Asian J. Pharm. Res. Vol 5, Issue 2, 88-92, 2015.

e-ISSN 2231 – 363X
Print ISSN 2231 – 3621

Asian Journal
of
PHARMACEUTICAL RESEARCH
Journal homepage:- www.ajprjournal.com

THE PHARMACOLOGICAL IMPORTANCE OF *ARTEMISIA CAMPESTRIS*- A REVIEW

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ABSTRACT

Artemisia campestris contained alkaloids, saponins, terpenes and flavonoids. The hydrodistilled essential oil of fresh aerial parts of *Artemisia campestris* contained β-myrcene (16.47%), α-pinene (14.18 %), trans-β- ocimene (12.61%), β-cymene (8.15%) and camphor(5.85%). *A. campestris*, revealed several pharmacological activities such as antimicrobial, antioxidant, cytotoxic, insecticidal, antivenomous and many other pharmacological effects. The present review will highlight the chemical constituents and the pharmacological and therapeutic effects of *Artemisia campestris*.

Key words: *Artemisia campestris*, Pharmacology, Contents.

INTRODUCTION

The genus *Artemisia* (Asteraceae) includes about 400 species distributed in the Mediterranean region, Northern Africa, Western Asia and Southwestern Europe, and in Arabian Peninsula. *Artemisia campestris* is one of the common species of this genus. Chemical analysis showed that *Artemisia campestris* contained alkaloids, saponins, terpenes, and flavonoids. The hydrodistilled essential oil of fresh aerial parts of *Artemisia campestris* contained β-myrcene (16.47%), α-pinene (14.18 %), trans-β- ocimene (12.61%), β-cymene (8.15%) and camphor (5.85%). *A. campestris*, revealed several pharmacological activities such as antimicrobial, antioxidant, cytotoxic, insecticidal, anti venomous and many other pharmacological effects [1].

Synonyms

ArtemisiaCampestris ssp.borealis var. wormskiold ii, *Artemisia borealis* var. wormskioldii, *Artemisia campestris var*. douglasiana (Bess.) Boivin, *Artemisia campestris* subsp. borealis var. scouleriana (Hook.) Cronq. *Artemisia campestris* var. odoratissima (Desf.) Batt, *Artemisia clausonis* Pomel, Artemisia dniproica Klokov , *Artemisia odoratissima* Desf., *Artemisia sosnovskyi* Krasch [1-4].

Classification

Kingdom: Plantae
Subkingdom: Tracheobionta
Superdivision: Spermatophyta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Asteridae
Order: Asterales
Family: Asteraceae
Genus: *Artemisia*
Species *Artemisia campestris* L [5].

Common names

Field sagewort, beach wormwood, field sagebrush, field wormwood, prairie sagewort, tall wormwood and dgouft

Description

This plant is a biennial or short-lived perennial. During the 1st year, a rosette of basal leaves is produced. The basal leaves are pinnatifid or bipinnatifid with narrow linear lobes. The upper surface of basal leaves is grayish blue and canescent; the petioles of these leaves are variable in length. During the 2nd and later years (if any), this plant bolts to become 1½-3½' tall, while the rosette of basal leaves withers away. The central stem and ascending lateral stems are light green to dark red and terete. Usually the young tips of stems are tomentose (with short white cobwebby pubescence), otherwise they are mostly

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glabrous. The cauline leaves alternate along these stems; they are more common along the lower half of the central stem and lower lateral stems. The lower cauline leaves resemble the basal leaves, except they are more green. Middle cauline leaves are smaller in size and less divided into linear lobes, while the upper cauline leaves are short and linear in shape. The upper surface of these leaves is green to whitish green, flat, and tomentose, becoming more glabrous with age. The lower surface of these leaf leaves is green, rounded (convex), and glabrous. The foliage is not strongly aromatic. The central stem (and upper lateral stems, if any) terminates in a panicle of flower heads that is about 4-18" long and about one-half as much across. Leafy linear bracts occur along the rachis (central stalk) and lateral branches of this panicle. The rachis and lateral branches are light green to dark red and glabrous to canescent. The rachis of the panicle is more or less erect, while its primary lateral branches are ascending. Individual flower heads are whitish green or yellowish green and 2-4 mm. long and similarly across. Each flower head has 8-30 inner disk florets that are perfect and 5-20 outer disk florets that are pistillate. Each inner floret consists of a narrow tubular corolla with 5 teeth along its upper rim, some fertile stamens, and an abortive ovary that is sterile. Each outer floret consists of a narrow tubular corolla with 2-3 teeth along its upper rim and a fertile ovary with a divided style. The base of each flower head is surrounded by oppressed overlapping bracts (phyllaries); individual bracts are lanceolate to ovate, mostly green, and up to 2 mm. long. At maturity, the flower heads droop from short pedicels. The blooming period occurs from mid-summer to early autumn, lasting about 2-3 weeks. The florets are cross-pollinated primarily by the wind. Afterwards, the outer florets of the flowerheads are replaced by bullet-shaped achenes that are up to 1.0 mm. in length. These achenes are without tufts of hair or a crown of scales; they are usually distributed only a short distance from the mother plant by the wind. The root systemconsists of a woody taproot or caudex with fibrous roots [6].

