

# ***Artemisia scoparia*: A review on traditional uses, phytochemistry and pharmacological properties**

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## **Abstract**

*Artemisia scoparia* is an aromatic annual herb, grow in the semi deserted areas with extreme temperatures either cold or hot. It has wide range of chemicals but  $\gamma$ -terpinene is the major component which is most abounded in the essential oil of the jhahoo. Essential oils of some *Artemisia* species are used in cosmetics, perfumes, soaps and in detergents. Its different parts have been used for the medicines. Its flowers, young stems and seeds have also been used for the extraction of the essential oils. These essential oils extracted show different activities like antibacterial, antiseptic, antipyretic, vasodilator and diuretic. Its aerial parts, flowers, pedestal roots are used for the extraction of the essential oils, flavonoides and cumens. This herb is currently used for the treatment of the burns, Jaundice and hepatitis. It is also used for the cure of ear ache.

**Key words:** Asteraceae, Toxicity,  $\gamma$ -terpinene, Perfumes, Hepatitis, Essential oil

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## **1. Introduction**

*Artemisia scoparia* belongs to the genus *Artemisia*. It belongs to the sunflower family (Asteraceae). This genus contains 300-400 species which contains herbs and shrubs, through which essential oils have been extracted and are used in the pharmaceutical Industry [1][2]. This genus contains almost 400 species. This is most large flowering plants. These species are medically important and used for the treatment for many diseases [3]. They grow in the semi deserted areas with extreme temperatures either cold or hot. It is also produced in Parachinar Valley in Pakistan [4]. The flowers are hermaphrodite (both male and female in same flower). Pollination takes place by insects [5]. Pollination can also occur depending upon the season's altitude, latitude and from summer to fall. Its name in Persian is Terekh and Jaroo e Mashhadi. These are medicinally important in Pakistan. Its common names are jhahoo, wormwood, Dona, Lasaj, Marua, Jaanh, Churi-Saroj, Jaukay. In Punjabi, it is known as Blur and Dona. In Hindi, it is called Las Bella. It is known as Annual scan dent herb in Urdu [6].

## **2. History/origin**

*Artemisia scoparia* has been grown wild in Iran and China. It is popular among the Chinese and Iranian due to its medical importance. This has been used for the folk medicines in Chinese and Iranian. *Artemisia scoparia* has been cultivated in India. Rajasthan was an area where it was

mostly produced. Several coumarines, flavonoids, phenylpropanoids, glycosides have been isolated. Their essential oils have antibacterial, antiinflammatory and antipyretic activities [7]. This herb is frequently present all over the world. This is the native plant of Tulcea country [3]. *Artemisia scoparia* is also grown in India, Malir, Kurram, Ziarat and Les bella. It also grows in various areas of Pakistan as in Gilgit, Peshawar, Rawalpindi, Malakand, Baltistan, Attok, Jhelum, Astor, Skardu, Kegan and Swat [3]. It is also present in Mandi Bahaudin, Pakistan. It grows in Western Asia to Central Europein countries such as China, Japan. India, Afghanistan, Korea, Russia, Thailand and Germany [8].

## **3. Demography/location**

*Artemisia scoparia* wildly and commonly grows after rain in the hot areas in sandy clayey soil, waste land and rural areas [8]. Its habitat is dried soil and saline soil in tropical regions. It is widely spread throughout the world as a wild herb. It requires extreme temperatures for its cultivations. It is non-marine herb. Sandy, loamy and well-drained soil is most suitable for its cultivation and growth. Acidic, basic and neutral pH is suitable for *Artemisia scoparia*. It can endure the drought conditions. Its flowering period is July to November [8]. This plant requires extreme temperatures. This plant is easily grown in well drained circumneutral or slightly alkaline loam soil. When it grows

in dry soil, this plant is harder and aromatic and longer lived. It grows in summer (in hot days) [9].

