinale				
<i>Sorbus domestica</i> L./Rosaceae	Nome popolare	sur'v	a sorve ⁻		
	Parte della pianta utilizzata	frutto	frutto		
	Uso culinario	frutta fresca	Mangiato essiccato o bollito		
	Uso medicinale				
<i>Silybum marianum</i> (L.)/Asteraceae	Nome popolare	cardone, scardunech'/u cardedde ⁻ /u cardone ⁻ spiochialiochie			
	Parte della pianta utilizzata	steli			steli
	Uso culinario	bollito/crudo come snack			
	Uso medicinale				Per le disfunzioni epatiche, come stimolante dell'attività gastrica, come diuretico e febbrifugo. I fitosteroli <u>fitosteroli</u> regolano la produzione ormonale femminile. Proprietà tonificanti, per il fegato, e proprietà antiossidanti

<i>Taraxacum officinalis</i> Weber/Asteraceae	Nome popolare	pasc'percor'	a maroglie ⁻⁻⁻	Cikoria spertè, Cikorione, Maroljè, Marosk, Liakra spertè	piscialletto
	Parte della pianta utilizzata	foglie	Giovani spirali	rosette basali	radice
	Uso culinario	zuppa di verdure miste, saltata in padella	Crudo: insalate miste; cotto: bollito, quindi amio con olio d'oliva, aglio, peperoncino, a volte salse di pomodoro	bollite in miscela, poi passate in padella	
	Uso medicinale				Presenta proprietà aperitive, rinfrescanti, colagoghe e diuretiche.
<i>Tordylium apulum</i> L./Apiaceae	Nome popolare			Kalkatrinj	
	Parte della pianta utilizzata			rosette basali	
	Uso culinario			scottate e/o ripassate in padella	
	Uso medicinale				
<i>Thymus serpyllum</i> s.l./Lamiaceae	Nome popolare		u sarapudde ⁻⁻⁻		
	Parte della pianta utilizzata		parti aeree		
	Uso culinario		Per aromatizzare il formaggio (aggiunto al latte con caglio o formaggio di copertura durante la conservazione)		
	Uso medicinale				
<i>Urtica</i> spp. (<i>dioica</i> L., <i>urens</i> L.)/Urticaceae	Nome popolare	lurdicul'		Hènz, Hinz, Hisér, Hith	
	Parte della pianta utilizzata	foglie			

	Uso culinario	zuppa di verdure miste, frittata		bollite	
	Uso medicinale				
<i>Urospermum delechampii</i> i (L.) SCHMIDT-B./	Nome popolare		a maroglie ⁻⁻⁻		
	Parte della pianta utilizzata		Giovani spirali		
	Uso culinario		Crudo: insalate miste; cotto: bollito, quindi amio con olio d'oliva, aglio, peperoncino, a volte salse di pomodoro		
	Uso medicinale				
<i>Verbascum crassifolium/Scrophulariaceae</i>	Nome popolare				
	Parte della pianta utilizzata				fiori, foglie
	Uso culinario				
	Uso medicinale				Cura dei raffreddori di petto, irritazioni dei bronchi, tosse catarrale, catarro polmonare, <u>irritazioni tubo digerente</u> . Afezioni asmatiche ed alle vie urinarie. La polvere ha un'utile applicazione se cosparsa su piaghe e ferite.
<i>Veronica beccabunga/Scrophulariaceae</i>	Nome popolare		u crisciune ⁻⁻⁻		
	Parte della pianta utilizzata	frutto	frutto		
	Uso culinario	in insalate	crudo in insalata		
	Uso medicinale				
<i>Vinca major/Violaceae</i>	Nome popolare				
	Parte della pianta utilizzata				fiori

	Uso culinario				
	Uso medicinale				E' utilizzata per preparati ipotensivi e ricostituenti. I fiori vengono utilizzati come lavaggio oculare calmante
<i>Viola rupestris</i>	Nome popolare				
	Parte della pianta utilizzata				fiori
	Uso culinario				
	Uso medicinale				I fiori hanno proprietà emollienti: impiegati nei casi di tosse ostinata e catarrhi bronchiali utilizzando uno sciroppo previamente preparato.
	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				
<i>Viscum album/Loranthaceae</i>	Nome popolare				
	Parte della pianta utilizzata				
	Uso culinario				
	Uso medicinale				Riduce la pressione e frequenza cardiaca, usato per l'epilessia e l'iperattività dei bambini
<i>Vitis vinifera</i>	Nome popolare				
	Parte della pianta utilizzata				fiore
	Uso culinario				come snack, succo bollito

	Uso medicinale			antidiarroico (snack), lassativo (succo)	
<i>Ziziphus jujuba</i> <i>Mulino/Rhamnaceae</i>	Nome popolare	scesc ^l	le ceciole ⁻		
	Parte della pianta utilizzata	frutto	frutto		
	Uso culinario	frutta fresca	crudo come snack		
	Uso medicinale				

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