

ETHNOBOTANY, MEDICINAL PLANTS & THE SEARCH FOR NEW DRUGS DISCOVERY

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UNIVERSITAT DE
BARCELONA



1. Introduction
2. Ethnobotany: Definition, specific objectives & methodology
3. Ethnobotany: New techniques & approaches
4. Medicinal plants
5. Plant natural products in drug discovery
6. Medical ethnobotany & global health issues



1. INTRODUCTION

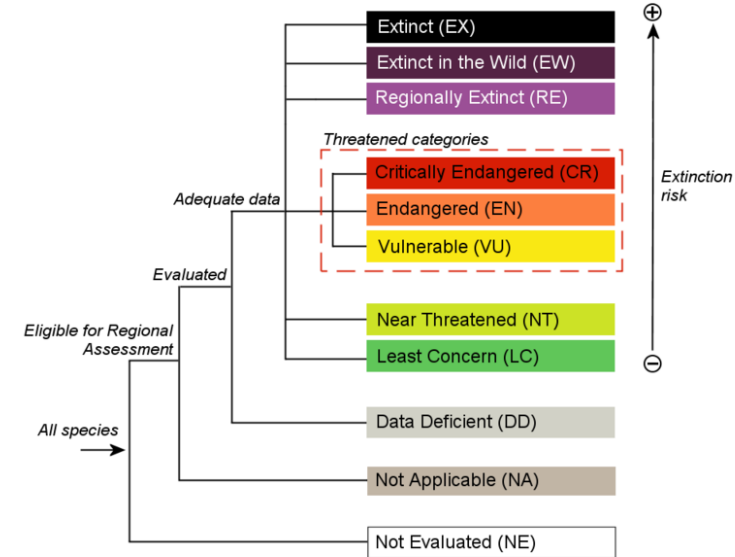


417,013 accepted species according to the World Checklist of Vascular Plants¹.

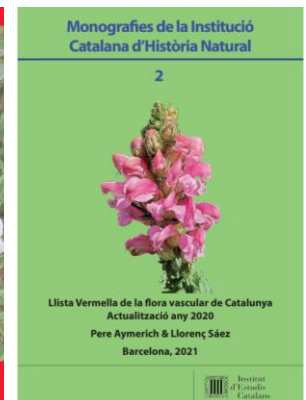
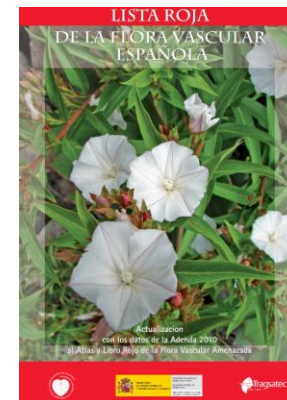


76,864 species have been assessed under IUCN Red List of Threatened Species².

29,748 species are considered vulnerable, endangered or critically endangered².



Source: IUCN webpage



¹WCVP – v14. 2025. RBGK; ²IUCN. 2025

Plant groups

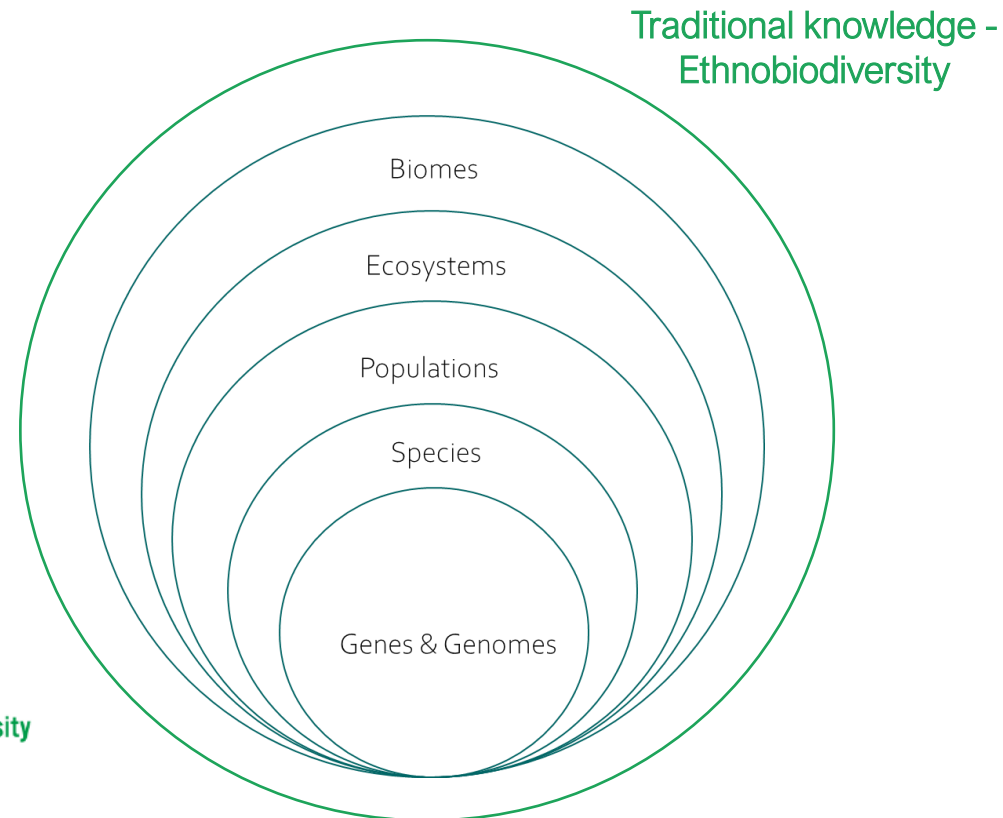


Biodiversity & Convention on Biological Diversity

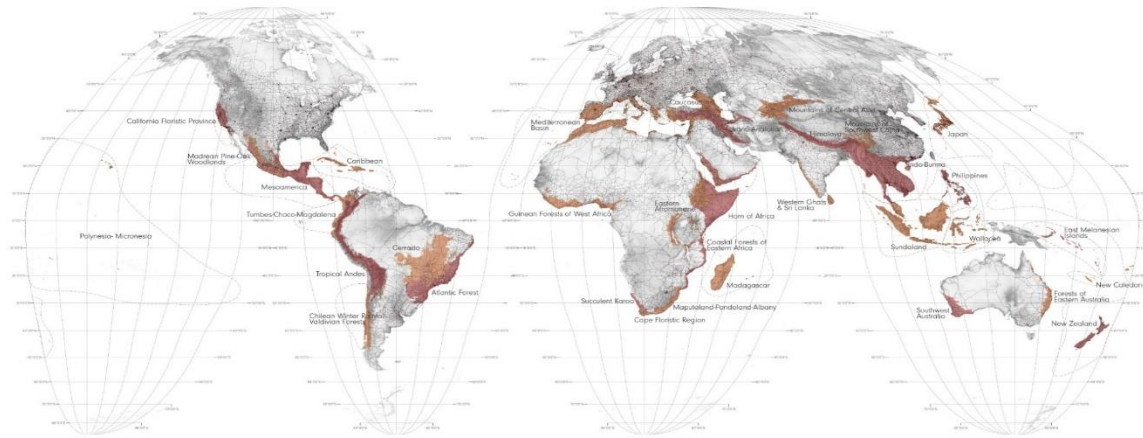
(Rio de Janeiro, 1992)

- Conservation of biological diversity → *“It is necessary to document all traditional uses of resources in their natural state – it is urgent – and give maximum priority to those that are in decline and could be lost.”*
- Sustainable use of its components
- Fair and equitable sharing of the benefits arising out of the utilization

↓
NAGOYA PROTOCOL
(2010)



Biodiversity hotspots



Ethnobiodiversity hotspots



2. ETHNOBOTANY: DEFINITION, SPECIFIC OBJECTIVES & METHODOLOGY

ETHNOBOTANY

ethnos
(people)



botané
(herb)



Harshberger (1896): "The study of ethno-botany aids in elucidating the cultural position of the tribes who used the plants for food, shelter or clothing [...] An ethno-botanical study throws light upon the past distribution of plants [...] An ethno-botanical study helps us to decide as to the ancient trade routes [...] Ethno-botany is useful as suggesting new lines of manufacture at the present day."

Nolan & Turner (2011): "Ethnobotany will be a field of relevance and importance in the world as long as there is a need for original, careful, systematic, collaborative documentation of people's dynamics interactions with the plant world, for bridging social and ecological systems, for maintaining and enhancing biocultural diversity, and for reconnecting Health and wellbeing with cultural and environmental integrity".

XIX century

XX century

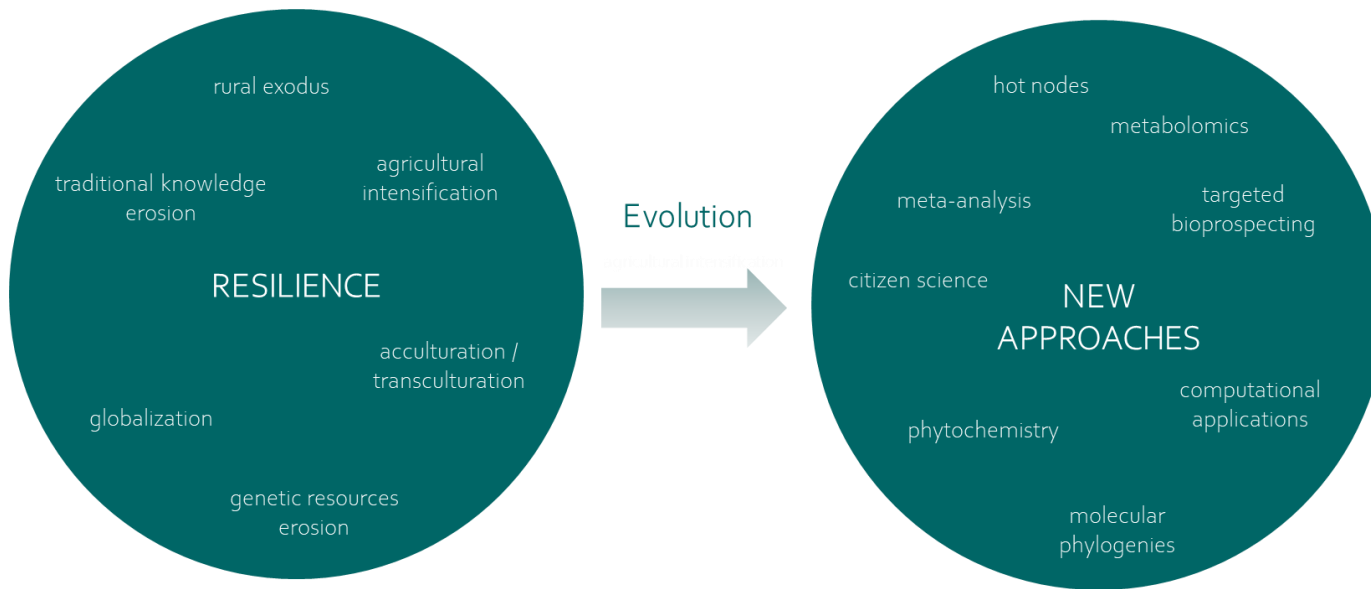
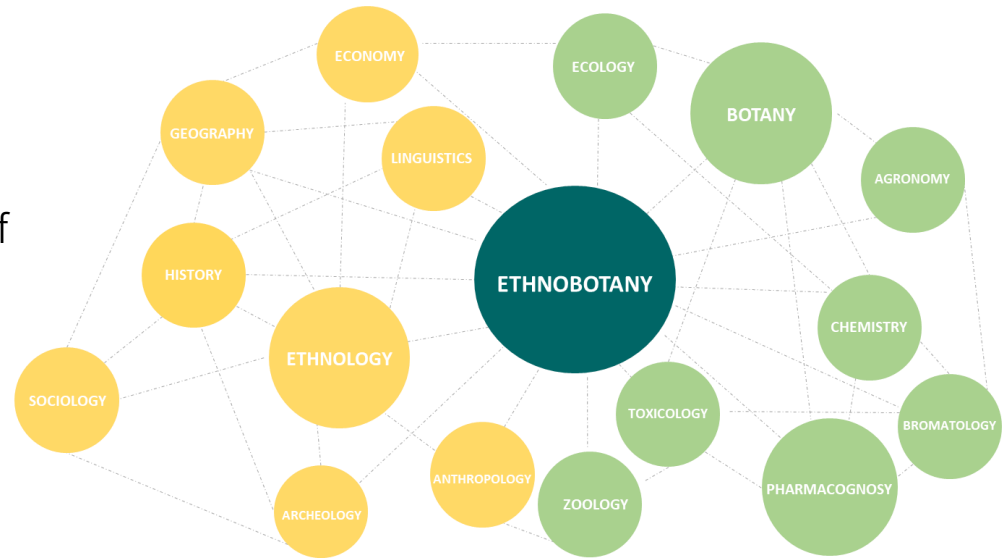
XXI century

Portères (1961): "L'Ethnobotanique est une discipline interprétative et associative qui recherche, utilise, lie et interprète les faits d'interrelations entre les Sociétés Humaines et les Plantes en vue de comprendre et d'expliquer la naissance et le progrès des civilisations, depuis leurs débuts végétaliens jusqu'à l'utilisation et la transformation des végétaux eux-mêmes dans les Sociétés primitives ou évoluées."

