



## Damong Maria (*Artemisia vulgaris* Linn.) – An ancient medicinal plant

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**Abstract:** Medicinal plants have long been around as treatment for numerous illnesses. The countless years of difficulties against diseases due to which man learned to seek drugs in the different plant parts like barks, seeds, and fruit bodies resulted in the awareness of medicinal plant application. The improved ability of physicians and pharmacists to react in response to the problems that arose with the spread of professional services in the facilitation of man's well-being has caused the advancement of knowledge related to the usage of medicinal plants. *Artemisia vulgaris*, one of the most important species of the genus *Artemisia*, has a long history for being used as a medicinal plant in various parts of the world. Besides, each part of the plant has been of great interest due to its medicinal uses and promising pharmacological properties. This study aims to review the medicinal uses, pharmacological properties, and other potentials of *A. vulgaris*. The reviewed data shows that the medicinal activities of *A. vulgaris* are attributed to its secondary metabolites such as flavonoids, sesquiterpene lactones, acetylenes, phenolic acids, organic acids, among others. Furthermore, each part of the plant has its own pharmacological actions. The reviewed data also details the plant's insecticidal and pharmacological activities. From the results obtained, it can be concluded that *A. vulgaris*, as a medicinal plant, has many properties, especially that can be used for the alternative therapeutic agent for the treatment of some human diseases.

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*Keyword: Artemisia vulgaris*

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### INTRODUCTION

Long before recorded history, people from all the corners of the world have been using herbal plants to treat numerous diseases. One to mention, the ancient Chinese and Egyptian papyrus writings depicted medicinal plant uses. Man was greatly reliant on crude botanical ingredients for medical purposes to cure diseases and retain vitality before the discovery of aspirin obtained from *Spiraea ulmaria* which was preliminarily prescribed for swelling and fever in Egyptian papyri. Indigenous cultures such as African and Native Americans utilized herbs in their healing rituals,



while others used more evolved traditional medical systems in which herbal therapies were used systematically. In the case of Chinese herbal knowledge, people who weren't familiar with its protocols incessantly led to mishaps; either the formulas or herbs have failed to work as expected, or even worse, side effects have resulted whenever herbs were used in inadvisable conditions. In the economic and political domains, government officials unfamiliar with the distinctive properties of traditional Chinese medicine have imposed constraints upon Chinese herbal practice which restrain its effective use and inhibit its unborn development within our civilization (1).

Since the distant past, cardiovascular disease, also known as heart disease, or coronary artery disease (CAD), has been the primary cause of mortality/morbidity. Today, cardiovascular diseases are still the prominent cause of death in industrialized countries which include a variety of diseases such as hypertension, hyperlipidemia, thromboembolism, coronary heart disease, and heart failure (2). It remains a dangerous threat to public health in developing countries, both rural and urban areas, produced chemically while some are obtained by selection from naturally occurring plants based on their uses in conventional procedure. However, our forefathers only made use of certain types of distinct natural treatments to counteract a specific illness. There is an all-encompassing trend of the application of herbal medications or related products considering contemporary development is a high-risk commercial attempt and artificial drugs have a preeminent rate of harmful events (3).

For the reason that there is a great lack of scientific evidence in modern medicine, medicinal herbs have been disregarded by practitioners of the said field, though, herbal medicine has made a comeback over the last few years. This has been due to the side effects which come alongside to the consumption of synthetic drugs and microbial resistance. Of more than 4 decades, the utilization of herbal medicine for the treatment of diseases has increased significantly (3). It has also been discovered by scientists that people in different parts of the globe tended to use similar plants for the same purposes. When chemical analysis methods first became accessible in the early 19th century, scientists began to modify and extract the active ingredients from plants. Subsequently, chemists started to make their own version of plant compounds, beginning the transition from raw herbs to synthetic pharmaceuticals. Over time, the use of herbal medicines dropped in favor of pharmaceuticals (4).

The earliest civilizations used to depend on herbal medicines' power, and in the present time, the modern communities have learned to make use of their practices in the employment of this alternative medicine (1). *A. vulgaris*, commonly named Mugwort, is an abundant herb that only a few people know its importance, but in reality, it is a plant that was used a long time ago as a medicinal and culinary herb. The Mugwort's Latin name '*Artemisia*' was derived from the Greek goddess *Artemis*, the goddess of childbirth, because it is considered an herbal ally for women that helps to cure the diseases and its actions on the female womb and menstrual cycle. The other source of the name *Artemisia* was named after Queen Artemisia of Caria, the wife of Mausolus, ruler of Caria, who was a botanist and a medical researcher (5).

