Helichrysum Mill

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Contributor: Okobi Ekpo

The genus *Helichrysum* Mill comprises hundreds of species that are mostly flowering perennial shrubs. Some of these plants that belong to the *Helichrysum* species are used in traditional medicine to treat cough, back pain, diabetes, asthma, digestive problems, menstrual pain, chest pain, kidney disorders, skin disorders, wounds, open sores, among other conditions, but, only a few scientific studies are reported in the literature with sufficient information that validates the acclaimed folkloric benefits of these plants. Cytotoxicity, genotoxicity, anti-proliferative, anti-bacterial, anti-fungal, anti-viral, anti-HIV, anti-malarial, anti-ulcerogenic, anti-tyrosinase, anti-inflammatory, and anti-oxidant activities are reported of selected *Helichrysum* species of interest: *H. petiolare, H. cymocum, H. foetidum,* and *H. pandurifolium Schrank*, using scientific databases as well as electronic and print sources.

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1. Introduction

The genus *Helichrysum* Mill comprises distinctively of aromatic herbs and shrubs of the family *Asteraceae* . It has a worldwide distribution but is mainly found in Africa, with its highest diversity in South Africa, where approximately 245 of the 500 known species occur. Other areas of *Helichrysum* diversity include Europe, southwestern Asia, South India, Sri Lanka, Turkey, and Australia. For ease of identification, the southern African species are divided into 30 informal groups [1].

Plants of the *Helichrysum* genus have been in use for more than 2000 years for various folkloric purposes. The flowers of some members of this genus have a unique bright-yellow color that depicts their Greek language origins: “helios” and “chryos” which mean “sun” and “gold” respectively. In folkloric medicine, some *Helichrysum* plant parts are either consumed as teas or prepared as “burnt offering” smoke to disinfect the abodes of sick patients and to appeal for blessings from the ancestors in indigenous traditional practices [2]. In general, plants of this genus are known to be used in traditional medicine for the treatment of many ailments, including liver disorders, gall bladder complications, cystitis, jaundice, stomach pain, allergies, infections, colds, cough, skin infections, inflammation, menstrual pain, asthma, arthritis, insomnia, diabetes mellitus, and for wound healing [3][4][5][6][7], most commonly, the scented leaves and flowers.

The therapeutic properties of the *Helichrysum* species are often attributed to their different constituent phytochemicals, especially the essential oils [8][9]. In addition to the essential oils, plants in this species also contain such phytochemicals as terpenoids, phenolics and oxygenated compounds as secondary metabolites, including flavonoids, chalcones, phenolic acids, terpenes and essential oils, pyrone, benzofurans, and phloroglucinols [10]. Thus, these plants are potential reservoirs of bioactive compounds for drug discovery and development. Hitherto, only limited biological effects of the *Helichrysum* phytochemicals have been reported including, the antioxidant, antifungal, anti-inflammatory, anti-bacterial, hepatoprotective, anti-proliferative and anti-diabetic activities [7][11][12][13].

So far, only a few of the many *Helichrysum* species have been studied; the best known *Helichrysum* species used traditionally to treat different ailments are *H. cymosum* , *H. odoratissimum* , *H. petiolare* and *H. nudifolium* . Only limited information is available in the literature on these plant species on their ornamental, industrial and pharmaceutical applications [14].

2. Essential Oils Present in Selected *Helichrysum* Species

Essential oils (EOs) are the condensed or concentrated hydrophobic liquids that contain volatile chemical compounds derived from plants. The variety of compounds in EOs depends on such factors as the plant species, plant part used (leaves, fruits, roots), harvest period, environmental conditions (land fertility, humidity, temperature) and the extraction technique employed [15].

One distinct characteristic of the helichrysum genus is its aromatic nature and most of the species in this genus have been reported to be rich in essential oils (EOs) containing many compounds [10]. Many EOs are prescribed as alternative medicine (in aromatherapy) based on the healing effects of their aromatic compounds [16]. Monoterpenes, sesquiterpenes and diterpenes are some of the broad groups of compounds present in the EOs of most plants, including the *helichrysum* genus ; these compounds are largely responsible for the reported anti-fungal, anti-bacterial, anti-diabetic, anti-inflammatory, anti-ulcer, anti-cancer, anti-oxidant, anti-nociceptive, and anti-spasmodic properties associated with these plants (**Table 1**).

Table 1. The common phytochemical compounds present in the essential oils of selected *Helichyrsum species*.