Pardo-de-Santayana & Macía (2015): "Ethnobotany has a key part to play in studies of how ethnic groups can benefit from and coexist with their ecosystems".

Garnatje et al. (2017a,b): "Ethnobotany, located at the interface of natural and social sciences, is a discipline that addresses the relationships between humans and plants [...] in confluence with 'omic' and molecular phylogeny could provide better tools for the discovery of the next generation of natural products inspired by popular knowledge".

Ethnobotany is an evolving interdisciplinary field at the intersection of natural and social science.



Specific objectives

- ❑ Create catalogs of uses and common names for plants and fungi.
- ❑ Inventory biological and ethnological heritage for its preservation.
- ❑ Improve the exploitation and conservation of natural resources.
- ❑ Research potentially useful species, as well as lineages of interest for research (bioprospecting and transfer).
- ❑ Return the acquired knowledge to society through appropriate dissemination.



Methodology



Selection of informants

Snowball sampling
(Goodman, 1961; Bernard, 2006)

Semistructured interviews,
participant observation,
freelisting, questionnaires

Code of ethics of the
International Society of
Ethnobiology (ISE, 2008)
ConSEFS (Heinrich et al. 2018)

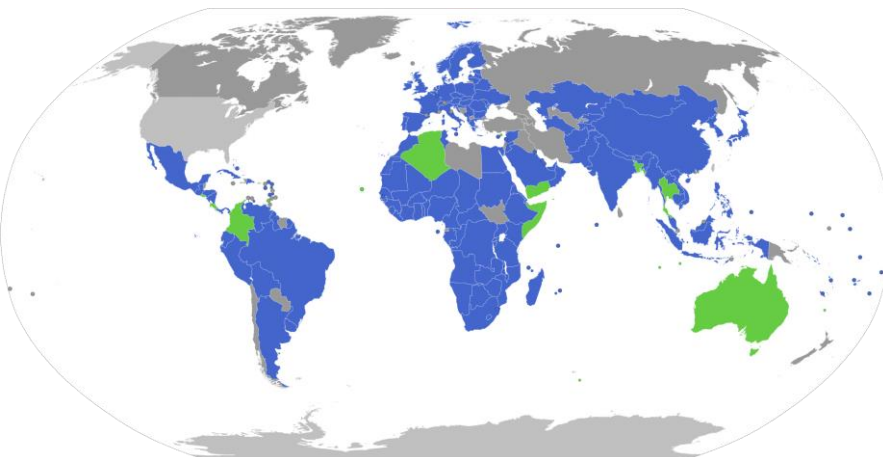
Interview transcriptions,
databasing & vouchering

Sharing results &
returning the
knowledge

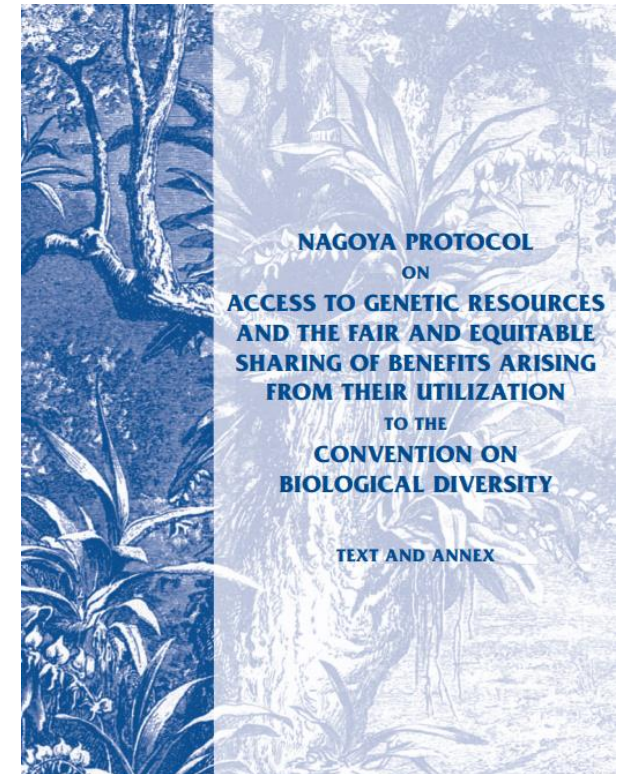
Sharing results with locals

Nagoya protocol provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. It also covers traditional knowledge (TK) associated with genetic resources that are covered by the CBD and the benefits arising from its utilization.

The protocol was approved in Nagoya (Japan) on 2010 and entered into force on 2014.



Blue (parties); Green (signed, but not ratified); Dark grey (non signatory, but BDC party); Light grey (non signatory, non-BDC party). Source: Wikipedia



POLICY BRIEF



How to link Local Ecological Knowledge and Digital Sequences Information to ensure an effective recognition of knowledge holders by the Nagoya protocol and the Kunming-Montreal Global Biodiversity Framework?

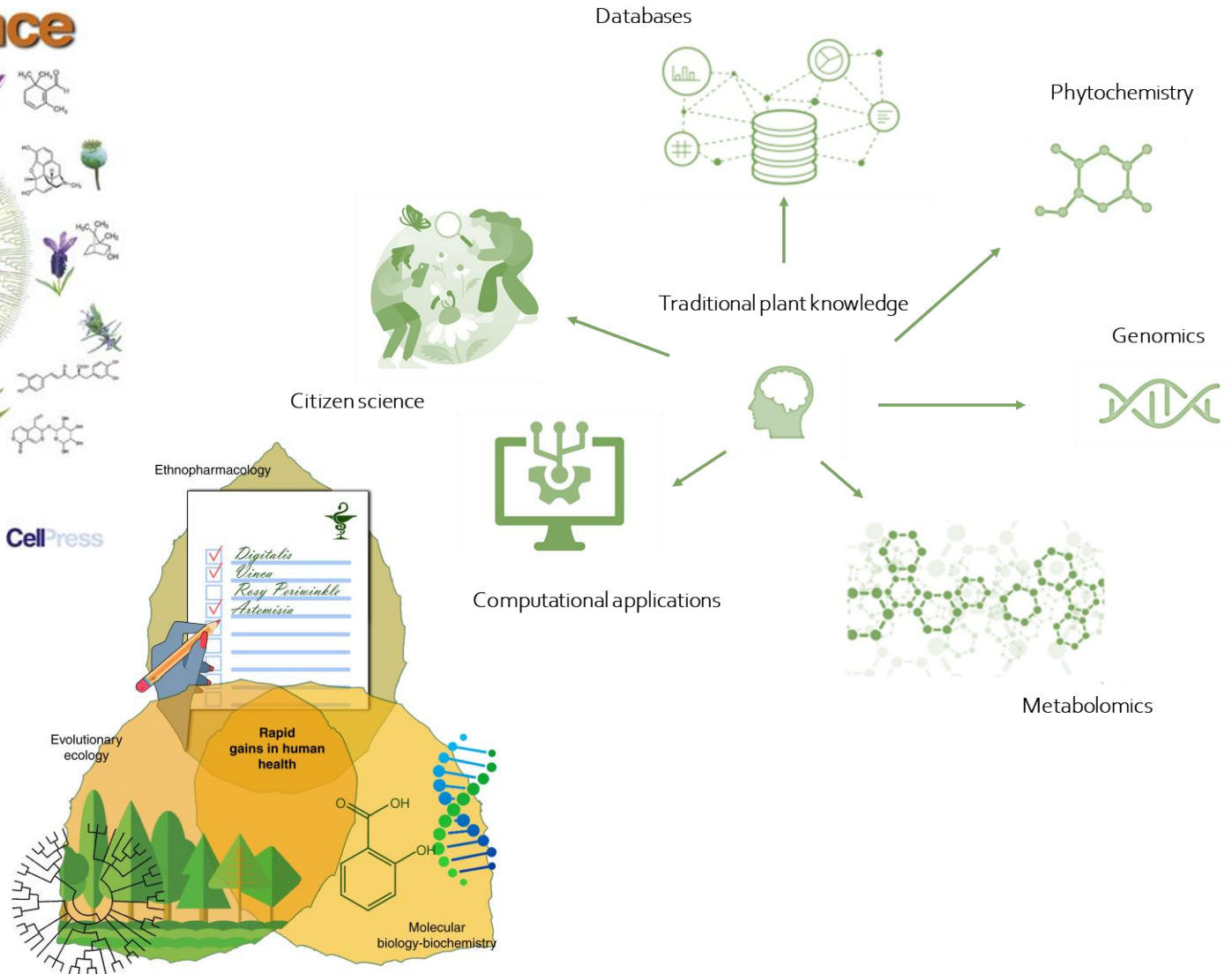
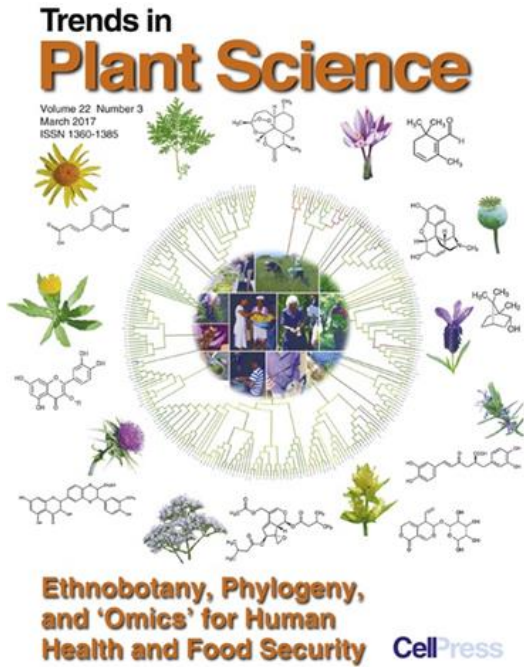
The overarching goal of the Nagoya Protocol is to protect biodiversity and associated traditional knowledge by facilitating access to genetic resources and associated knowledge and ensure a fair and equitable sharing of the benefits of their uses. It requires prior informed consent and mutual agreement on terms between the holders of knowledge associated with biodiversity and its users. In the case of fundamental research on local knowledge, often intended for patrimonial purposes, the subsequent dissemination of this knowledge in peer-reviewed publications makes it de facto available to the whole world. Its publication provides proof of anteriority and can be an effective protection tool, but the sheer quantity of information produced and published makes it extremely difficult to enforce intellectual property rights on Local Ecological Knowledge (LEK, definition 1). The use of Digital Sequences Information coupled with AI-assisted bioinformatics methods is likely to hamper the achievement of this objective even further. That's why we urgently need a thorough global reflection on how to preserve this locally owned world heritage.

Recognizing the inextricable relation between biodiversity local knowledge and territories

There is an intimate, intrinsic, and inseparable connection between biodiversity and local knowledge holders. Much of the biodiversity that exists on our planet today has been used and managed by ancestral and current indigenous Peoples and Local Communities (IP and LCs, definition 2) in their territories. Thus, local knowledge associated with biodiversity (and its genetic resources) is the result of complex and long-term interactions within local ecological systems. The intellectual property of peoples and communities needs to be recognized and valued, ensuring the fair and equitable sharing of benefits arising from their globalized use.