Distribution

It was originated in Asia and now distributed to North America, and to wide areas in Asia and North Africa [7-10].

Traditional use

Artemisia campestris flowers were used as hypoglycemic, cholagogue, choleretic, digestive, depurative, antilithiasic, and for the treatment of obesity and to decrease cholesterol. It was used as a decoction as antivenin, anti-inflammatory, anti-rrheumatic and antimicrobial [11-14].

Part used

Flowers and leaves were used medicinally .

Chemical constituents

The fresh parts of *Artemisia campestris* contained alkaloids, saponins, terpenes, and flavonoids [15]. Four flavanones (pinostrobin, pinocembrin, sakuranetin and naringenin), one dihydroflavonol (7-methyl aromadendrin) and one flavone (hispidulin) have been isolated from *Artemisia campestris* [16]. Phenolic derivatives included dihydroquercetin-7,3′-dimethyl ether and three acetophenone derivatives identified as 3-[4-acetoxyisopent-2(*Z*)-enyl]-4-hydroxyacetophenone, 3-[4-acetoxyisopent-2(*E*)-enyl]-4-hydroxy acetophenone and 3-(3-acetoxymethyl-2-hydroxybut- 3- enyl)- 4- hydroxy acetophenone, were isolated from the hexane extract of *Artemisia campestris* [17]. However, six flavanones, two chromones and the coumarin scopoletin were isolated from the acetone extract of *Artemisia campestris* subsp. *maritima*. 5-Hydroxy-7-methoxychromone and 5,7-dimethoxychromone were new compounds, while the flavanone eriodictyol-7,3′-dimethyl ether was reported previously in this species [18].

The hydrodistilled essential oil of fresh aerial parts of *Artemisia campestris* L. contained β-myrcene (16.47%), α-pinene (14.18 %), trans-β- ocimene (12.61%), β-cymene (8.15%) and camphor (5.85%) [19].

However, the volatile fraction of the aerial parts of *Artemisia campestris* contained the following groups: monoterpene hydrocarbons 42.2%, oxygen-containing monoterpenes 49.5%, sesquiterpene hydrocarbons 2.8%, oxygen-containing sesquiterpenes 2.9%, and other oils 0.2 %. The compounds isolated were included: tricyclene 0.4%, α-thujene 0.3%, α-pinene 18.4%, camphene 7.7%, sabinene 1.2 %, 1-octen-3-ol trace (<0.05%), β-pinene 1.8%, dehydro 1,8-cineole 0.9%, myrcene 1.7%, α-phellandrene 0.2 %, α-terpinene 0.7%, *p*-cymene 0.6 %, 1,8-cineole 0.4%, β-phellandrene trace (<0.05%), limonene 5.2 %, *cis*-β-ocimene 0.1 %, *trans*-β-ocimene 2%, γ-terpinene 1.2 %, *trans*-sabinene hydrate 0.7%, 2,5-dimethyl styrene 0.1 %, terpinolene 0.6%, linalool 2.4%, chrysanthenone 0.1%, oct-1-en-3-ol acetate 0.2%, α-campholenal 0.1 %, *trans-p*-2-menthen-1-ol: trace (<0.05%), camphor 9.2%, *trans*-pinocarveol 0.4 %, *cis*-verbenol 0.3%, *trans*-verbenol 1.1% , pinocarvone 0.4% , borneol 5.2%, terpinen-4-ol 2.2 %, myrtenal 0.3%, α-terpineol 3.6 %, myrtenol trace (<0.05%), *trans*-carveol 0.4%, *cis*-carveol trace (<0.05%), carvone trace (<0.05%), *cis*-ocimenone trace (<0.05%), piperitone trace (<0.05%), geraniol 0.1%, *cis*-chrysanthenyl acetate trace (<0.05%), bornyl acetate 2.7%, myrtenyl acetate trace (<0.05%), α-terpenyl acetate 18.8%, geranyl acetate 0.2%, α-copaene 0.2%, α-gurjunene 0.1%, β-caryophyllene 0.8%, α-humulene 0.1%, germacrene-D 0.8%, β-bisabolene 0.1%, *trans*-calamenene trace (<0.05%), δ-cadinene 0.1%, *trans*-α-bisabolene 0.6 %, *trans*-nerolidol 2.8% and α-muurolol 0.1% [20].

