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Artemisia: A short review on Morphology, Composition and extraction.

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Abstract:

Artemisia species are wildly found plant across the globe. These various species grown at different climatic and demographic conditions. This review article mainly focus on morphology, chemical composition and extraction process of Artemisia species. As this plant having medicinal value, use to treat various diseases and disorders further novel research on this plant is continuously carried out.

Introduction:

Artemisia L. ("sweet wormwood," "annual wormwood,"), belonging to Asteraceae family of flowering plants, is annual, aromatic, herbaceous, and glabrous or sparselyhairy, with an upright brownish colored stem. It naturally grows up to a height of 1 meter, but under cultivated conditions, it may reach up to a height of 2 meters. It usually consists of a single stem with alternate branches and deeply dissected leaves. The inflorescence consists of small capitula arranged in loose panicles with bisexual disc florets at the center and pistillate ray florets at the margins.[1] Chinese phytochemist You-You Tu working in the Institute of Chinese Materia Medica, China Academy of Traditional Chinese Medicine discovered Artemisinin (Qinghaosu) in the early 1970s. [2]

Fig. 1 various species of Artemisia [3]

The source of this medicine was the *Artemisia annua* L., which has long been used in Chinese folk medicine. This plant well-known representatives of the *Artemisia* L.genus. *Artemisia* genus is named after the Greek goddess Artemis, of the hunt and fertility. It is one of the most widely distributed genera all over the globe. More than400 species of plants distributed in various forms like grasses, shrubs, and trees. [4] As per current and future climate conditions, in mid-latitudes in western and central Europe, southeastern Asia, southeastern North, and southeastern South America are suitable areas for growth of *Artemisia*. [5] For long past years, *Artemisia* plants have been using by local peoples as remedies mainly in areas where plant occur naturally. Currently, ethnobotanical and ethno pharmacological indications of *Artemisia* genus have been proved by scientific studies. There are many species of the plant that have proven therapeutic value. [5,6]. The major antioxidant phenolic compounds found in *Artemisia* species are Gallic acid, catechin, vanillic acid, caffeic acid, epicatechin, ferulic acid, sinapic acid, rutin, quercetin, luteolin, gentisic acid, chlorogenic acid, isoquercitrin, quercetol, kaempferol, and apigenin. [7]

Scientific classification and description of plant

Family: Asteraceae

Subfamily: Asteroideae

Tribe: Anthemideae

Genus: Artemisia L.

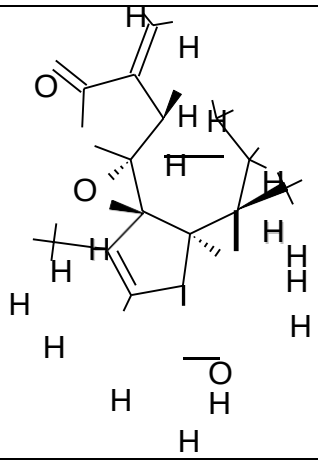
The plants of this genus are annual, biennial, and perennial herbs or small shrubs and half shrubs.[8] Morphological features of the genus *Artemisia* is described as alternate leaves, small racemouse capitula, paniculate or capitate, inflorescence,