However, there is a large deficit in the recognition of IP and LCs as subjects of rights, which requires a historical reparation of the appropriation and misuse of their intellectual property. Considering the asymmetries between "knowledge holders" and "patenters", the new World Intellectual Property Organization treaty on Intellectual Property, Genetic Resources and Associated Traditional Knowledge (DGRI), recognizes Local Knowledge (LK) associated with genetic resources and aims at preventing patents from being granted erroneously for inventions that are not novel or inventive with regard to genetic resources and associated LK. The body suggests "the establishment of information systems (such as databases) of genetic resources and associated LK, in consultation, where applicable, with IP and LCs, and other stakeholders".

3. ETHNOBOTANY: NEW TECHNIQUES & APPROACHES



Ethnobotanical databases



Medicinal Plant Names Services



Native American Ethnobotany

A Database of Foods, Drugs, Dyes and Fibers of Native American Peoples, Derived from Plants.

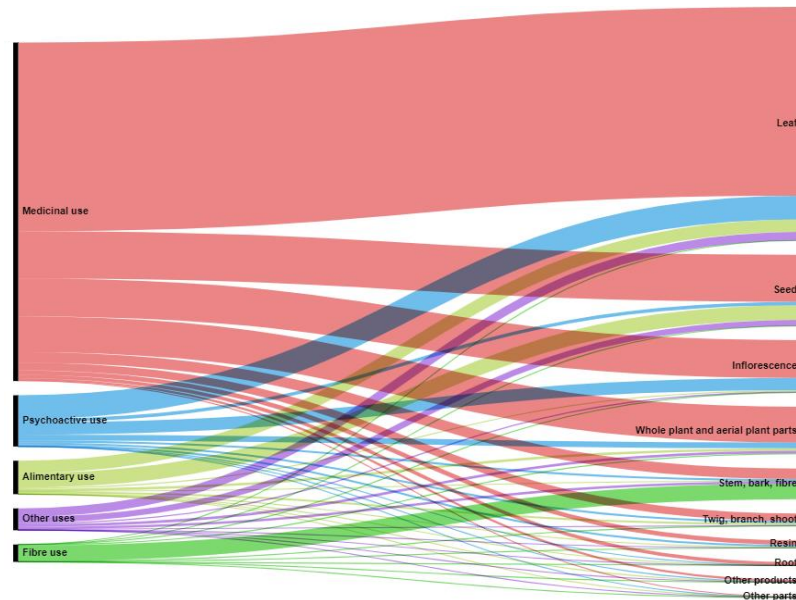


Dr. Duke's Phytochemical and Ethnobotanical Databases

U.S. DEPARTMENT OF AGRICULTURE

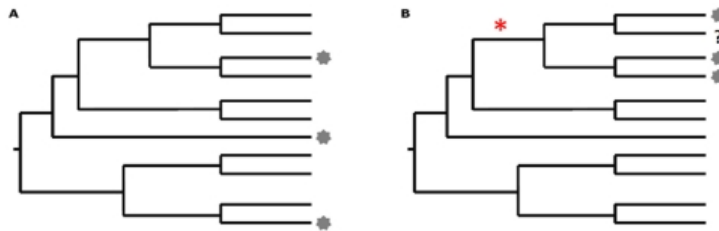
CANNUSE

A database of *Cannabis* traditional uses



Phylogenetic prospecting

Phylogeny offers robust predictive perspectives for plant usage.



A: No significant phylogenetic signal (taxa overdispersed). B: Strong phylogenetic signal (hot node).

ETHNOBOTANICAL CONVERGENCE



The use of the same (or closely related) species in the same ways in different cultures indicates that different and often non-interacting human groups have independently acquired this knowledge.

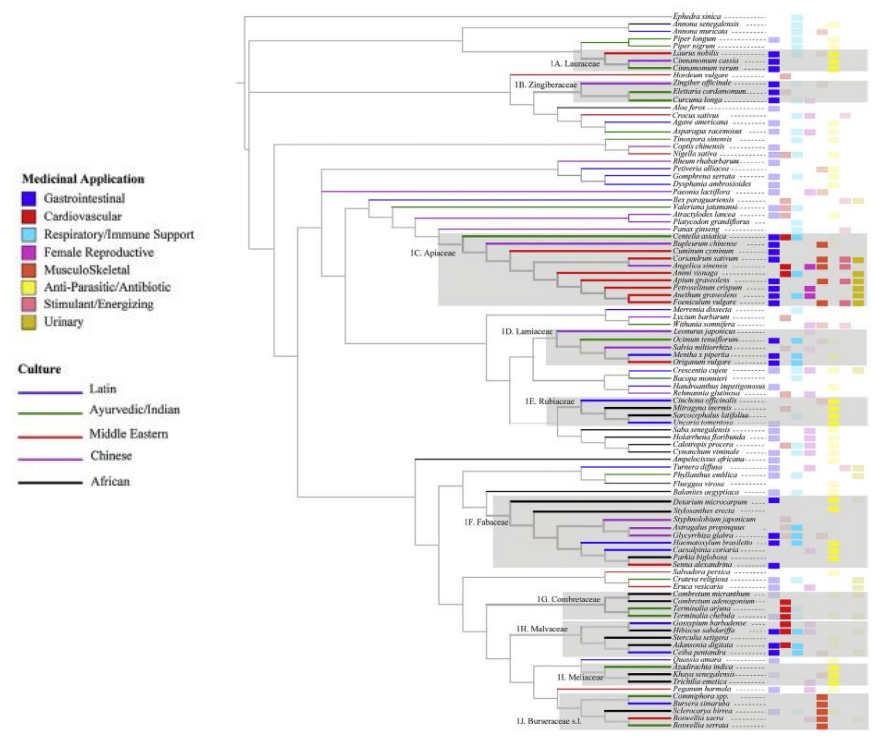


Research paper

Phylogeny of medicinal plants depicts cultural convergence among immigrant groups in New York City



Camilla Xavier, Jeanmaire Molina*



The phylogenetic analysis revealed that plant families converge in uses for specific health conditions.

Received: 5 March 2024 | Revised: 5 July 2024 | Accepted: 31 July 2024
 DOI: 10.1002/ppp3.10566

RESEARCH ARTICLE



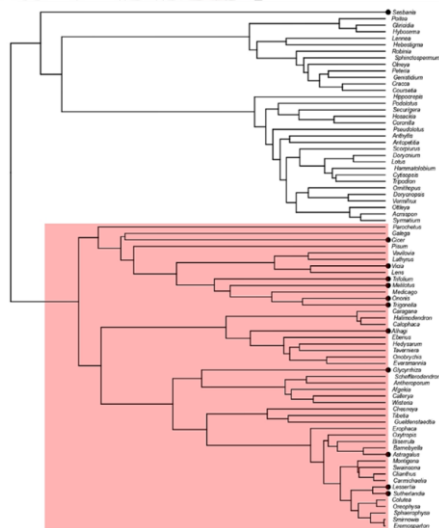
Phylogeny and bioprospecting: The diversity of medicinal plants used in cancer management

Jamie B. Thompson | Julie A. Hawkins

597 genera
used globally to
treat cancers

The phylogeny predicts certain lineages with high potential for cancer drug discovery.

The study shows the independent and repeated targeting of specific lineages of plants by different people in different parts of the world.

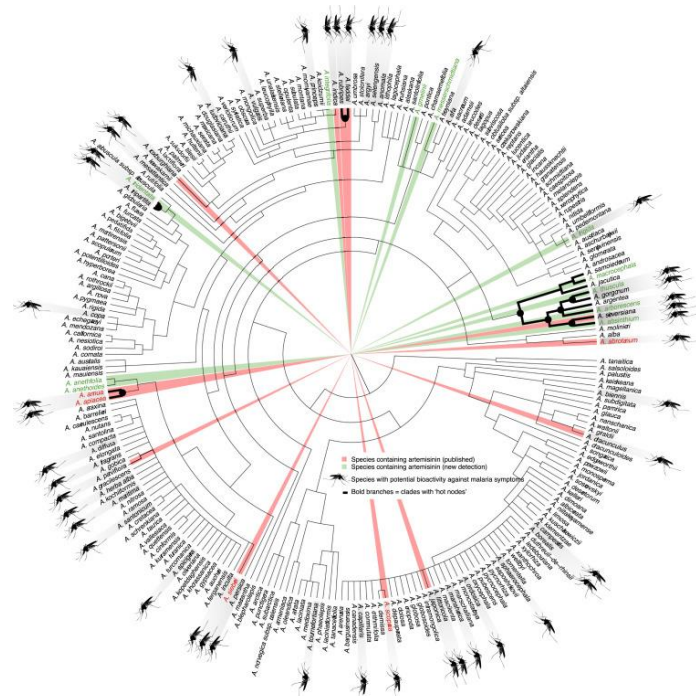


A phylogenetic road map to antimalarial *Artemisia* species

Jaume Pellicer^{a,1}, C. Haris Saslis-Lagoudakis^{b,1}, Esperança Carrió^c, Madeleine Ernst^b, Teresa Garnatje^d, Olwen M. Grace^e, Airy Gras^e, Màrius Mumbrú^f, Joan Vallès^c, Daniel Viales^d, Nina Ronsted^{b,*}



117 species with ethnobotanical data



Species with potential bioactivity against malaria symptoms.
 Novel records of artemisinin presence in *Artemisia*.

Ethnobotany has applications in many fields of current global concern and can contribute to them in different aspects:

- ❑ Development of new drugs
- ❑ Food security & sovereignty
- ❑ Sustainable materials
- ❑ Biodiversity conservation
- ❑ Climate change
- ❑ Education initiative



4. MEDICINAL PLANTS

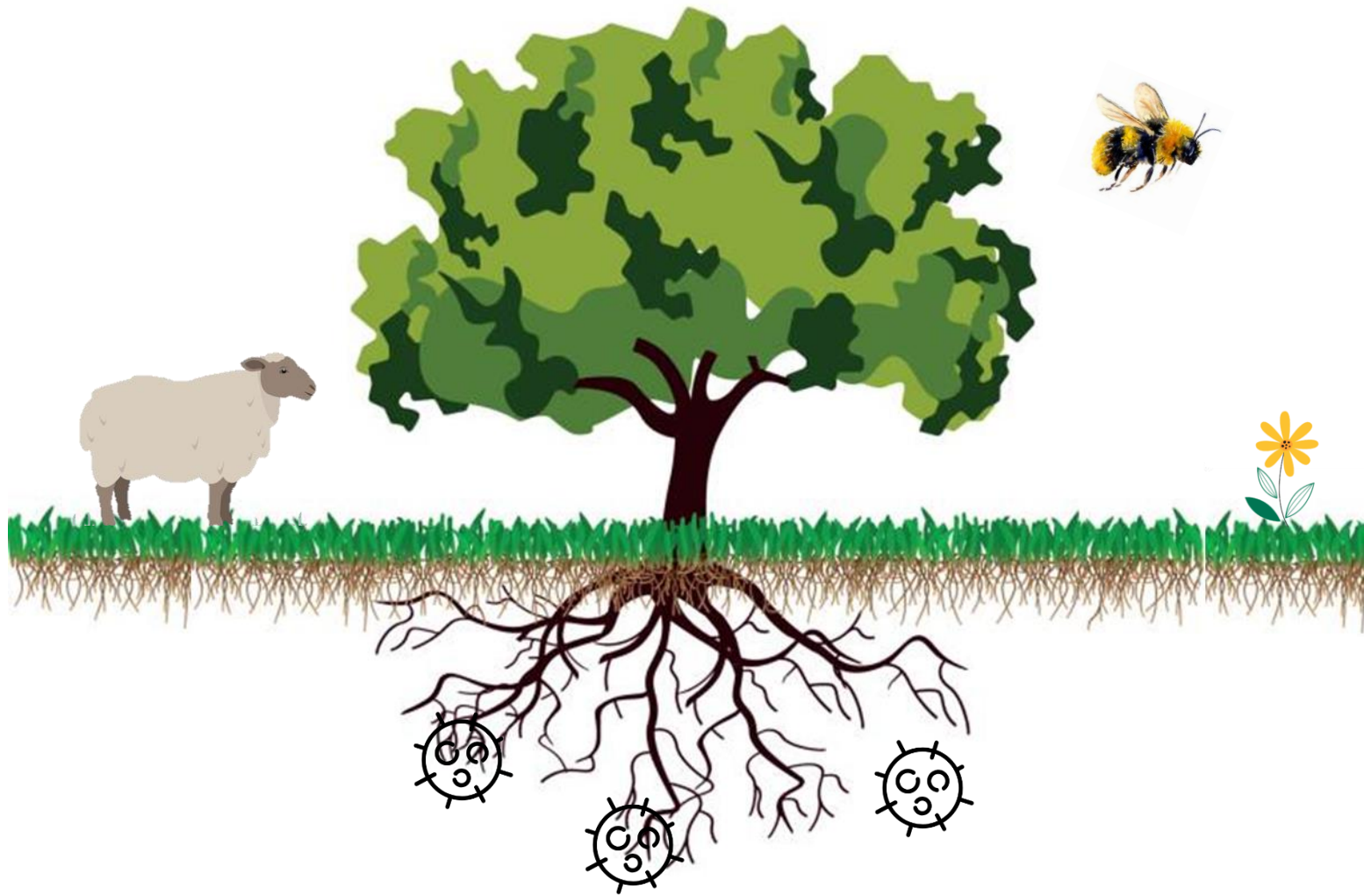
Traditional medicine is one of the most easily available treatment methods in developing countries. Approximately **80% of the world's population uses traditional medicine** to meet their primary healthcare needs³.