#### 4. Botany, Morphology, Ecology

This plant grows about 0.6 m (2 feet). It contains two embryonic leaves (dicotyledons) which are long straight biennial herbs. Its body is hairy. It is 40-120 cm in height and lower part of it is more branched. The color of the young stem and plant is sea green but its color become yellowish after maturation but stem's ting is purple. Their leaves are pinnatifid with various dimensions. The petiole of lower leaves is 2-3 cm in length and the blade of the leaf is ovate oblong [10]. Middle leaves are sessile mostly curved. Uppermost leaves are bracts. The number of ray floret is 5-7 and the number of disc floret are 5-10 [8]. It has strongly scented and alternate leaves. The shape of the cypsela is oblong-oblongate, its surface is deeply striate and color is dark brown. It is slender branched biennial herb. The leaves are much divided and flowers are produced at small heads. Jhahoo is long day herb and its flowering period is July-October. It grows in full bright day, full sun condition. It require high temperatures.

#### 5. Chemistry

Jhahoo (*Artemisia scoparia*) has bitter taste. It is an aromatic annual herb [9]. Quercetin equivalent, total flavonoid content in jhahoo is 18.7 g QE/mg extract and gallic acid total equivalent is 26.7 g GAE/mg extract. Both contents were quantified in ethanolic extract. Reverse phase HPLC-DAD was used for the qualitative and quantitative analysis of the extracts of the jhahoo. The evaluation showed the presence of the significant amount of the caffeic acid, apigenine, quercetine, kaempferol, artemisinin and rutine ranging 0.06-6.55 g/mg in extract [9]. There are 16 components which are identified in the essential oil through hydro-distillation of *Artemisia scoparia*. Some of which are  $\beta$ -pinene (9.8%), limonine (9.2%), 1,8-cineole (9.2%), capilline (5.6%), capillene (48.5%) and camphor (6.9%) [11].

##### 5.1. Chemical Composition

$\gamma$ -terpinene is the major component which is most abundant in the essential oil of the jhahoo [12].

**Table 1: Four grouped components are present in the volatile oil of the *Artemisia scoparia* [13]**

Name of the grouped components	Percentage
Oxygen containing monoterpenes	24.12
Oxygen containing sesquiterpenes	7.67
Monoterpenes hydrocarbons	54.56
Sesquiterpenes hydrocarbons	5.35

##### 5.2. Phytochemistry

Number and percentage of chemical constituents present in the plant is depended on the vegetative stages of the plants. The yield of the essential oils also depends upon the parts of the plants and the vegetative states. Analysis of the essential oil is generally done by GC/GC-MS [14-16]. Essential oils obtained from the various plants show antimicrobial [14-17-18] and antioxidant activities etc.[19] and used in various medicinal applications [20-21]. Almost 49 chemical constituents were eluted from the essential oils. But it entirely depends on different seasons [22]. There were about 24 monoterpenoids, 2 aliphatic ketones, 1 hydrocarbon, 1 chromene, 19 sesquiterpenoides and 1 ester. 72% of the essential oil is composed of oxygenated compounds and 27% of essential oil are hydrocarbons [3]. The flower heads and leaves hold more flavonoids than the stem [23]. The major chemical constituents of *Artemisia scoparia* present in flower heads are Quercetin-3-glycogalactoside and a group of glycogens. Other flavonoids which are identified from the plants are Kaempferol-3-glycogalactoside, quercetin-3,7-rutinosidigalactoside and quercetin-3, 7-rutinosoga-lactoside, the major chemical compounds which are independent of vegetative stages and plant organs is quercetin-3-glycogalactoside. The chemical composition of the essential oil extracted from the plant varies at different vegetative state and growth stage. The yield of the extracted essential oil based on plant's dry weight is reported to be 0.9% at flowering, 0.7% at floral budding, 0.4% at vegetative stage. Additionally, chemical constituents from vegetative, floral budding and flowering growth stages were 98.4%, 98.5% and 98.7%. The essential oil extracted at the vegetative stage contain 20.3%  $\beta$ -thujone, 55.4%  $\alpha$ -thujone, 5.9% 1,8-cineolol and 9.4% camphor. The oils obtained from the floral budding and flowering stage contain 73.7-79.3%  $\alpha$ -thujone and 15.6-13.7%  $\beta$ - thujone. The percentage of the other components in lower amount was observed at vegetative stage and highest at flowering stage [24]. Main chemical constituents of the *Artemisia scoparia* are rutine and quercetin-3-glucogalactoside. Various coumarines have also been reported in *Artemisia scoparia*. Scoparon (6, 7-dimethoxycoumarine) is also present in the plant. It also contains scopoletin, esculetin-6, 7-dimethyl ether,  $\beta$  pinene, capillene, capilline and capillone [25].