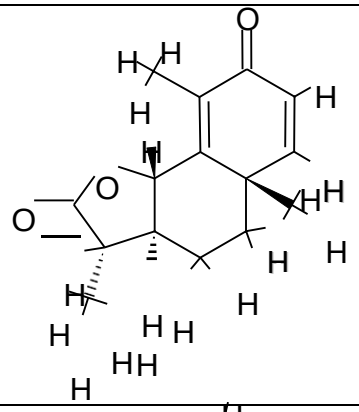
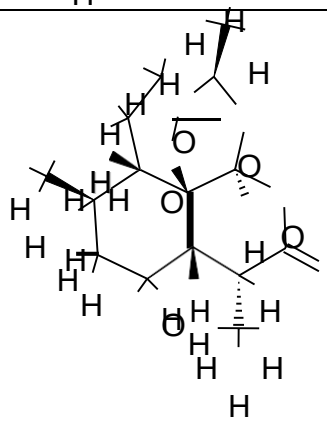
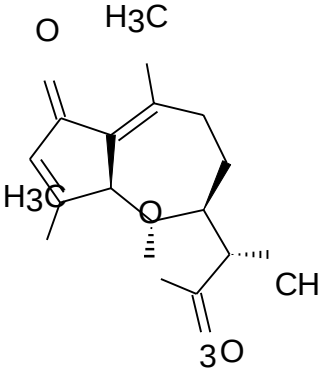
Rarely solitary; involucral bracts in few rows, receptacle flat to hemispherical, without scales and sometimes hirsute; florets all tubular, achenes obovoid, pappus absent or sometimes a small scarious ring. [9]

Phytochemistry:

The phytochemical assessment of *Artemisia species* showed the presence of different phytoconstituents namely tannins, alkaloids, flavonoids, terpenoids, aminoacids, glycosides, and quinines, etc. Various secondary metabolites such as terpenoids, flavonoids, polysaccharides, and saponins have been characterized and authenticated by using High-performance liquid chromatography (HPLC), Gas Chromatography–Mass Spectroscopy (GC–MS), and Nuclear Magnetic Resonance(NMR). [10]

Sesquiterpene lactones found in *Artemisa* L

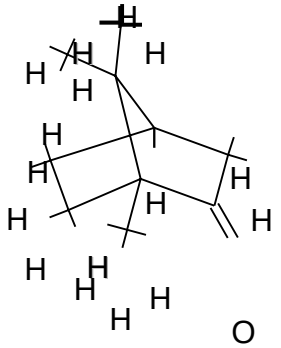
Sr. No	**Name of constituent**	**Structure**
1.	Arablin	

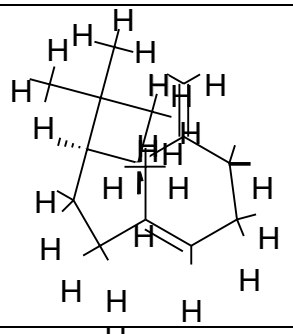
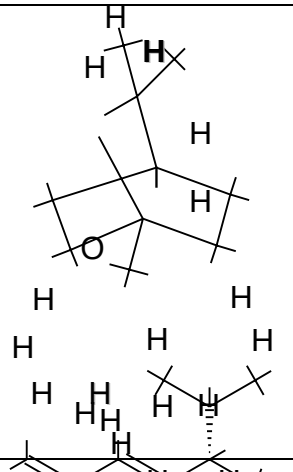
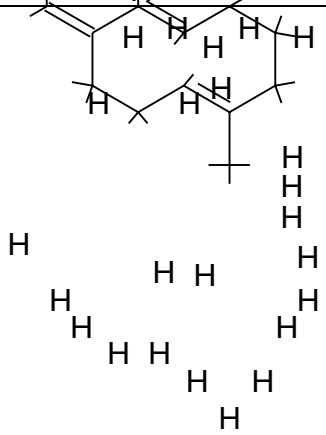
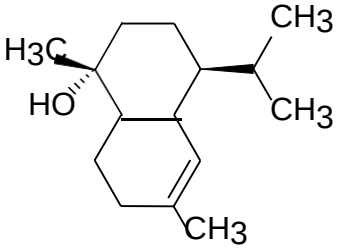
2.	Santonin	
3.	Artemisin	
4.	Leocomisin	