***Helichrysum* Species**	**Plant Parts**	**Compounds**	**Method of Analysis**	**Pharmacological Activity**	**References**
H. petiolare  **A growing *Helichrysum petiolare* plant [17] SANBI available online http://pza.sanbi.org/helichrysum-petiolare (accessed on 19 June 2021)**	Leaves	α-pinene (6.8%), 1, 8-cineole (22.4), p-cymene (9.8%) and β-caryophyllene (14%)	G.C.-M.S.	Anti-fungal, anti-inflammatory	[18]
	Whole plant	(*E*)-Longipinane (11.79%), *trans*-Geranylgeraniol (11.68%), Phytol (11.28%) Geranyllinalool (11.13%) and α-Eicosane (12.07%)	G.C.-M.S.	Anti-microbial, anti-inflammatory	[19]
H. cymosum  **A growing *Helichrysum cymosum* plant [20] SANBI available online: http://pza.sanbi.org/helichrysum-cymosum-subsp-cymosum (accessed on 19 June 2021)**	Leaves, Flowers	Δ-3-carene (16.1%), β-caryophyllene (12.0%)	G.C., G.C.-M.S.	Anti-fungal	[21]
	Flowers	Monoterpenes (77.9%)	G.C.-M.S. G.C., G.C.-M.S.	Anti-inflammatory	[22]
	Leaves, Flowers	(Z) -β- ocimene	G.C.-M.S.	-	[23]
	Leaves	α-pinene (12.4%), 1, 8-cineole (20.4%), β-		Anti-bacterial	[18]

Helichrysum Species	Plant Parts	Compounds	Method of Analysis	Pharmacological Activity	References
		caryophyllene (10.8%)			
H. foetidum  A growing *Helichrysum foetidum* plant [24] SANBI available online http://pza.sanbi.org/helichrysum-foetidum (accessed on 19 June 2021)	Leaves, flower	B-pinene (3.1%), Trans-Sabiene hydrate (1.8%), 4-terpineol (3.1%), β-caryophyllene (2.5%)	G.C.-M.S.	Anti-microbial Anti-inflammatory	[25]
H. pandurifolium  A growing *Helichrysum pandurifolium* plant [26] iNaturalist. Available online: https://www.inaturalist.org/observations/23571154 (accessed on 19 June 2021)		N/A	N/A	N/A	N/A

Gas chromatography: G.C.; Gas chromatography mass spectrometry: G.C.-M.S.; Not available: N/A.

3. Conclusions

Plants belonging to the *Helichrysum* genus are a vital source of traditional medicines in many parts of the world, including South Africa. The many novel chemical compounds present in the extracts of these plants and their essential oils account for most of their pharmacological actions. We highlighted the reported diversity of the *Helichrysum* genus and the ethnomedicinal and biological activities of some of its species. However, only limited scientific reports are available in the literature on some species, hence further multi-disciplinary studies by botanists, plant pathologists, chemists, ethnopharmacologists and medical scientists are required on all the plants in this genus, as they appear to be potential sources of useful bioactive medicinal compounds that could be exploited in the drug discovery and development value chain.

References

1. Hillard, O. Flora of southern Africa. In Asteraceae; Leistner, O.A., Ed.; Botanical Institute of South Africa: Pretoria, South Africa, 1983; Volume 33, pp. 61–310.
2. Pooley, E. Mountain Flowers: A Field Guide to the Flora of the Drakensberg and Lesotho; Flora Publications Trust: Durban, South Africa, 2003.