However, it appeared that oil constituents were differ according to plant source and variety, a previous study showed that *Artemisia campestris* oils contained

mainly β-pinene (24.2–27.9%), *p*-cymene (17.4–22.3%) and α-pinene (4.1–11.0%) [3].

Judzentiene *et al* found that the major constituents of *A. campestris* oil was caryophyllene oxide (8.5-38.8%), and compounds with the caryophyllane skeleton ranged from 10.2 to 44.5%. However, they isolated eighty seven compounds included germacrene D (< or = 15.0%), humulene epoxide II (< or = 8.1%), beta-ylangene (< or = 7.7%), spathulenol (< or = 6.8%), beta-elemene (< or = 6.8%), beta-caryophyllene (< or = 6.2%), junenol (< or = 6.1%) and alpha- or beta-pinene (< or = 5.5%) [14]. Many other studies reported that α- pinene was the major constituent of *A. campestris* oils. Other differences in the oil constituents of *Artemisia campestris* were also recorded . The chemical composition was highly variable depending on the sample location [9-10, 21-24].

PHARMACOLOGICAL EFFECTS

Antimicrobial effects

The methanolic leaves extract of *A. campestris* exerted antibacterial activity only against Gram-positive with no antagonistic effects against Gram-negative bacterial species. The minimum inhibitory concentrations against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *and Salmonella typhi* were 12.5, 12.5, 250, 500 and 250 µg/ml respectively [13]. The antibacterial activity of *Artemisia compestris* L. essential oil was tested against *Escherichia coli ATCC 25922, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa ATCC, Pseudomonas aeruginosa 27853, Salmonella typhimurium, Staphylococcus aureus ATCC 43300, and Staphylococcus aureus.*. The best antibacterial activity was obtained against *Pseudomonas aeruginosa* ATCC 27853 and *Escherichia coli* with 23 mm and 20 mm inhibition zones, respectively [25].

Antidiabetic, antioxidant and cytotoxic effects

The effects of aqueous extracts of *A. campestris* leaf aqueous extract was examined on glycemic state, lipid profile, lipid peroxidation (MDA), protein carbonyl content (PCO), advanced oxidation protein products (AOPP), activities of both non-enzymatic and enzymatic antioxidants in alloxan-induced diabetic rats. The administration of *A. campestris* to diabetic rats at a dose of 200 mg/kg bw resulted in a significant reduction in glycemia, TC, TG, LDL, pancreas LPO, PCO and AOPP levels, CAT and GPx activities associated with an elevation of GSH content and SOD activity in comparison with diabetic group [26].

The protective effects of *Artemisia campestris* leaf powder against oxidative damage and hepatotoxicity induced by fenthion (FEN) in female rats and their pups was studied. Treatment with *Artemisia campestris* prevented the liver damage induced by FEN, as revealed by inhibition of hepatic lipid peroxidation accompanied by an improvement of liver histopathological changes, CAT and GPx activities except GSH and SOD which were not modified [27].