Sesquiterpene lactones are formed in the plant by oxidation of the methyl part of the isopropyl group attached to the main carbon skeleton. Cyclization of farnesyldiphosphate gives (+)-germacrene A. Oxidation of the isopropenyl side chain by (+)- germacrene A-hydroxylase enzyme to primary alcohol and further oxidation by NAD (P)+- dependent dehydrogenases enzyme gives germacrene acid. This is followed by hydroxylation at the C-6 position and subsequent lactonization leads to (+)- costunolide. It is assumed that the second stage of the cyclization of

germacranolides to the guaianolide skeleton proceeds through epoxidation or hydroxylation of the costunolide. As a result of research on the homology of nucleotide sequences with known sesquiterpene monooxygenases, six promising cytochrome P450 contigs were identified and selected for functional characterization. A new cytochrome P450, cauniolide synthase, which catalyzes theformation of guaianolide cauniolide from the germacranolide substrate costunolide, has been characterized. Unlike most cytochromes P450s, cauniolide synthase has a unique mechanism of action, combining stereoselective hydroxylation of costunolide at the C-3 position with elimination, cyclization, and regioselective deprotonation. One of the promising guaianolides is arglabin, isolated for the first time from Artemisia glabella, an endemic species of Artemisia. A. glabella is a source of a number of biologically active compounds such as sesquiterpene lactones and essential oils. Arglabin is the active substance of the anticancer drug "Arglabin", which was developed at the International Research and Production Holding "Phytochemistry" and is produced on an industrial scale by the Karaganda Pharmaceutical Plant. Arglabin is found in all organs of A. glabella and throughoutthe growing season.[11]

Other chemical constituents in various species of artemisia [12]:

Sr. No	**Name of chemical constituent**	**Structure**
1.	Camphor	

2.	E-caryophyllene	
3.	Eucalyptol	
4.	Germacrene D	
5	Cadinol	

Extraction technique:

Most widely used technique to extract Artemisia species is High-pressure green technique, also called as pressurized liquid extraction (PLE) or accelerated solvent extraction (ASE) or pressurized fluid extraction (PFE). PLE is a technique characterized by the employment of suitable pressures to sustain the solvent in its

Liquid phase and high temperatures that lay below the critical point. Major advantage of this technique is, that a smaller amount of solvent is needed to carry out the process. As a result of this, the efficiency of extraction is enhanced due to a better mass transfer rate. At elevated temperature conditions, solvent solubility is improved while viscosity decreases; this helps in matrix penetration and mass transfer. So, pressure and temperature are consequential parameters to be considered when performing PLE. However, while pressure is a significant parameter, increasing pressure beyond the point necessary to maintain the solventin its liquid state has a negligible impact on the extraction process. Instead, time would be better spent on selecting a solvent that is consistent with the nature of the desired compounds. [13]

Reference:

1. Wani, Kaiser & Zehra, Andleeb & Choudhary, Sadaf & Naeem, M. & Khan, M. Masroor & Khan, Riyazuddeen & Aftab, Tariq. (2022). Artemisia annua L.: Traditional Uses, Phytochemistry, and Pharmacological Activities. 10.1007/978-981-19-6080-2.
2. Liao F. Discovery of Artemisinin (Qinghaosu). *Molecules*. 2009; 14(12):5362-5366. https://doi.org/10.3390/molecules14125362.
3. Olennikov, Daniil & Chirikova, N. & Kashchenko, Nina & Nikolaev, Vyacheslav & Kim, Sang-Woo & Vennos, Cécile. (2018). Bioactive Phenolics of the Genus Artemisia (Asteraceae): HPLC-DAD-ESI-TQ- MS/MS Profile of the Siberian Species and Their Inhibitory Potential againstα-Amylase and α-Glucosidase. Frontiers in Pharmacology. 9. 10.3389/fphar.2018.00756.
4. Sharifi-Rad J, Herrera-Bravo J, Semwal P, Painuli S, Badoni H, Ezzat SM,Farid MM, Merghany RM, Aborehab NM, Salem MA, Sen S, Acharya K,Lapava N, Martorell M, Tynybekov B, Calina D, Cho WC. *Artemisia* spp.: An Update on Its Chemical Composition, Pharmacological and Toxicological Profiles. Oxid Med Cell Longev. 2022 Sep 5;2022:5628601. doi: 10.1155/2022/5628601. PMID: 36105486; PMCID: PMC9467740.
5. Danyu Wang, Chaoyi Shi, Khan Alamgir, SeMyung Kwon, Leilei Pan, Yuanjun Zhu, Xiaohui Yang, Global assessment of the distribution and conservation status of a key

medicinal plant (Artemisia annua L.): The rolesof climate and anthropogenic activities, Science of The Total Environment,Volume 821,2022,153378,ISSN 0048-9697,https://doi.org/10.1016/j.scitotenv.2022.153378.