> **38,000 species** of plants are documented as medicinal⁴.

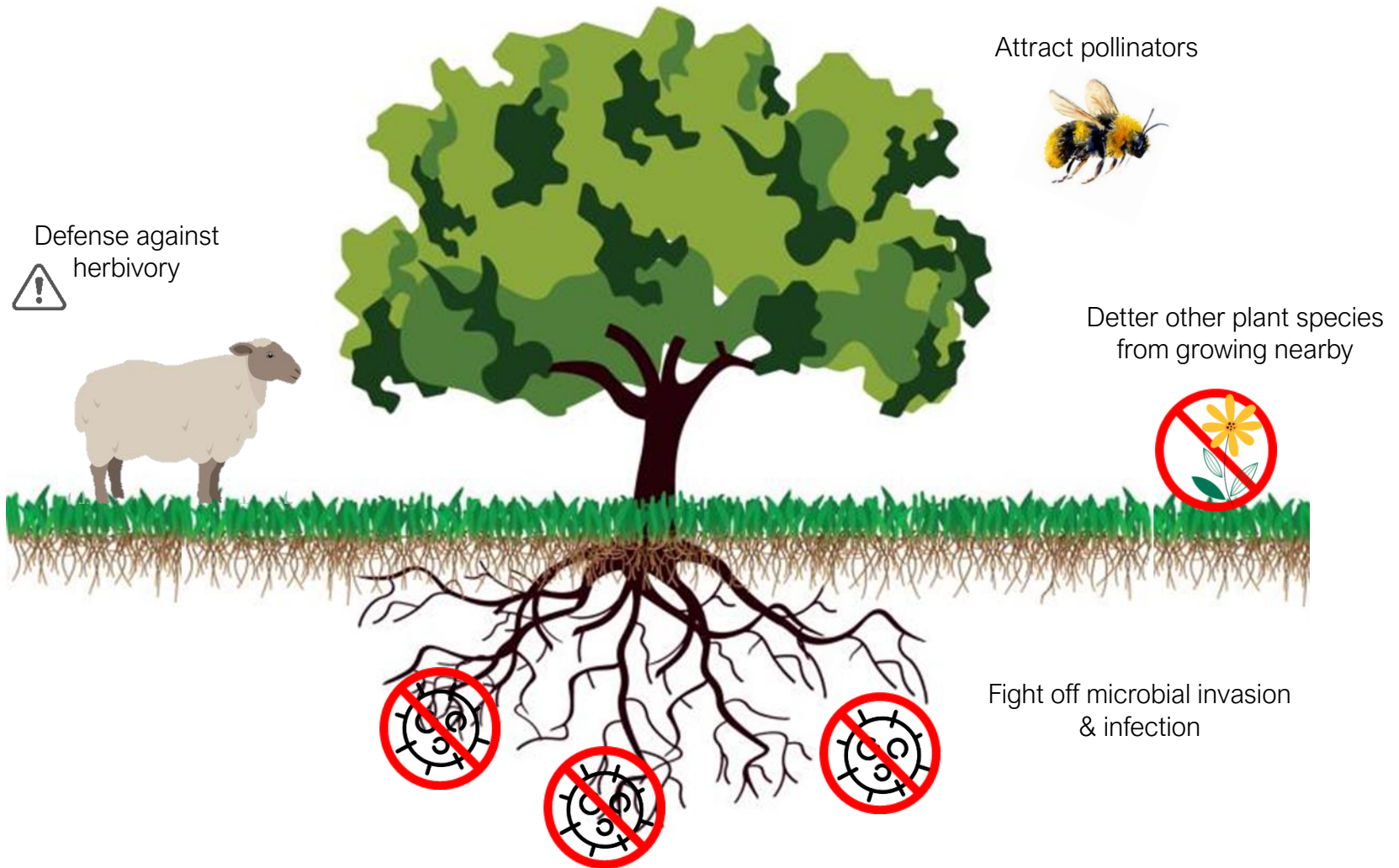
ETHNOBOTANY plays a very important role in the path of new compounds discovery.



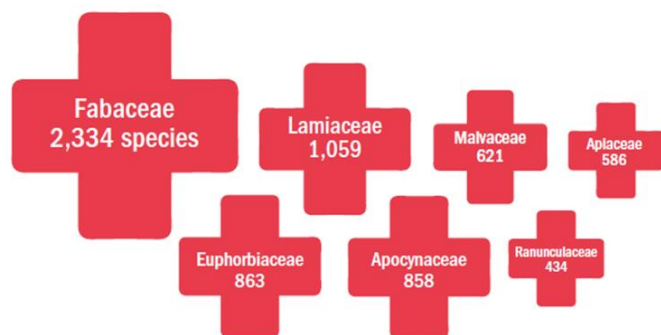
Why do plants make medicinal compounds?



Why do plants make medicinal compounds?



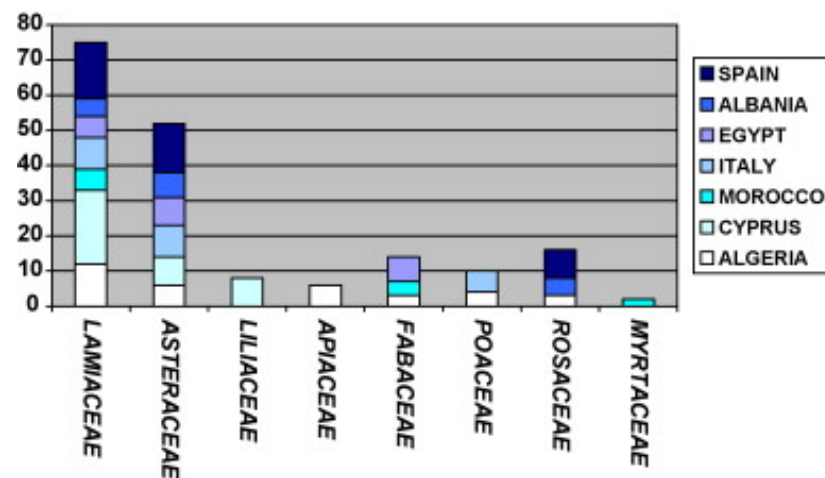
Medicinal plants families



FAMILY	COMMON FAMILY NAME	TOTAL NUMBER OF SPECIES	NUMBER OF MEDICINAL SPECIES IN MPNS	MEDICINAL SPECIES AS % OF TOTAL	KEY CLASS OF COMPOUNDS FOUND IN MANY MEDICINAL SPECIES IN EACH FAMILY
Fabaceae	pea and bean	20,856	2,334	11.2	alkaloids
Lamiaceae	mint	7,756	1,059	13.7	terpenes
Euphorbiaceae	spurge	6,407	863	13.5	diterpenoids
Apocynaceae	dogbane	6,341	858	13.5	cardiac-glycosides
Malvaceae	mallow	5,329	621	11.7	organic acids
Apiaceae	parsley or carrot	4,079	586	14.4	coumarins
Ranunculaceae	buttercup	3,640	434	11.9	alkaloids

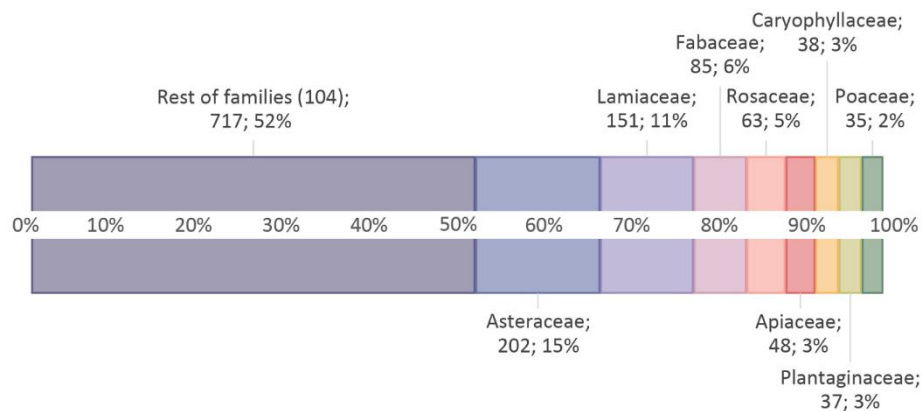
Source: Willis et al. 2017

Mediterranean area



Source: González-Tejero et al. 2008

Spain



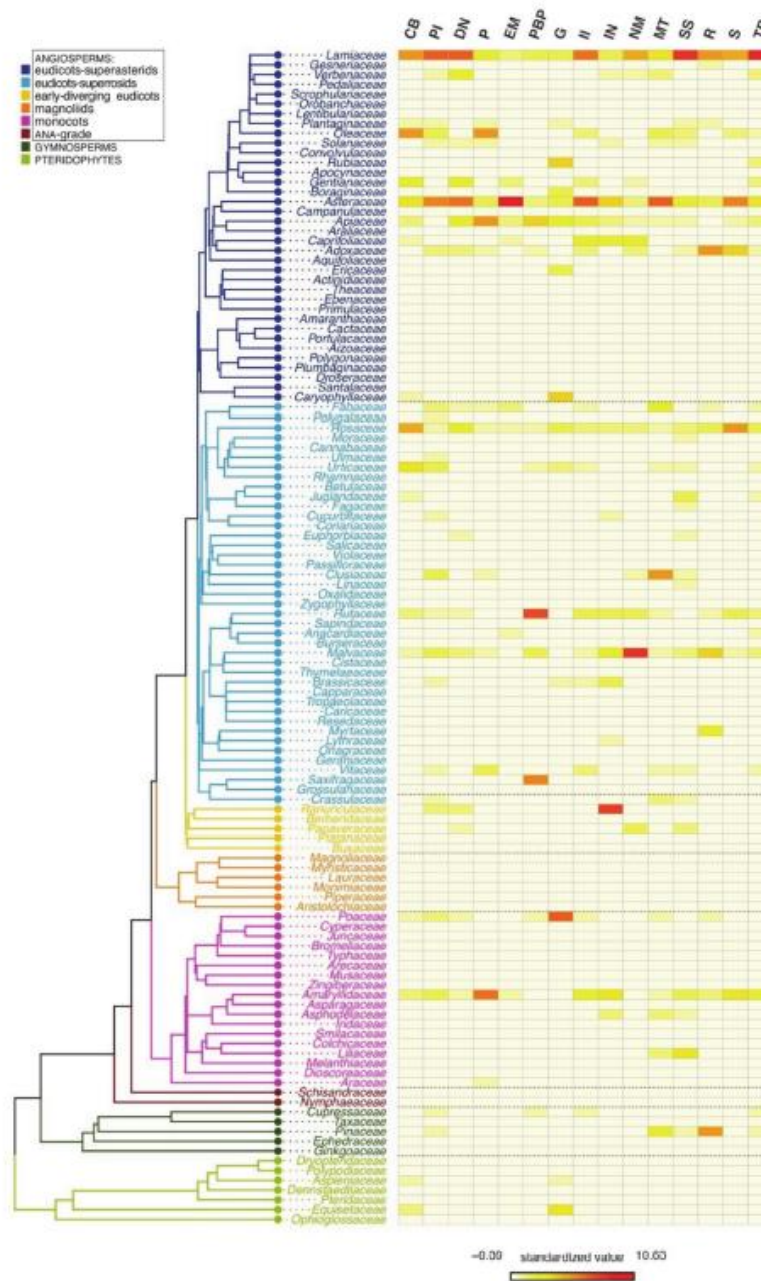
Source: Mateo-Martín et al. 2022

Article
**The Role of Botanical Families in Medicinal Ethnobotany:
 A Phylogenetic Perspective**