3. Viegas, D.A.; Palmeira-de-Oliveira, A.; Salgueiro, L.; Martinez-de-Oliveira, J.; Palmeira-de-Oliveira, R. Helichrysum italicum: From traditional use to scientific data. J. Ethnopharmacol. 2014, 151, 54–65.
4. Rigano, D.; Formisano, C.; Pagano, E.; Senatore, F.; Piacente, S.; Masullo, M.; Capasso, R.; Izzo, A.A.; Borrelli, F. A new acetophenone derivative from flowers of Helichrysum italicum (roth) don ssp. Ital. Fitoter. 2014, 99, 198–203.
5. Czinner, E.; Lemberkovics, É.; Bihátsi-Karsai, E.; Vitányi, G.; Lelik, L. Composition of the essential oil from the inflorescence of Helichrysum arenarium (L.) Moench. J. Essent. Oil Res. 2000, 12, 728–730.
6. Eroğlu, H.E.; Hamzaoğlu, E.; Aksoy, A.; Budak, Ü.; Albayrak, S. Cytogenetic effects of Helichrysum arenarium in human lymphocytes cultures. Turk. J. Biol. 2010, 34, 253–256.
7. Reidel, R.V.B.; Cioni, P.L.; Ruffoni, B.; Cervelli, C.; Pistelli, L. Aroma profile and essential oil composition of Helichrysum species. Nat. Prod. Commun. 2017, 12, 1934578X1701200931.
8. Harborne, J.B.; Turner, B.L. Plant Chemosystematics; Academic Press: London, UK, 1984.
9. Mari, A.; Napolitano, A.; Masullo, M.; Pizza, C.; Piacente, S. Identification and quantitative determination of the polar constituents in Helichrysum italicum flowers and derived food supplements. J. Pharm. Biomed. Anal. 2014, 96, 249–255.
10. Akaberi, M.; Sahebkar, A.; Azizi, N.; Emami, S.A. Everlasting flowers: Phytochemistry and pharmacology of the genus Helichrysum. Ind. Crop. Prod. 2019, 138, 111471.
11. Aslan, M.; Orhan, D.D.; Orhan, N.; Sezik, E.; Yeşilada, E. A study of antidiabetic and anti-oxidant effects of Helichrysum graveolens capitulums in streptozotocin-induced diabetic rats. J. Med. Food 2007, 10, 396–400.
12. Hutchings, A.; van Staden, J. Plants used for stress-related ailments in traditional zulu, xhosa and sotho medicine. Part 1: Plants used for headaches. J. Ethnopharmacol. 1994, 43, 89–124.
13. Najar, B.; Nardi, V.; Cervelli, C.; Mecacci, G.; Mancianti, F.; Ebani, V.V.; Nardoni, S.; Pistelli, L. Volatilome analyses and In Vitro antimicrobial activity of the essential oils from five South African Helichrysum species. Molecules 2020, 25, 3196.
14. Giovanelli, S.; De Leo, M.; Cervelli, C.; Ruffoni, B.; Ciccarelli, D.; Pistelli, L. Essential oil composition and volatile profile of seven Helichrysum species grown in italy. Chem. Biodivers. 2018, 15, e1700545.
15. Ebani, V.V.; Mancianti, F. Use of essential oils in veterinary medicine to combat bacterial and fungal infections. Vet. Sci. 2020, 7, 193.
16. Plant, R.M.; Dinh, L.; Argo, S.; Shah, M. The essentials of essential oils. Adv. Pediatrics 2019, 66, 111–122.
17. Helichrysum Petiolare. Available online: http://pza.sanbi.org/helichrysum-petiolare (accessed on 19 June 2021).
18. Mukherjee, P.K. Anti-viral evaluation of herbal drugs. In Quality Control and Evaluation of Herbal Drugs; Elsevier: Amsterdam, The Netherlands, 2019; pp. 599–628.
19. Aladejana, A.E.; Bradey, G.; Afolayan, A.J. Comparative evaluation of essential oils of Helichrysum petiolare Hilliard & B.L. Burtt obtained from solvent-free microwave and hydrodistillation extraction methods. Asain J. Chem. 2020, 32, 1–13.
20. Helichrysum cymosum (L.) D.Don Subsp. cymosum. Available online: https://keys.lucidcentral.org/keys/v3/helichrysum/key/Helichrysum/Media/Html/Helichrysum_cymosum_subsp._cymosum (accessed on 14 July 2021).

21. Franccedil, T.; Lambert, S.M.; Michel, J.D.P.; Gaby, N.M.E.; Fabrice, F.B.; Zaché, N.; Henri, A.Z.P.; Chantal, M. Composition, radical scavenging and anti-fungal activities of essential oils from 3 Helichrysum species growing in Cameroon against Penicillium oxalicum a yam rot fungi. Afr. J. Agric. Res. 2010, 5, 121–127.
22. Lall, N.; Kishore, N. Are plants used for skin care in south africa fully explored? J. Ethnopharmacol. 2014, 153, 61–84.
23. Sobhy, E.; El-Feky, S. Chemical constituents and antimicrobial activity of Helichrysum stoechas. Asian J. Plant Sci. 2007, 6, 692–695.
24. Swelankomo, N. Helichrysum foetidum (L.) Moench (Asteraceae). 2005. Available online: http://pza.sanbi.org/helichrysum-foetidum (accessed on 14 July 2021).
25. Najar, B.; Cervelli, C.; Ferri, B.; Cioni, P.; Pistelli, L. Essential oils and volatile emission of eight South African species of Helichrysum grown in uniform environmental conditions. S. Afr. J. Bot. 2019, 124, 178–187.
26. Fiddle Everlasting (Helichrysum pandurifolium). Available online: https://www.inaturalist.org/observations/23571154 (accessed on 19 June 2021).