6. Ekiert H, Klimek-Szczykutowicz M, Rzepiela A, Klin P, Szopa A. ArtemisiaSpecies with High Biological Values as a Potential Source of Medicinal andCosmetic Raw Materials. *Molecules*. 2022; 27(19):6427. https://doi.org/10.3390/molecules27196427
7. Bordean ME, Ungur RA, Toc DA, Borda IM, Marțiș GS, Pop CR, Filip M, Vlassa M, Nasui BA, Pop A, Cinteză D, Popa FL, Marian S, Szanto LG, Muste S. Antibacterial and Phytochemical Screening of Artemisia Species. Antioxidants (Basel). 2023 Feb 27;12(3):596. doi: 10.3390/antiox12030596. PMID: 36978844; PMCID: PMC10045255.
8. Ekiert H, Pajor J, Klin P, Rzepiela A, Ślesak H, Szopa A. Significance of *Artemisia Vulgaris* L. (Common Mugwort) in the History of Medicine and Its Possible Contemporary Applications Substantiated by Phytochemical and Pharmacological Studies. Molecules. 2020 Sep 25;25(19):4415. doi: 10.3390/molecules25194415. PMID: 32992959; PMCID: PMC7583039
9. Kundan Singh Bora1 and Anupam Sharma. The Genus Artemisia: A Comprehensive Review. Pharmaceutical Biology, 2011; 49(1):101–109©2011 Informa Healthcare USA, Inc.ISSN 1388-0209 print/ISSN 1744-5116onlineDOI: 10.3109/13880209.2010.497815Pharmaceutical Biology201149110110926 April 201021 May 201027 May 20101388-02091744-5116© 2011 Informa Healthcare USA, Inc.10.3109/13880209.2010.497815PHB497815.
10. Bisht D, Kumar D, Kumar D, Dua K, Chellappan DK. Phytochemistry and pharmacological activity of the genus artemisia. Arch Pharm Res. 2021 May;44(5):439-474. doi: 10.1007/s12272-021-01328-4. Epub 2021 Apr 24. PMID: 33893998; PMCID: PMC8067791.
11. S Adekenova Gulimzhan, S Shaikenova Zh, V Chervyakova, Zakarya KD, S dekenov. The costunolide biosynthesis enzymes of Artemisia glabella Kar. etKir.: Determination of the nucleotide sequences of the mRNA. 2021 Apr 30;13(1):9–18.
12. Sharifi-Rad J, Herrera-Bravo J, Semwal P, Painuli S, Badoni H, Ezzat SM, Farid MM, Merghany RM, Aborehab NM, Salem MA, Sen S, Acharya K, Lapava N, Martorell M, Tynybekov B, Calina D, Cho WC. *Artemisia* spp.: An Update on Its Chemical

Composition, Pharmacological and Toxicological Profiles. Oxid Med Cell Longev. 2022 Sep 5;2022:5628601. doi: 10.1155/2022/5628601. PMID: 36105486; PMCID: PMC9467740.

13. Anibogwu R, Jesus K, Pradhan S, Pashikanti S, Mateen S, Sharma K. Extraction, Isolation and Characterization of Bioactive Compounds from *Artemisia* and Their Biological Significance: A Review. Molecules. 2021 Nov 19;26(22):6995. doi: 10.3390/molecules26226995. PMID: 34834086; PMCID: PMC8618776.