Airy Gras ^{1,*}, Oriane Hidalgo ¹, Ugo D'Ambrosio ², Montse Parada ³, Teresa Garnatje ¹ and Joan Vallès ^{3,4,*}

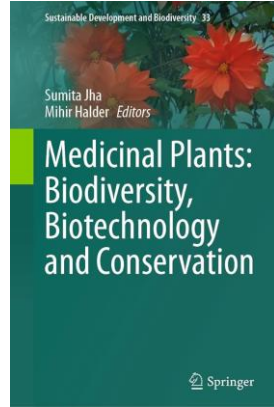
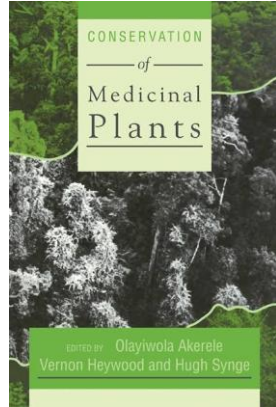
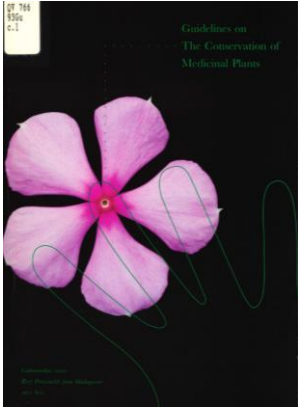
Family	UR	UR (%)	Number of Taxa with Medicinal Uses
Lamiaceae	7336	15.40	75
Asteraceae	5667	11.90	116
Rosaceae	2652	5.57	57
Malvaceae	2298	4.82	13
Adoxaceae	1971	4.14	3
Apiaceae	1661	3.49	26
Amaryllidaceae	1544	3.24	8
Oleaceae	1468	3.08	9
Pinaceae	1383	2.90	10
Rutaceae	1329	2.79	12

- Amaryllidaceae → Poisoning
- Rutaceae → Pregnancy, birth and puerperal disorders
- Saxifragaceae → Pregnancy, birth and puerperal disorders
- Poaceae → Genitourinary system disorders
- Ranunculaceae → Genitourinary system disorders
- Malvaceae → Immune system disorders and neoplasia
- Nervous system and mental disorders



-0.00 standardized value 10.00

Conservation of medicinal plants



Protecting medicine's wild pharmacy

Medicinal plants, often harvested directly from the wild, are under increasing pressure from climate change, development and over-exploitation in response to increasing demand. Is cultivation the answer, or can a certification programme create incentives to achieve sustainable harvests?

Molecules from nature: Reconciling biodiversity conservation and global healthcare imperatives for sustainable use of medicinal plants and fungi

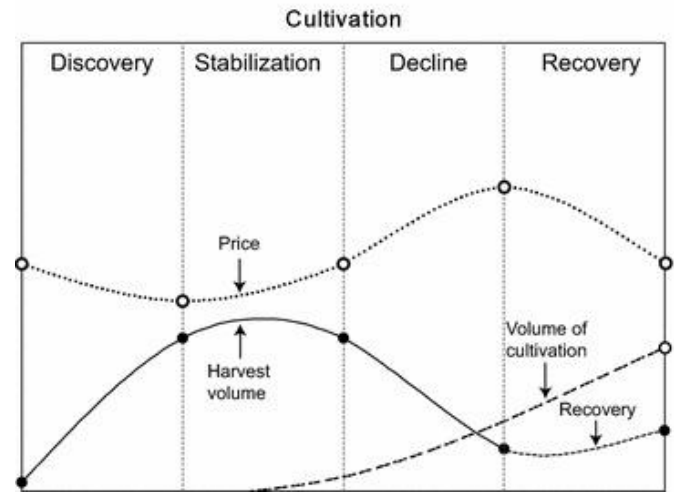
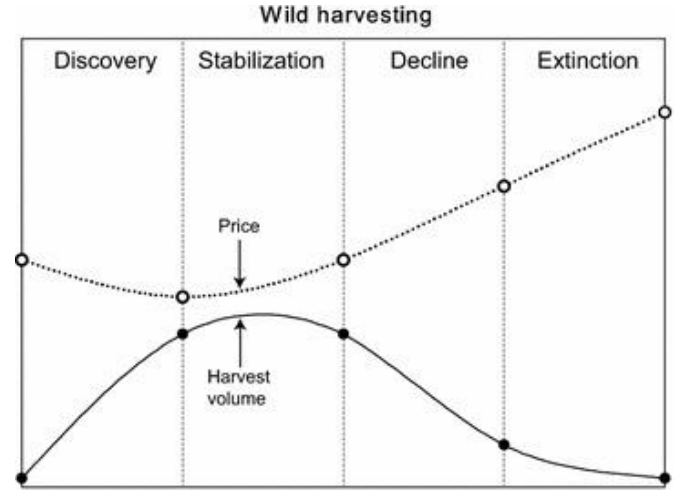
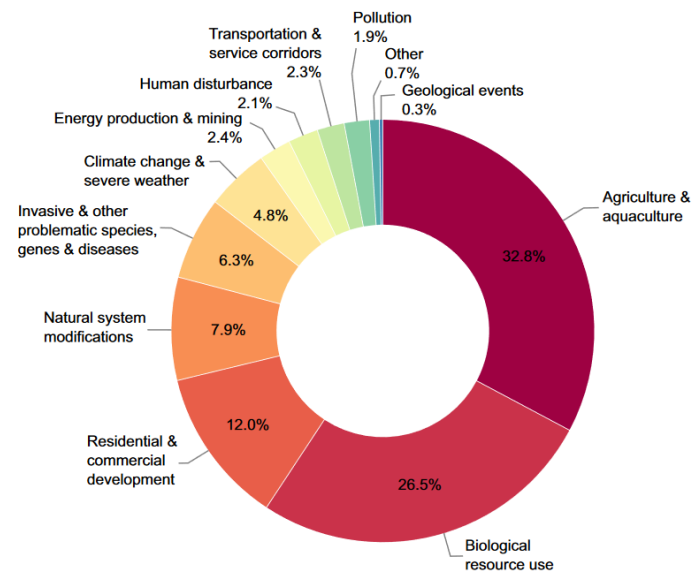
Authors: Melanie-Jayne R. Howes^{1,2}, Cassandra L. Quave³, Jérôme Collemare⁴, Evangelos C. Tatis^{5,6}, Danielle Twilley⁷, Ermias Lulekal⁸, Andrew Farlow^{9,10}, Liping Li¹¹, Maria-Elena Cazar¹², Danna J. Leaman¹³, Thomas A. K. Prescott¹⁴, William Milliken¹⁵, Cathie Martin¹⁶, Marco Nuno De Carvah¹⁷, Namrita Laal^{18,19}, Haijing Qie²⁰, Barnaby E. Walker²¹, Carlos Viscoso-Londolo²², Bob Aldred²³, Malin Rivers²⁴, Monique S.J. Simmonds²⁵, Elizabeth Ball^{26,27}, Alex Botton²⁸, Juri Felix²⁹, Felix Forest³⁰, Christine Leon³¹, China Williano³², Elmar Nic Lughadha³³

Keywords: Conservation, Biodiversity, Medicinal plants, Fungi, Sustainable use, Global healthcare, Climate change, Development, Over-exploitation, Certification, Sustainable harvests.

Abstract: Medicinal plants, often harvested directly from the wild, are under increasing pressure from climate change, development and over-exploitation in response to increasing demand. Is cultivation the answer, or can a certification programme create incentives to achieve sustainable harvests?

Introduction: Medicinal plants, often harvested directly from the wild, are under increasing pressure from climate change, development and over-exploitation in response to increasing demand. Is cultivation the answer, or can a certification programme create incentives to achieve sustainable harvests?

Conclusion: Medicinal plants, often harvested directly from the wild, are under increasing pressure from climate change, development and over-exploitation in response to increasing demand. Is cultivation the answer, or can a certification programme create incentives to achieve sustainable harvests?



Source: Howes et al. 2020

Source: Chen et al. 2016

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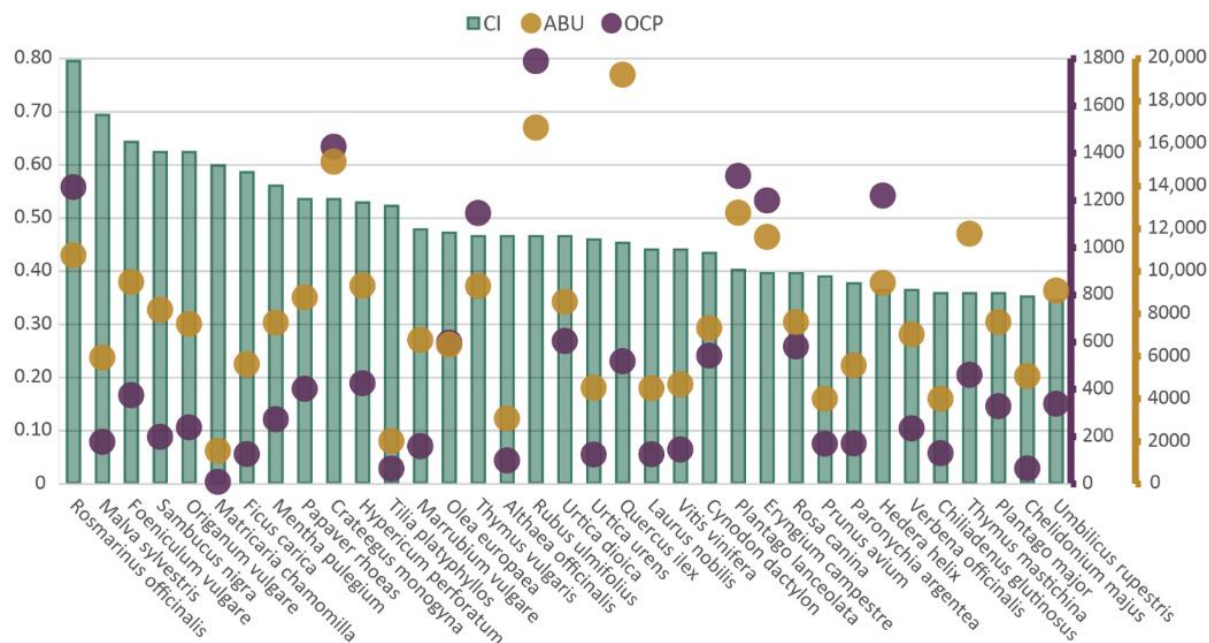
RESEARCH ARTICLE






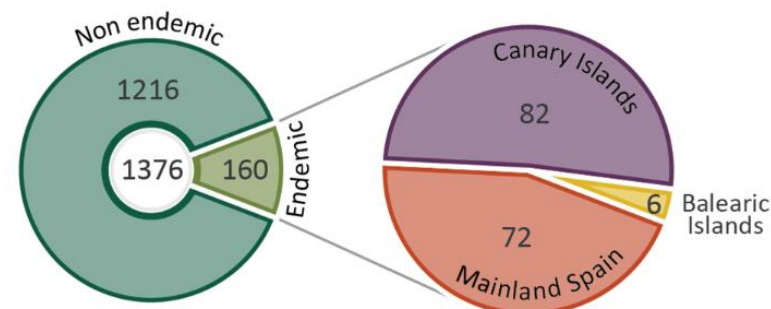
Cultural importance, availability and conservation status of Spanish wild medicinal plants: Implications for sustainability

J. Mateo-Martín^{1,2} | G. Benítez³ | A. Gras^{4,5} | M. Molina⁶ |
 V. Reyes-García^{7,8} | J. Tardío⁶ | A. Verde⁹ | M. Pardo-de-Santayana^{1,10}