## MATERIALS AND METHODS

This review was compiled using relevant published data from major and reputable databases. All data were thoroughly gathered from Google Scholar, PubMed, Research Gate, Stuart Exchange, Scribed, Science Direct, NCBI and various scientific literature and journals of both local and international.



## RESULTS AND DISCUSSION

**Botanical description:** *A. vulgaris* is a perennial, herbaceous, medicinal plant belonging to the family Asteraceae. It is dark green in color, has a pungent smell and possesses a bitter taste. This herb is hairy, growing to a height of 1 meter or less. The stems are leafy and branched. Leaves are 5 to 14 centimeters long and pinnately lobed. Flowering heads are numerous, 3 to 4 millimeters long ovoid, appears in large numbers in spike like, ascending, and branched inflorescences. Fruit is a small achene (6).

**Geographic distribution:** *Artemisia* is a diverse and economically important genus that consists of over 500 species (7). This genus is highly valued because it is a source of metabolites that are useful in medicine. Most species within the genus have great importance as to medicine, agriculture, ecology, and industry (8). *Artemisia* species are found in many temperate regions in Europe, Asia, northern Africa, Alaska, and North America (9). The species *A. vulgaris* is widely cultivated in the Philippines, where it is grown as an ornamental and medicinal plant. On Mt. Banahaw, which is located between the provinces of Laguna and Quezon, this plant grows wild. It is found in areas at low and medium elevation throughout the Philippines from Batan Islands to Mindanao (10).

**Taxonomic Classification:** It belongs to the kingdom of Plantae, Class of Magnoliopsida, Family of Asteraceae, Order of Asterales, Genus *Artemisia*, Species *vulgaris*, Scientific name is *A. vulgaris*, and a Common name is Mugwort (11).

**Phytochemical constituents:** *A. vulgaris* is generally recognized to possess different classes of secondary metabolites as shown in Table 2. Numerous flavonoids have been isolated from the whole plant. These compounds are attributed to the classes of flavones, flavonols, flavonol glycosides, and flavone glycosides. The fundamental sources of these phytonutrients are fruits and vegetables which are also noted to possess several pharmacological properties, including anti-carcinogenic, anti-inflammatory, antioxidant effects (12). An inulin-type fructan as the main water-soluble polysaccharide can be found in infusions from the aerial parts of *A. vulgaris* (13). Inulin has been known and studied for its biological properties such as its prebiotic and hepatoprotective effects (14).

Artemisinin, which was primarily detected in *A. annua* by Professor Youyou Tu (15). Although in a study conducted in 2013, it was reported that the quantity of artemisinin in the specimen was much lower than the other *Artemisia* species. Fifty, 20 and 3 mg kg<sup>-1</sup> dried weight was the content of artemisinin for the leaf, stem, and root respectively (16). Thus, *A. vulgaris* has only been used for applications such as cosmeceuticals, foods and pharmaceuticals and not as a commercial source of artemisinin. Ur Rashid M, et al. were able to review the pharmacological potential and unique skeleton types of certain *Artemisia*'s alkaloids.

The pharmacological potential and unique skeleton types of certain *Artemisia*'s alkaloids provoke the importance of analyzing *Artemisia* species for bioactive alkaloids and allied nitrogen compounds. The results of the review showed the various types of bioactive *Artemisia*'s alkaloids, where the main classes were the derivatives of rupestone (pyridine-sesquiterpene), lycotonine (diterpene), pyrrolizidine, purines, polyamine, peptides, indole, piperidine, pyrrolidine, alkaloids, and flavo-alkaloids. Furthermore, the reviewed showed the important nitrogen metabolites of *Artemisia* such as pellitorine, zeatin, and tryptophan (17).