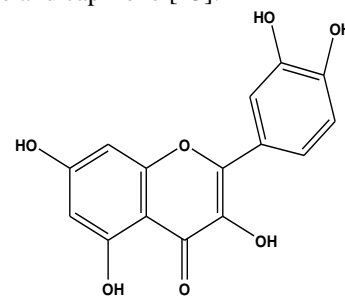


Fig.1. Structure of Quercetin

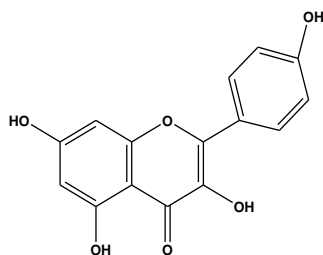


Fig.2. Structure of Kaempferol

## 7. Processing

Mostly this plant is collected fresh in form. But sometimes it is stored in bags and in sacks from one week to one year. Jhahoo herb is first washed and then it is dried in sun light before storing. During storage, a large mass of the herb is lost due to the unawareness of the storing method. It is sold in the local markets of the Pakistan but it is also sold in national markets of Rawalpindi, Jhelum and Peshawar. Abiotic effects like salt stress pose significant danger to the sustainability of the plants. Excess salinity is one of the important environmental factors which is responsible for the productivity of the plant. Due to the less rainfall, concentration of the salts increases in the soil hence the water available for the plant is restricted which may cause fatal effect on the plants [5].

## 8. Value addition

Essential oils of some *Artemisia* species are also used in cosmetics, perfumes, soaps and in detergents [8]. Essential oils are extracted from the *Artemisia scoparia*. Different parts of the plants such as seeds and young flowering stem of the plant are used for extraction of the essential oil [1]. Fresh and dried leaves are used for the essential oils. Dried leaves as spices by local people of the Khorasan province of Iran. It's fresh and dried both leaves are consumed. Fresh leaves are used as vegetables, and dried leaves are used in medicines as well as used as spices in Khorasan province of Iran [24]. Its smoke is considered good for burns.

## 9. Uses

Ethereal oil or essential oil extracted from the Red-Stem Wormwood or *Artemisia scoparia* are used as raw material for the synthesis of a drug "Artemisol". This drug used for treatment of Urolithiasis. Dried young parts of *Artemisia scoparia* also used in "Ing-Chan Hao" Chinese drug for the cure of Jaundice [25]. The whole plant is boiled in H<sub>2</sub>O and used for the removal of intestinal parasite at night. It has been used for the treatment of burns and cleansing. It is also used for the cure of snake's poison. It also used for earache. It is considered as fodder for animals [8]. In Iranian medicines, the aerial parts of this plant have been extensively used for anti-inflammatory, hypoglycemic and hypolipidaemic activities. Aerial parts of *Artemisia scoparia* have insecticidal activities against the insects [26]. It is an important medicinal plant which has been extensively used in treatment of gallbladder inflammation, Jaundice and Hepatitis.

### 9.1. General use

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This herb currently used for the treatment of the burns, Jaundice and hepatitis. It is also used for the cure of ear ache. For chest infections, it is inhaled as fumes. The leaves of the plants were mashed with water and this paste is used for the treatment for the ear ache [6]. It is used for the thorax illness [8]. Herba *Artemisia scoparia*, is a chinese traditional medicine. It consists of dried sprout of *A. scoparia* (jhahoo). This medicine can reduce heat, normal the function of the gallbladder, promote diuresis and in the treatment of jaundice [27]. This medication has been used in many traditional prescriptions [28]. It has also been used for the management of cancer as an antitumor agent. In case of acute oral ulcer and icteric infectious hepatitis [27]. A bagged tea was made by *Artemisia scoparia* by washing it, drying in the air, crushing, and then mixing with high quality green tea sterilized by baking, screening and then packing in the bags. These bags were used for promoting the growth rate of liver cells, resisting microbes, reducing blood pressure and anti-pyresis [29].