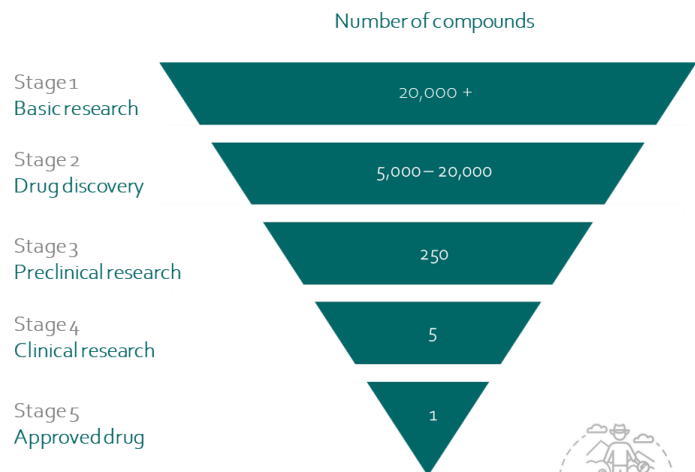
1,376 autochthonous wild vascular plant species



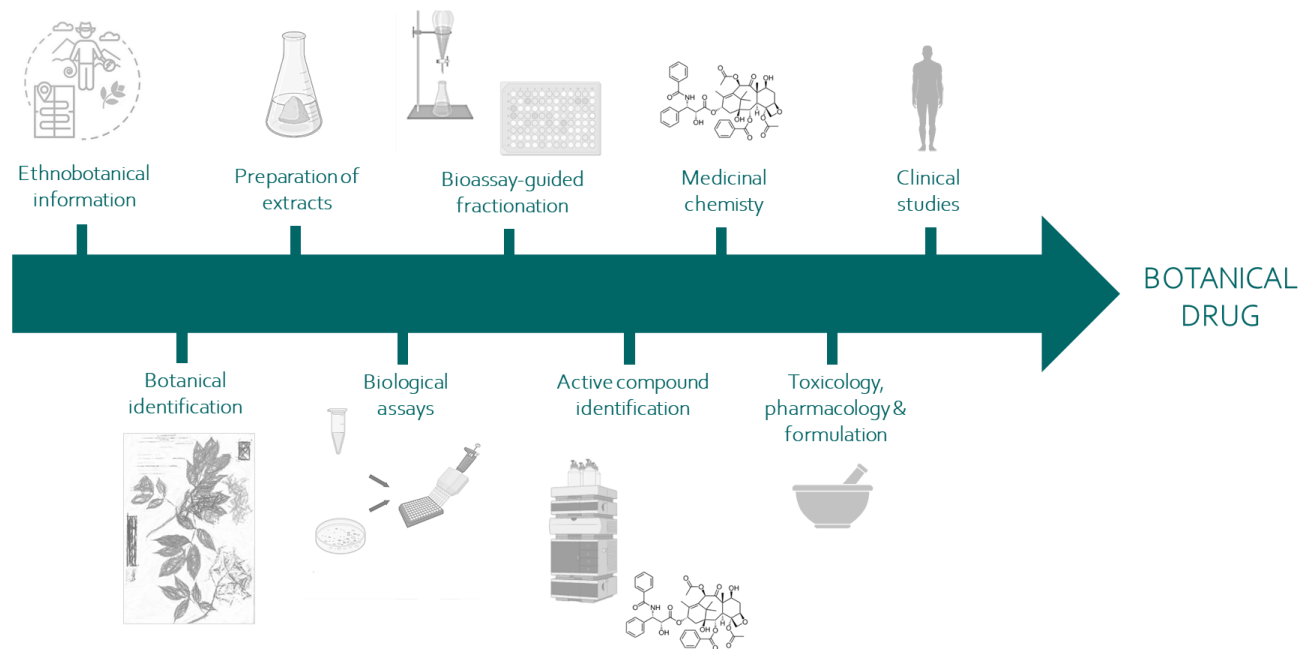
- 
First list of medicinal wild plants
 With their CI, availability, threat and protection status
- 
Sustainable gathering
 Highly available, with exceptions (marketed species)
- 
Traditional management systems
 Do not threaten plants long-term viability



5. PLANT NATURAL PRODUCTS IN DRUG DISCOVERY

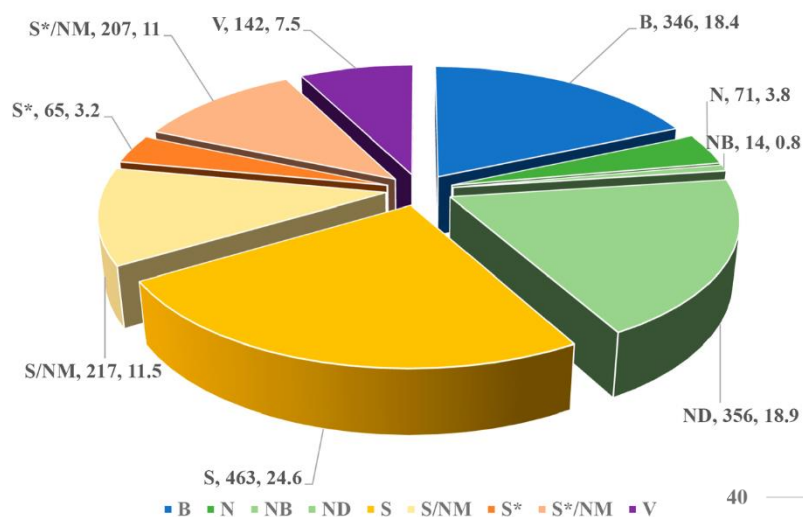


- ❑ The process of drug discovery has been estimated to take an average of 10 years upwards⁵ and cost more than 800 million dollars⁶.
- ❑ It has been estimated that only one in 5,000 lead compounds will successfully advance through clinical trials and be approved for use⁷.

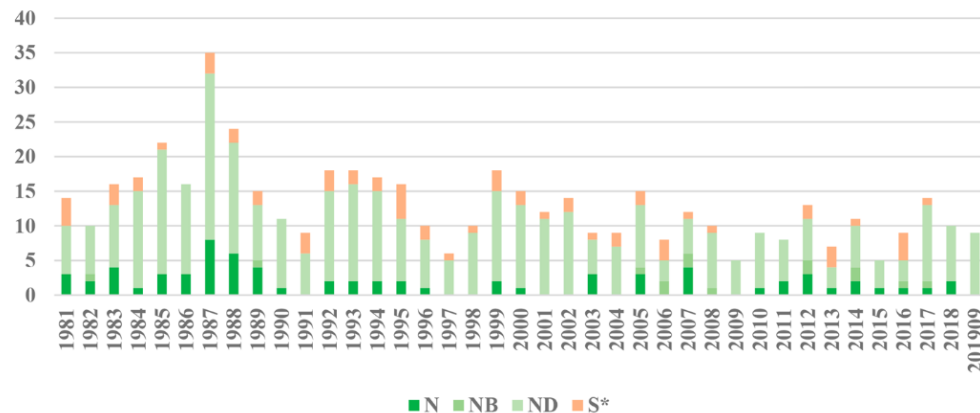


Natural Products as Sources of New Drugs over the Nearly Four Decades from 01/1981 to 09/2019

David J. Newman* and Gordon M. Cragg



code	brief definition/year
B	biological macromolecule, 1997
N	unaltered natural product, 1997
NB	botanical drug (defined mixture), 2012
ND	natural product derivative, 1997
S	synthetic drug, 1997
S*	synthetic drug (NP pharmacophore), 1997
V	vaccine, 2003
/NM	mimic of natural product, 2003



Traditional herbal medicinal products

30.4.2004

EN

Official Journal of the European Union

L 136/85

DIRECTIVE 2004/24/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 31 March 2004

amending, as regards traditional herbal medicinal products, Directive 2001/83/EC on the Community code relating to medicinal products for human use

The long tradition of the medicinal product makes it possible to reduce the need for clinical trials, in so far as the efficacy of the medicinal product is plausible on the basis of long-standing use and experience. Pre-clinical tests do not seem necessary, where the medicinal product on the basis of the information on its traditional use proves not to be harmful in specified conditions of use. However, even a long tradition does not exclude the possibility that there may be concerns with regard to the product's safety, and therefore the competent authorities should be entitled to ask for all data necessary for assessing the safety. The quality aspect of the medicinal product is independent of its traditional use so that no derogation should be made with regard to the necessary physico-chemical, biological and microbiological tests. Products should comply with quality standards in relevant European Pharmacopoeia monographs or those in the pharmacopoeia of a Member State.

The vast majority of medicinal products with a sufficiently long and coherent tradition are based on herbal substances. It therefore seems appropriate to limit the scope of the simplified registration in a first step to traditional herbal medicinal products.

Article 16c

1. The application shall be accompanied by:

- (c) bibliographical or expert evidence to the effect that the medicinal product in question, or a corresponding product has been in medicinal use throughout a period of at least 30 years preceding the date of the application, including at least 15 years within the Community. At the request of the Member State where the application for traditional-use registration has been submitted, the Committee for Herbal Medicinal Products shall draw up an opinion on the adequacy of the evidence of the long-standing use of the product, or of the corresponding product. The Member State shall submit relevant documentation supporting the referral;

Examples of active ingredients to human health with ethnobotanical knowledge associated:

Taxon	Active ingredients or derived medicines	Medicinal use
<i>Aesculus hippocastanum</i> L.	Escin	Antivaricose, antihemorrhoidal, for venous insufficiency
<i>Artemisia annua</i> L.	Artemisinin	Antimalarial
<i>Atropa belladonna</i> L.	Atropine	Mydriatic
<i>Filipendula ulmaria</i> (L.) Maxim., <i>Salix alba</i> L.	Acetylsalicylic acid	Analgesic, antipyretic, antiinflammatory
<i>Camellia sinensis</i> (L.) Kuntze, <i>Coffea arabica</i> L.	Cafeine	Stimulant
<i>Cannabis sativa</i> L.	Cannabidiol, tetrahydrocannabinol	Analgesic, antiemetic
<i>Carapichea ipecacuanha</i> (Brot.) L. Andersson	Emetin	Emetic, for amoebic dysentery
<i>Carica papaya</i> L.	Papaine	Mucolytic, digestive
<i>Catharanthus roseus</i> (L.) G. Don	Vinblastin, vincristin	Antileukemic, for Hodgkin's lymphoma
<i>Chondrodendron tomentosum</i> Ruiz & Pav.	Tubocurarine	Muscle relaxant
<i>Colchicum autumnale</i> L.	Colchicine	Antiuricemic
<i>Digitalis purpurea</i> L., <i>D. lanata</i> Ehrh.	Digoxin, digitoxin	Cardiotonic
<i>Dioscorea composita</i> Hemsl., <i>D. zingiberensis</i> C. H. Wright	Diosgenin	Contraception, sex hormone
<i>Ephedra sinica</i> Stapf	Ephedrine, pseudoephedrine	Bronchodilator, for rhinitis
<i>Ginkgo biloba</i> L.	Ginkgolide	To improve memory, for Alzheimer's disease
<i>Illicium verum</i> Hook.f.	Oseltamivir	For influenza
<i>Melilotus officinalis</i> (L.) Pall.	Dicumarol	Antithrombotic
<i>Papaver somniferum</i> L.	Codeine; morphine; papaverine	Analgesic, antitussive; analgesic; antispasmodic
<i>Physostigma venenosum</i> Balf.	Physotigmine	For glaucoma
<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Reserpin	Antihypertensive
<i>Senna alexandrina</i> Mill.	Sennoside	Laxative
<i>Silybum marianum</i> (L.) Gaertn.	Silymarin; silibinin	Hepatoprotective; antitumor
<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry	Eugenol	Dental analgesic
<i>Taxus brevifolia</i> Nutt., <i>T. baccata</i> L.	Paclitaxel	Antitumor
<i>Valeriana officinalis</i> L., <i>V. phu</i> L.	Valepotriate	Sedative, anxiolytic



Sweet wormwood (*Artemisia annua* L.; Asteraceae)

- Annual herbaceous plant from Asia
- Used in Chinese traditional medicine to treat fevers for more than 2,000 years

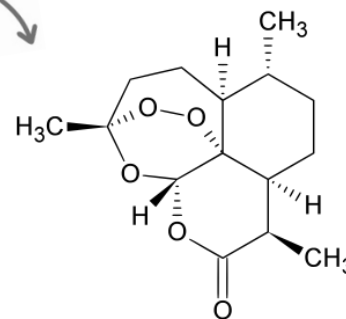


Tu Youyou

Nobel Prize in Physiology or
Medicine in 2015



A handbook of prescriptions for
emergencies
(Ge Hong, around 317-420
A.D.)