Table 2. Secondary compounds in *A. vulgaris* found in the different parts of the plant (4)

Compound	Plant part
apigenin	leaf
chrysoeriol	whole plant
eupafolin	whole plant
isoquercitin	aerial parts
jaceosidine	whole plant
kaenopferol	aerial parts
luteolin	aerial parts
quercetin	aerial parts
rutin	aerial parts
tricine	whole plant
vitexin	whole plant
gallic acid	whole plant
malic acid	leaf
quinic acid	leaf
artemisinin	leaf, stem, & root
vulgarin	whole plant
yomogin	leaf
tracheloside	leaf
dehydrovomifoliol	leaf

*Biological activities, pharmacological properties, and medicinal uses:* To cure various illnesses, the mugwort's aerial parts are utilized in mixtures. Carbohydrates too are derived alongside warm water and are found in the mixtures apart from secondary metabolites. These carbohydrates feature plentiful therapeutic characteristics (12). *A. vulgaris* has been used to cure epilepsy, depression, irritability, stress, and insomnia in folk remedies. In the Philippines, this herb is known as 'herbaka' and is used against hypertensive diseases. The plant extracts also contain analgesic, anti-oxidant, allelopathic, larvicidal, cytotoxic, anti-hyperlipidemic, and anti-malarial activity (18).

Nab and Effert studied the activity of *Artemisia spp.* and their constituents against Trypanosomiasis. Results showed that not only *A. annua* L. and its active principle, but artemisinin also revealed inhibitory activity towards trypanosomes. Other *Artemisia* species (*A. absinthium*, *A. abyssinica*, *A. afra*, *A. douglasia*, *A. elegantissima*, *A. maciverae*, *A. mexicana*, and *A. roxburghiana*) also inhibited *Trypanosoma brucei*, *T. cruzi*, or *T. congolense*. It was also found out that the plants contained numerous chemical constituents including 3',4'-dihydroxybonanzin, apigenin, betulinic acid, bonanzin, dehydroleucodine, dihydroluteolin, dracunculin and bis-dracunculin, helenalin, nepetin, scoparol, scopoletin, stigmasterol, (Z)-p-hydroxy cinnamic acid,  $\beta$ -sitosterol, and others. In addition to artemisinin from *A. annua*, artemether and artesunate (19).

Shaik, et al studied both the anti-implantation and estrogenic effects of the methanol extract of mugwort and found out that its extract had a strong dose-dependent estrogenic effect and interfered with the activity of implantation depending on the dose. Their study concluded that *A. vulgaris*' methanol extract possesses anti-fertility activity (20). The free radical scavenging effects of several solvent extracts (chloroform, aqueous and methanol) of the leaves was also studied and



found out that the methanol extract displayed maximum effect. Their findings rendered that the extracts of the plant's leaves may be used as an effective antioxidant (21).

Table 3. Pharmacological action of each part of *A. vulgaris* plant (4)

Stem	Acaricidal
Leaf	Estrogenic
	Anti-leukemic
	Antimalarial
	Anti-inflammatory
Aerial parts	Antioxidant
	Antimicrobial
Plant	Bronchodilator
	Anti-trypanosomic
	Antispasmodic
	Hepatoprotective
	Hypolipidemic
	MAO Inhibitor (monoamine oxidase)

The essential oil extracts have potent analgesic and anti-inflammatory activities (22). On the chemical analysis of *A. vulgaris* essential oil, it was revealed that it is rich in several terpenes like  $\alpha$ -thujone, trans-caryophyllene, sabinene, and pinocarpone (23). Mugwort essential oils may be used as a tonic for the nerves and have a warming effect on the body that can be used to block the effects of moisture and cold in the air. Aside from that, essential oils extracted from *A. vulgaris* in low doses were revealed to exhibit repellence against *Aedes aegypti*, making mugwort a natural larvicide (24). A similar study regarding the essential oils extract and eucalyptol from *A. vulgaris* L. was conducted by Jiang Z, et.al. The results proved that the essential oils significantly attenuated APAP-induced liver damages. Furthermore, the study confirmed that eucalyptol is an inhibitor of Keap1, the affinity  $KD$  of eucalyptol and Keap1 was  $1.42 \times 10^{-5}$ , which increased the Nrf2 translocation from the cytoplasm into the mitochondria. The activated Nrf2 increased the mRNA expression of uridine diphosphate glucuronosyltransferases (UGTs) and sulfotransferases (SULTs), also inhibiting CYP2E1 activities. Thus, the activated Nrf2 suppressed toxic intermediate formation, promoting APAP hepatic non-toxicity, whereby APAP was metabolized into APAP-gluc and APAP-sulf. Collectively, APAP non-toxic metabolism was accelerated by eucalyptol in protecting the liver against APAP-induced injury, indicating eucalyptol or EOs from AV potentials as a natural source of hepatoprotective agent (25).