The protective effects of an aqueous extract (5 g/l) of *A. campestris* leaves and stems, was investigated on oxidative damages induced by liver extract of poisonous fish *Lagocephalus lagocephalus* in rats. Liver extract of poisonous fish *Lagocephalus lagocephalus* injected rats (1 ml/100 g body wt) for 10 days caused (1) a reduced appetite and diarrhea resulting in a lower growth rate than controls, (2) a decrease in serum ALT and AST activities suggesting liver functional disorders, (3) an increase of serum urea and creatinine and reduced serum sodium and potassium concentrations highlighting renal insufficiency and (4) an oxidative stress as evidenced by the raise of TBARS and the inhibition of SOD, CAT and GSH-Px activities in liver, kidney and brain tissues. *Artemisia campestris* which contained large significant antioxidant capacities highlighted by high level of polyphenols and scavenging activities prevented all the disorders induced by liver extract of poisonous fish *Lagocephalus lagocephalus* [28].

The essential oil of *Artemisia campestris* and the ethanol-water, hexane and water extracts of *A. campestris* collected in southern of Tunisia were investigated for their antioxidant (DPPH, ABTS and beta-carotene methods) and antitumor growth inhibition of human colon cancer HT-29 cells using MTT test activities. The essential oil and other extracts of *A. campestris* (100 µg/ml) showed cytotoxic activity against the HT-29 cells ranging from 19.5% for essential oil to 64.4% for infusion extract. The ethanol-water and infusion extracts of *A. campestris* showed high antioxidant activity [29].

Ethyl acetate extract (EAE) is rich in phenolic compounds with 481.25±0.026 mg gallic acid equivalent/g dry weight, while the chloroform extract (CHE) had the highest content of flavonoid with 34.37±0.056 mg quercetin equivalent/g dry weight. The evaluation of DPPH scavenging activity of extracts confirmed that EAE is the most active extract with IC_{50} of 0.0058 mg/ml. In addition, EAE showed the most scavenging activity against hydroxyl radical generated in the H_2O_2/Fe^{+2} system with IC_{50} of 0.17 mg/ml which is comparable to the activity of the standard antioxidant, ascorbic acid (0.15 mg/ml). Ferrous ion chelating capacity assay showed that aqueous extract (AQE) was the most active with 0.11 mg/ml. The inhibition of linoleic acid/ ß-carotene coupled oxidation was estimated by the ß- carotene bleaching assay, which showed a highest relative antioxidant activity for the crude extract (CE) (82.72% of inhibition) [25].The mutagenic and antimutagenic activities of *Artemisia campestris* oils were investigated by the *Salmonella typhimurium*/ microsome assay, with and without addition of an extrinsic metabolic activation system. The oils showed no mutagenicity when tested with *Salmonella typhimurium* strains TA98 and TA97. On the other hand, it had antimutagenic activity against the carcinogen Benzo (a)

pyrene, when tested with *Salmonella typhimurium* strains TA98 and TA97 assay systems [30].

Insecticidal effects

Ethanolic extract from *Artemisia campestris* var *glutinosa* showed weak larvicidal activity against mosquito Culex Linnaeus (Diptera, Culicidae) larvae [31].

Anti venomous effects

The anti-venomous activity of *Artemisia campestris* leaves extracts against the scorpion *Androctonus australis garzonii* and the viper *Macrovipera lebetina* venoms was examined. Assays were conducted by fixing the dose of extract to 3 mg/mouse, while the doses of venom were variable. A significant activity with respect to the venoms of scorpion *Androctonus australis garzonii* for the ethanolic extract was detected, and a significant neutralizing activity of the dichloromethane extract against the venom of a viper *Macrovipera lebetina* was obtained [27].

The effect of the aqueous dry leaves extract of *Artemisia campestris* on hemodynamic variations induced by *Buthus occitanus tunetanus* venom was assayed in pregnant and non pregnant rats. The results showed that the venom induced hypertension magnitude was much important in pregnant rats (maximal of 156% of baseline) than in cycling ones (maximal of 143.9% of baseline). When injected alone, the aqueous leaves extract of *A. campestris* induced a progressive significant diminishing of the mean arterial pressure. This effect did completely abolish the venom induced hypertensive shock, when envenomed rats were pretreated with the extract. The aqueous extract of *A. campestris* leaves prevented the induced hypertensive phase associated with the scorpion venom, probably mediated by adrenergic pathway [33].

CONCLUSION

The paper reviewed *Artemisia campestris* as promising medicinal plant with wide range of pharmacological activities which could be utilized in several medical applications because of its effectiveness and safety.

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