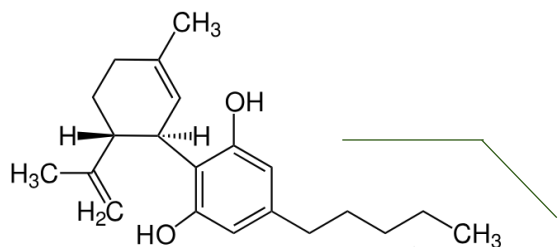


Artemisinin
(antimalarial activity against
Plasmodium spp.)



Hemp (*Cannabis sativa* L.; Cannabaceae)

- ❑ Annual herbaceous plant from Central Asia
- ❑ One of the oldest domesticated plants in the history of mankind
- ❑ Panoply of traditional uses, not only as a psychotropic

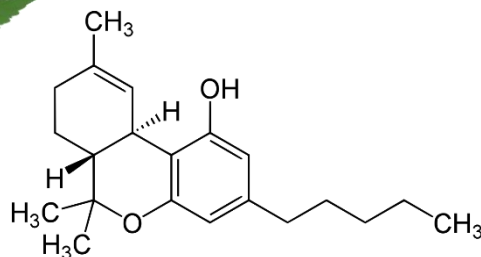


CBD
Cannabidiol



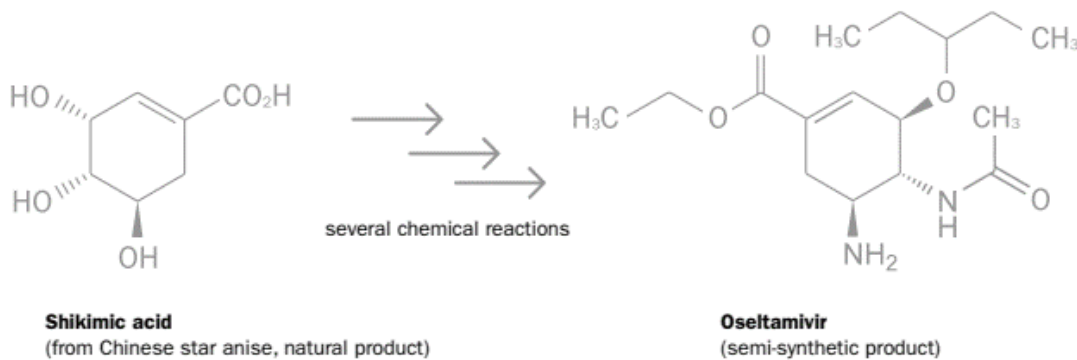
Cannabinoids
Sterols Flavonoids
Terpenoids

THC
Tetrahydrocannabinol

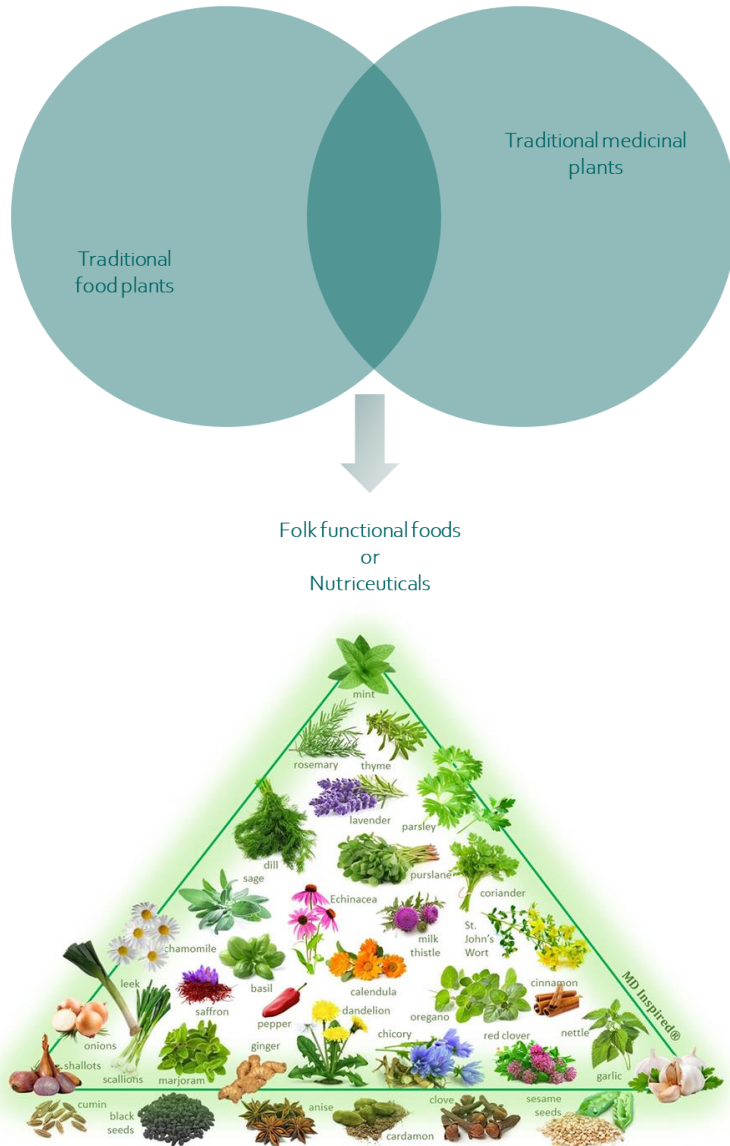


Star anise (*Illicium verum* Hook.f.; Schisandraceae)

- ❑ Evergreen tree from China
- ❑ Used in Chinese traditional medicine as a stimulant and expectorant, to relieve flatulence, to increase libido and to cure rheumatism
- ❑ Commonly used as a spice



Folk functional foods and active ingredients



JSFA Reports

MINI-REVIEW

Mediterranean herbs, spices, and medicinal plants—Natural remedies and rich sources of bioactive compounds

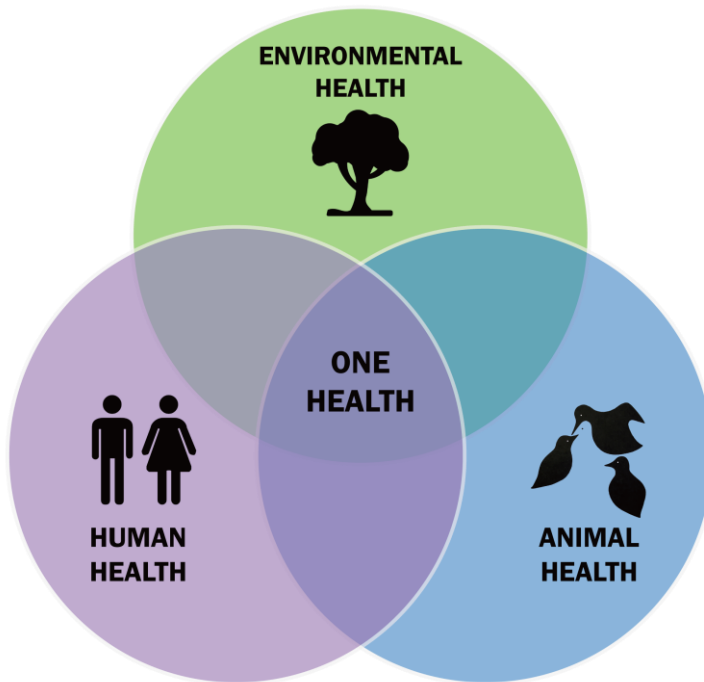
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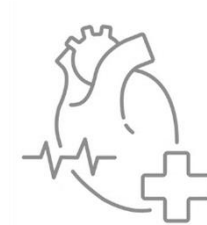
TABLE 1 Bioactive compounds found in Mediterranean herbs, spices, and medicinal plants

Compound	Chemical structure	Plants
Apigenin		Parsley, onion, cumin, chamomile, feverfew, calendula, anise, purslane, lavender
Quercetin		Onion, leek, shallots, bay leaf, coriander, dill, scallions, fennel, feverfew, cinnamon, St. John's wort, calendula, anise, clove, nettle, red clover, cardamon, lavender
Kaempferol		Onion, leek, coriander, dandelion, clove, nettle, red clove, purslane, cardamon, lavender
Chlorogenic acid		Cumin, mint, artichoke, echinacea, St. John's wort, nettle
Allicin		Garlic
Safranal		Saffron
Rosmarinic acid		Rosemary, thyme, oregano, mint, sage, basil, marjoram
Thymol and Carvacol		Thyme, oregano, marjoram, sage, cumin

6. MEDICAL ETHNOBOTANY & GLOBAL HEALTH ISSUES



Source: Wikipedia



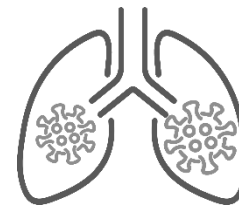
CARDIOVASCULAR
DISEASES



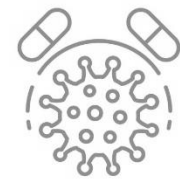
DIABETES



MENTAL
HEALTH



LONG COVID



ANTIMICROBIAL
RESISTENCE

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems.

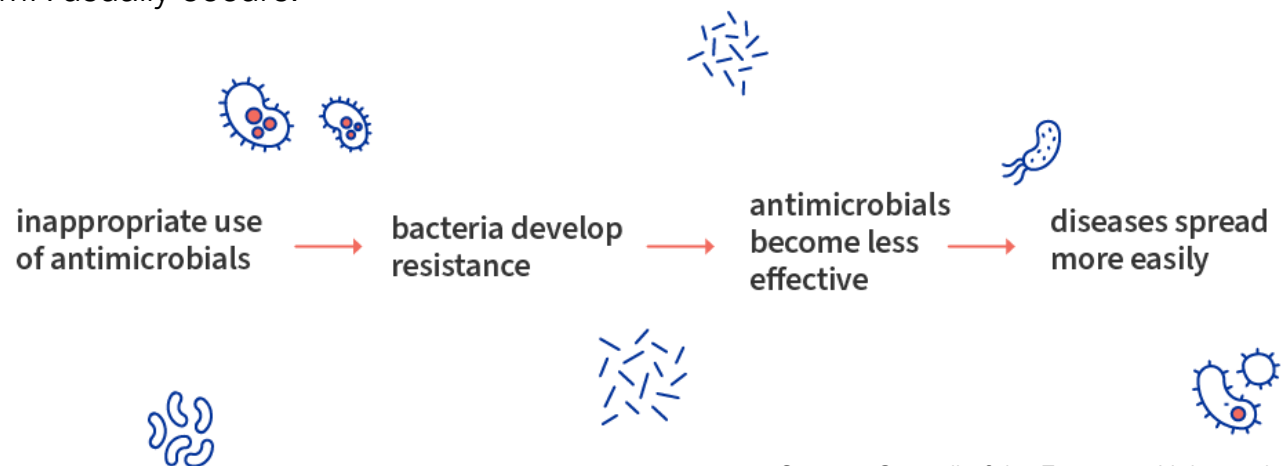
Infectious diseases & antimicrobial resistance

Infectious diseases are one of the leading causes of mortality in the world and the most important reasons are:

- ❑ Antimicrobial resistance (AMR)
- ❑ Rapid spread of emerging diseases
- ❑ Extended reach of tropical and vector-borne diseases



How AMR usually occurs:



Source: Council of the European Union webpage

ESKAPE pathogens are considered highly virulent and antibiotic resistant bacteria.

Enterococcus faecium

Staphylococcus aureus

Klebsiella pneumoniae

Acinetobacter baumannii

Pseudomonas aeruginosa

Enterobacter spp.

Staphylococcus aureus is one of the ESKAPE group bacteria which exhibits resistance to many antibiotic drug classes and is a high priority for drug discovery.

The Gram-positive pathogen *Staphylococcus aureus* commonly causes skin infections but can also lead to more severe conditions such as pneumonia, bacteremia, endocarditis, and osteomyelitis.