### 9.2. Pharmacological uses

Different parts of the plants have been used for the medicines. Its flowers, young stems and seeds have also been used for the extraction of the essential oils. These essential oils extracted show different activities like antibacterial, antiseptic, antipyretic, vasodilator and diuretic [1], [4]. Its aerial parts, flower, pedestal roots are used for the extraction of the essential oils, flavonides and cumens [3]. In Pakistan, it is used for the treatment of burns, jaundice and hepatitis. Its fumes are used for chest illness by inhalation. The essential oils show different types of important activities like antibacterial, antispasmodic activity and vasodilator. It has been used for the treatment of Jaundice, hepatitis and gall bladder inflammation [1]. The flower heads of the plant are used as an excellent mouthwash [30], [31]

#### 9.2.1. Antioxidant Activity

Singlet oxygen (O<sub>2</sub>), hydroxyl ion (OH) and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) are reactive oxygen species (ROS). These are generated in the cell in response to metabolic activity. Due to the various factors like pollutant, ionizing radiations, alcohol and tobacco smoke, the production of the ROS (Reactive oxygen species) increases. These species cause the destruction of the proteins, DNA, lipids and carbohydrates. It also can cause mutations [4]. Free radical reaction can damage the body and cause severe diseases both in animals (include humans) and plants. Oxidation reactions can cause chronic disease like ulcer, heart disease and hypertension. BHT (butylated hydroxyl toluene) and BHA (butylated hydroxyl anisole) are artificial antioxidants used in cosmetics, food and medicines. They stop the oxidation process and act as antioxidants. But now people want to use the natural antioxidants for minimum side effects. So, antioxidants are obtained from the essential oils of the plants [19]. Plants have natural antioxidant compounds and they show good scavenging activity. The

natural antioxidants play important role to help the endogenous antioxidants to counterbalance the oxidative stress [4]. But due to the ageing and external stress, the efficiency of these systems or activities is reduced or decreased. For this purpose, artificial antioxidant substances are required from the food supplements. Essential oils of different plants have the antioxidant activity. Naturally found essential oils from the aromatic plants which have antioxidant activity have been extensively used in the beverage and food industry [1-32-33]. *Artemisia scoparia* has outstanding scavenging activity. The scavenging activity of the essential oil of *Artemisia scoparia* having two major monoterpenes were checked against DPPH (2,2-diphenyl-1-picrylhydrazyl). DPPH is extensively used to check the antioxidant capacity. The sample solutions mixed with the solution of DPPH in methanol and made the solution up to 4 ml. The absorbance of the solution in which blank and positive control were included was at 515nm at spectrophotometer. The decrease in reading of the DPPH solutions showed the increase in the scavenging activity of the essential oil of *Artemisia scoparia*. Essential oils extracted from the *Artemisia scoparia* reduced the DPPH. So it was scavenged due to the antioxidant activity of the *Artemisia scoparia* [1].

#### **9.2.2. Anti-nociceptive, Anti-inflammatory and ant-pyretic activity**

*Artemisia scoparia* which is commonly known as jhahoo has been used for the treatment of the pain, fibril conditions and inflammation. The extract of the *Artemisia scoparia* prepared as *Artemisia scoparia* hydro-methanolic extract (ASHME) which is administrated in mice to reduce the pain in mice. Administration of single dose of ASHME, reduced significantly carrageenan encouraged paw edema in mice. These shows that *Artemisia scoparia* Hydro-methanolic extract has anti-inflammatory and anti-nociceptive [34]. Anti-pyretic activity of the jhahoo is due to the presence of the chlorogenic acid butylester and magnolioside.

#### **9.2.3. Analgesic activity**

Jhahoo plant also has analgesic activity due to the presence of the chlorogenic acid, coumarin, cappillarisin, butylester, magnolioside and b-sitosterol. These constituents are present throughout the plant. The whole plant is used as analgesic.

#### **9.2.4. Anti-malarial-activity**

*Artemisia scoparia* has been reported to show anti-malarial activity. It contains a phyto active component named artemisinin, which is responsible for the anti-malarial activity [11]. Artemisinin is extracted from the different parts of the plant however maximum is usually obtained from the arial parts of the herb with the least found in the callus. [11].