Mugwort can also be used as an analgesic agent and for acupuncture therapy (26). In the Philippines, it is widely used as traditional medicine. They used the leaves as a decoction that is considered to be an expectorant, emmenagogue, and stomachic (27). In 2018, a study was conducted that analyzed the essential oil extract from *A. vulgaris* and its larvicidal and repellent activity against *Aedes aegypti*, a dengue fever vector. The analysis shows that 63 compounds were present in the oil. It is important to note that the essential oil of *A. vulgaris* consists of the succeeding



significant insecticidal compounds; camphor (26.99%),  $\beta$ -caryophyllene oxide (15.87%),  $\alpha$ -humulene (0.72%), and  $\beta$ -caryophyllene (0.8%). The essential oil detected in the dried leaves of *A. vulgaris* with the aid of hydrodistillation possesses a favorable insecticidal property that could be used against *Aedes aegypti*. Out of all the terpenoids,  $\alpha$ -humulene (0.72%), Camphor (26.99%),  $\beta$ -caryophyllene (0.8%), and  $\beta$ -caryophyllene oxide (15.87%) are the most significant insecticidal compounds (28).

In another experiment, a group of researchers scientifically evaluated *A. vulgaris*' anti-cancer activity in HCT-15 human colon cancer cells. The results showed that the growth-inhibitory role of the methanol extract on HCT-15 cells was detected by the treatment of these cells with varied methanol extract concentrations. Methanol extract displayed a potent anti-proliferative effect against HCT-15 cells with an  $IC_{50} = 50 \mu\text{g/ml}$ . In the colony formation assay, the researchers observed that methanol extract treated cells showed a reduced number of colony formation in a dose-dependent manner. The extract brings about autophagy and hinders the formation of the colony as what was noticed in the study. It was discovered that the fundamental mechanism that produces autophagy was ROS-mediated. From the finding, *A. vulgaris*' extract could be a great point of supply for the isolation of anticancer molecules beneficial to colon cancer management (29). The studies further explain and prove that *A. vulgaris* exhibits many different pharmacological and insecticidal activities, among many others.

Another anticancer activity of artemisinin and its derivatives was reviewed by Slezakova S and Ruda- Kucerova J. The review summarizes results of preclinical studies, documenting mechanisms of anticancer actions of artemisinin and its derivatives (ARTs) and clinical studies focused mainly on efficacy, safety and dose-ranging of ARTs as anticancer chemotherapeutics. Results showed that the main mechanisms of action of ARTs are the production of reactive oxygen species, inhibition of cell cycle in the G0/G1 phase, induction of apoptosis and inhibition of angiogenesis. Safety studies have shown no evident toxicity and low incidence of adverse effects. ARTs potential to inhibit the growth of solid tumors suggests their application in neoadjuvant therapy. The reviewed article showed that dihydroartemisinin and artesunate exhibit chemosensitizing effects in vivo in breast, lung, pancreas, and glioma cancer cells, proposing the use of ARTs also in combination of anticancer therapy (30).

Lang SJ, et. al conducted a study using *A. annua* extract to prove its anticancer activity. Results exhibited potent anticancer activity against triple-negative human breast cancer. Another breakthrough from the study was that new active ingredients of *A. annua* extract with potential anticancer activity have been identified (31). Truly, the genus *Artemisia* has been widely used for medicinal purposes All the mentioned researches from various scientific journals have one commonality that *Artemisia* is a medicinal plant.

## CONCLUSION

The presented results showed that *A. vulgaris*, also known as mugwort, is a widespread, aromatic, herbaceous perennial plant common to the temperate regions of Europe, Asia, and North Africa. *A. vulgaris* is not only an edible plant but also has a long history of being utilized by the public for its pharmacological properties. Being a medicinal plant, its extracts contain properties that are considered useful in the treatment of stomach ulcers, indigestion, and liver disorders, among others. Furthermore, the latest findings proved that *Artemisia* extract possesses anticancer activity. Essential



oils of common mugwort are also used for their acaricidal, antimicrobial, antimalarial and antispasmodic properties.

Indeed, medicinal plants have been known to be an important potential source of curative aids. Not only used to treat diseases but have a commanding role in maintaining good health. *A. vulgaris* is just one of the many abundant medicinal plants in the Philippines. Some have been studied by scientists to reveal their biological activities; some are still waiting to be discovered and studied. It, therefore, concludes that further research should be done for other endemic medicinal plants in the country to reveal their potential biological activities. Not only will this lead to more scientific breakthroughs, but it will also help to employ more people once these plants are industrialized.

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### **DECLARATION OF CONFLICT OF INTEREST**

No conflict of interest to declare.

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