- ❑ Plant natural products represent a promising source of antibacterial lead compounds.
- ❑ 958 plant species are identified for their antibacterial potential⁹.
- ❑ 459 plant-derived compounds are detected with antibacterial properties¹⁰.

A Systematic Review of Plants With Antibacterial Activities: A Taxonomic and Phylogenetic Perspective

François Chassagne^{1*}, Tharanga Samarakoon^{2*}, Gina Porras¹, James T. Lyles¹, Micah Dettweiler¹, Lewis Marquez¹, Akram M. Salim¹, Sarah Shabih¹, Darya Raschid Farroki¹ and Cassandra L. Quave^{1,2,3,4}

¹Center for the Study of Human His University, Alaska, GA, United States
²Systems Pharmacology Program, L

Background: Antimicrob the globe. The cost of brr on investment is low. F dramatically since the 1 bioactive secondary rme pipeline. While many st natural products with antibacterial potential of j

Objectives: This system antibacterial activities.

Methods: Following the Science, PubMed and S "inhibitory concentration."

Results: We identified a t reviewed 66% of these (4 rigorous selection proce yielding data on 958 plant is found in 51 of 79 was reported within eudicots, 1 prominent in monocotyle chemical evolution across Lamiales, Fabaceae an *Cinnamomum verum*, *Ri* species. South Africa was medicinal was the most i tissue investigated. Frra bacteria in these studies. the 15 families most stuc

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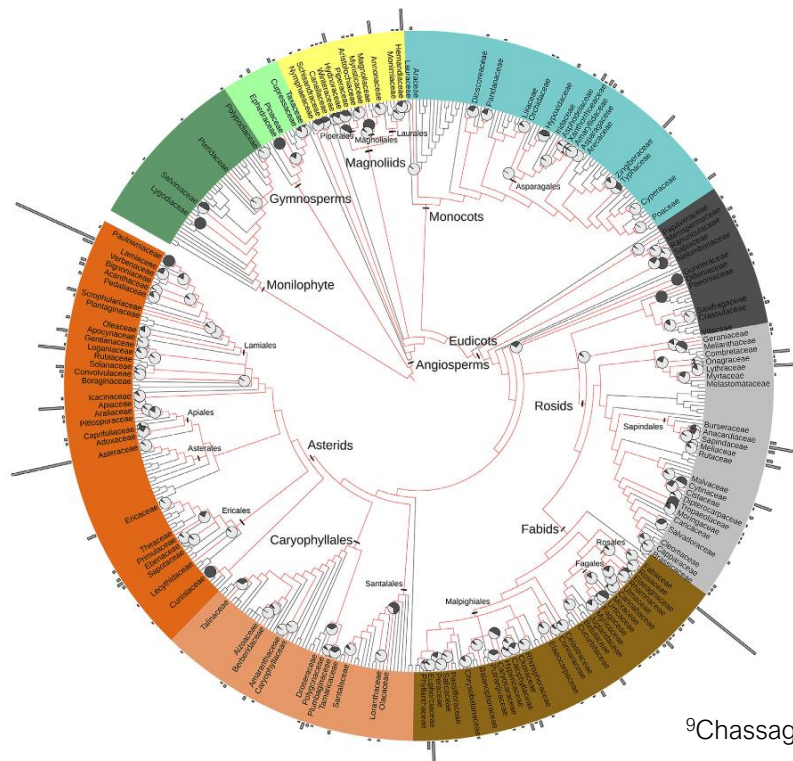
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CHEMICAL REVIEWS

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Ethnobotany and the Role of Plant Natural Products in Antibiotic Drug Discovery

Gina Porras,¹ François Chassagne,¹ James T. Lyles,¹ Lewis Marquez, Micah Dettweiler, Akram M. Salim, Tharanga Samarakoon, Sarah Shabih, Darya Raschid Farroki, and Cassandra L. Quave*

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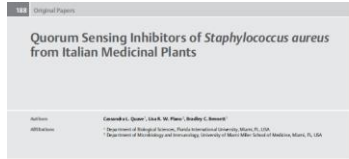
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ABSTRACT: The crisis of antibiotic resistance necessitates creative and innovative approaches, from chemical identification and analysis to the assessment of bioactivity. Plant natural products (NPs) represent a promising source of antibacterial lead compounds that could help fill the drug discovery pipeline in response to the growing antibiotic resistance crisis. The major strength of plant NPs lies in their rich and unique chemodiversity, their worldwide distribution and ease of access, their various antibacterial modes of action, and the proven clinical effectiveness of plant extracts from which they are isolated. While many studies have tried to summarize NPs with antibacterial activities, a comprehensive review with rigorous selection criteria has never been performed. In this work, the literature from 2012 to 2019 was systematically reviewed to highlight plant-derived compounds with antibacterial activity by focusing on their growth inhibitory activity. A total of 459 compounds are included in this Review, of which 50.8% are phenolic derivatives, 26.6% are terpenoids, 5.7% are alkaloids, and 1.7% are classified as other metabolites. A selection of 183 compounds is further discussed regarding their antibacterial activity, biosynthesis, structure–activity relationship, mechanism of action, and potential as antibiotics. Emerging trends in the field of antibacterial drug discovery from plants are also discussed. This Review brings to the forefront key findings on the antibacterial potential of plant NPs for consideration in future antibiotic discovery and development efforts.

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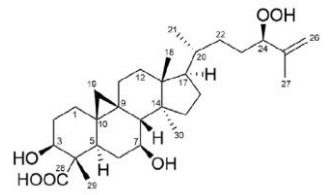
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Anti-quorum sensing medicinal compounds



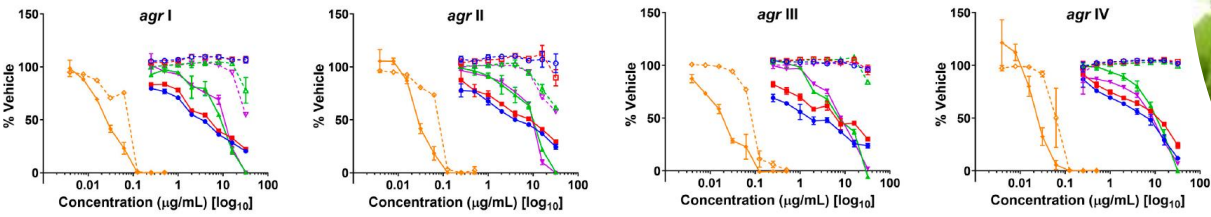
From 104 Italian plants studied, three medicinal plants exhibited anti-QS activity

Abstract
 Virulence and invasivity attributes due to quorum sensing inhibitors (QSIs) are well established in *Staphylococcus aureus* (S. aureus). QSIs are natural products that inhibit the production of quorum sensing (QS) signals, which are essential for the coordination of bacterial activities. QSIs are potential candidates for the development of novel antimicrobial agents. In this study, we investigated the anti-QS activity of 104 medicinal plants from Italy. The results showed that three medicinal plants (Castanea sativa, Echinacea purpurea, and Salvia officinalis) exhibited anti-QS activity. The active compounds were isolated and identified as castaneroxy A, echinacoside, and salvigenin, respectively. These compounds inhibited the production of QS signals and, consequently, the virulence and invasivity of S. aureus. Our findings suggest that medicinal plants can be a valuable source of novel anti-QS compounds for the treatment of S. aureus infections.



Castaneroxy A From the Leaves of Castanea sativa Inhibits Virulence in Staphylococcus aureus

Akram M. Salam¹, Gina Porras², Young-Saeng K. Cho³, Morgan M. Brown³, Caitlin J. Risener¹, Lewis Marquez¹, James T. Lyles⁴, John Bacsa⁴, Alexander R. Horswill³ and Cassandra L. Quave^{1,2,4*}



- 224C-F2 OD
- 224C-F2c OD
- △ 224C-F2c-PF42 OD
- ◇ Castaneroxy A OD
- Clindamycin OD
- 224C-F2 FLD
- 224C-F2c FLD
- ▲ 224C-F2c-PF42 FLD
- ◆ Castaneroxy A FLD
- Clindamycin FLD



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The Role of Traditional Plant Knowledge in the Fight Against Infectious Diseases: A Meta-Analytic Study in the Catalan Linguistic Area

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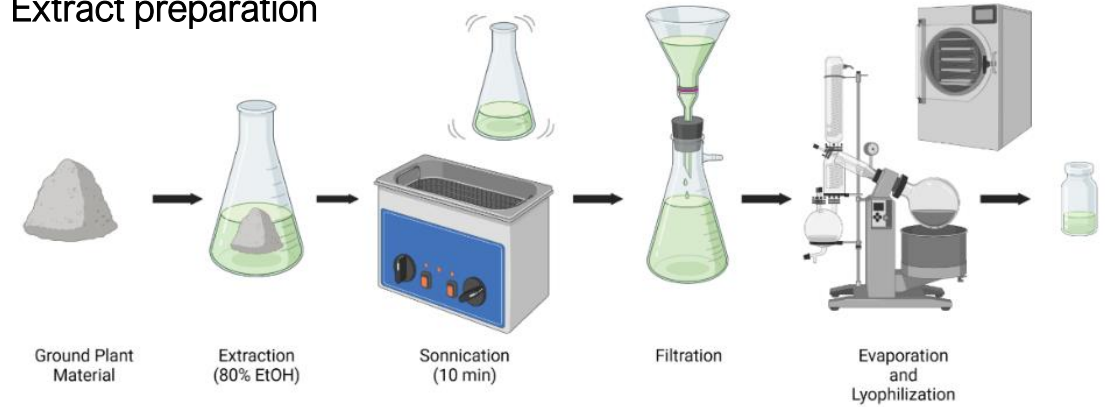
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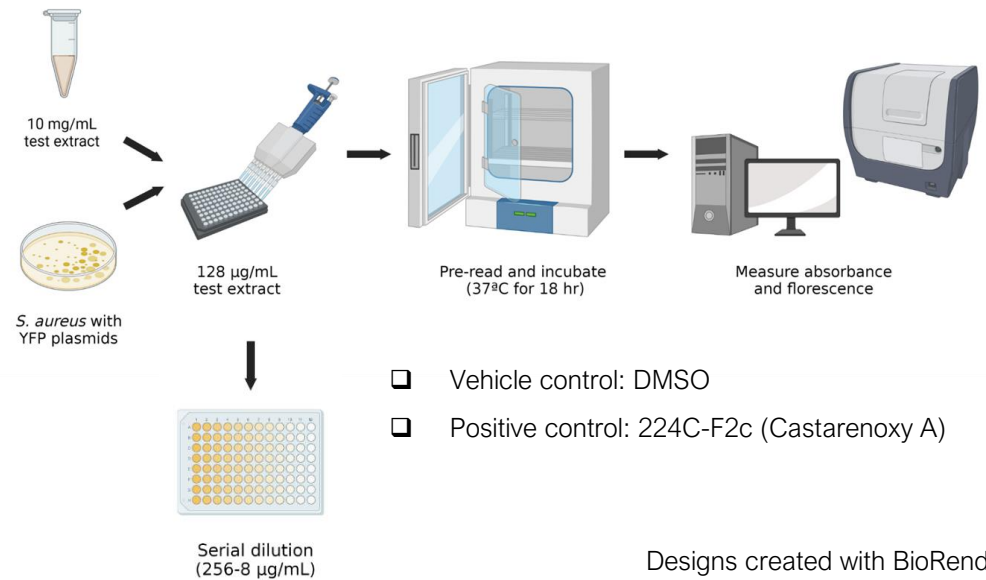
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Extract preparation



Anti-q_s activity screening



Medicinal plants & animal health care

- ❑ Ethnoveterinary refers to the traditional knowledge, skills, and practices used by local communities to maintain animal health and treat livestock diseases.
- ❑ In veterinary medicine, in the European Union, there is no specific regulation that establishes a simplified registration procedure for products of traditional use.



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SUMMARY



1. Traditional knowledge is an important part of the biodiversity.
2. Ethnobotany is an interdisciplinary field at the interface of the natural and social sciences that studies the relationships between humans and plants.
3. The use of new techniques and approaches linked to the traditional knowledge of plants make ethnobotany a key science to guarantee the human well-being.
4. Ethnobotany plays a very important role in the path of new compounds discovery and medical ethnobotany is a sustainable way to treat some of the global health issues.