#### **9.2.5. Insecticidal activity**

Stored foods are destroyed from the effect of the insects and form fungus throughout the world. Different

types of artificial fumigants have been used for the preservation of the food. These artificial agents damaged and harm the food and can cause toxicity. Methyl bromide and phosphine are mostly used but fumugants of natural origin are believed to be better and safer for the preservation of the food. Essential oil of the aerial part of *Artemisia scoparia* has excellent insecticidal activity against insects.. The insecticidal activity checked against the 7-day old insect *Tribolium castaneum* showed that insects exposed to the vapor of the essential oils died after 24 hours [31].

#### **9.2.6. Antimicrobial activity of Artemisia scoparia**

All species belonging to the *Artemisia* genera show antimicrobial activity. Methanol extracts of aerial parts of *A. scoparia* were used to check the antibacterial activity. Extracts of *A. scoparia* were used against five different bacterial species as *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, *Canadida albican* and *Pseudomonas aeruginosa* and found to have good antibacterial activity. *Artemisia scoparia* also shows the antifungal activity [35].

#### **9.2.7. Anti-leishmanial activity**

Different chemical compounds are present in the essential oil which is extracted from the whole plant of the *Artemisia scoparia*. The extraction of the essential oil was made with different solvents. Only (methanol) soluble extract of the plant showed anti-cancerous activity. Chloroform extract of the plant showed the anti-leishmanial activity [36].

#### **9.2.8. Bio herbicidal activity**

Volatile oils which are extracted from the plant provide significant benefits to the plants. They help in pollination by acting as pollinator attractor. These also stop the growth of the other plants. The volatile oil of the plant inhibits the seed germination. It can be said that, the volatile oil of the *Artemisia scoparia* (jhahoo) is phytotoxic to the weeds [37]. Not only essential oils but its constituents also showed active potential against the germination of the seeds or plant growth. Herbicidal activity of the essential oil of the *Artemisia scoparia* was checked by the different seeds of the weeds which include *A. aspera*, *P. hysterothorus*, *E. crus-galli*, *A. conyzoides* and *C. occidentails*. Essential oils were sprayed at the weeds and 1- day after spraying the small weeds stop germinating and matured weeds showed signs of visible injury like necrosis and chlorosis. The visible injury was recorded for 1-7 days after spraying. The increase in the concentration of the essential oil also showed the increase in bio-herbicidal activity [38]. Phytotoxic effect of the essential oils of the *Artemisia scoparia* was greatest on the *E. crusgalli* and then the minimum effect was observed on the *P. hysterothorous* and *C. occidentails* [37].

#### **9.2.9. Anti-obesity activity**

Obesity is a worldwide problem. It is a very common but dangerous problem and sometimes it is known as a disease. It is the result of the accumulation of the fats and carbohydrates in large amounts. The increase in the

body weight leads to disease like heart disease, cancer, hypertension, respiratory problems, and diabetes. Macrophages are responsible for the accumulation of the fats in the body and nitric oxide is produced in the body by enzymes known as NO synthetase. NO (nitric oxide) is a free radical which is liposoluble. There are some chemical constituents present in the 80% aqueous EtOH extract of the plant *A. scoparia* which inhibits the accumulation of the fats (triglycerids) in the adipocytes and also inhibits the activity of the NO (nitric acid). Scoparinchromane is a new derivative of the chromane and 18 other chemical constituents which are responsible for the anti-obesity activity. These and other showed the inhibitory effect on the accumulation of the TG (triglycerides). Jacociden is responsible for the inhibition of the production of the nitric acids (NO). All these chemicals are present in the essential oil which is extracted from the aerial parts of the *Artemisia scoparia* [39].

### 10. Summary

It is an aromatic annual herb, grows in the semi deserted areas with extreme temperatures either cold or hot. It has wide range of chemicals but  $\gamma$ -terpinene is the major component which is most abundant in the essential oil of the jhahoo. Essential oils of some *Artemisia* species are used in cosmetics, perfumes, soaps and in detergents. Its different parts have been used for the medicines. Its flowers, young stems and seeds have also been used for the extraction of the essential oils. These essential oils extracted show different activities like antibacterial, antiseptic, antipyretic, vasodilator and diuretic. Its aerial parts, flower, pedestal roots are used for the extraction of the essential oils, flavonoids and cumens. This herb currently used for the treatment of the burns, Jaundice and hepatitis. It is also used for the cure of ear ache.

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