

A Review on *Eupatorium glandulosum*

Silpa M¹, Suresh J^{1*}, Babu S², Hamsalakshmi¹

¹J S S College of pharmacy, Department of Pharmacognosy, Jagadguru Sri Shivarathreeshwara University, Mysuru, India

²J S S College of pharmacy, Department of Pharmacology, Jagadguru Sri Shivarathreeshwara University, Mysuru, India

Received: 21st Sep 17; Revised 14th Oct, 17, Accepted: 2nd Apr, 18; Available Online: 25th Apr, 18

ABSTRACT

Eupatorium glandulosum (Asteraceae) is used as a folk medicines to treat various disease. This review article presents the main phytochemical and pharmacological activities of *Eupatorium glandulosum*. The *Eupatorium glandulosum* is mainly containing flavanoids, alkaloids, phenolic, glycosides, tannins, saponins and glycosides. These phytochemical constituents which are responsible for various medicinal and pharmacological activities like anti oxidant, anti proliferative, antibacterial, wound healing, antimicrobial, antifungal and also making them promising for the development of new drugs.

Keywords: *Eupatorium glandulosum*, phytochemistry, pharmacology.

INTRODUCTION

Recent years the popularity of the herbal medicines is increases day by day. Natural products are significant source of many drugs. According to World health organization (WHO), traditional medicines are used 80% of the world population as their primary health care needs¹. Various disease are treated by using the species of Asteraceae family and the genus *Eupatorium* as a folk medicine because these have high biological potential².

Eupatorium glandulosum belongs to the family Asteraceae is in different parts of world popularly known as Nilgiriweed, cat weed, Mexican devil or goat weed³. *Eupatorium glandulosum* grows as a erect herb or occasionally it may be a subshrub and perennial. It grows up to 1 - 3m in height with a few purplish dark color ascending branches. simple, decussate, opposite, glabrous, subentire and deltoid-ovate shaped dark green leaves with purple underneath and each grows to 10cm in height. Flowers: white colored from February to may. Crushed plant has an offensive smell. Irular, Toda and Badagar tribal people of the Nilgiris, used the leaves paste to treats wounds and cuts^{4,1,9}.

Mexico is the native of *Eupatorium glandulosum*, but has naturalized in many countries. In several parts of world in nineteenth century it was introduced as an ornamental, but it is known as an introduced species and often a noxious weed in many other part of the world³. *Eupatorium glandulosum* plants showed antioxidant, antiproliferative, antimicrobial and wound healing properties but in agriculture it causes a great economic loss thereby effecting the native biodiversity¹. *Eupatorium glandulosum* replaced native herbaceous species in the grass land of Himalaya. The *Eupatorium glandulosum* containing the allelochemicals effects the germination and dry weight of native species and also the plant has caused decrease in primary productivity, species diversity and biomass. The replacement of the important medicinal

plant species and grasses caused serious environmental problems like reduction in fodder, medicinal species and decreasing the species status there by its threatening the economy based on these grass land as well as the biodiversity¹⁴.

Ethanobotany

The natural wealth of India depends on indigenous system of medicine⁵. The *Eupatorium glandulosum* plant containing lots of phytochemical constituents which are responsible for varies medicinal and pharmacological activities¹. In folklore the leaves of the *Eupatorium glandulosum* used as a stimulant, astringent and thermogenic⁵. The extract of plant possess the antiproliferative activity and highest anti oxidative activities⁶. Traditionally the leaves are used to treat wounds because it has broad spectrum of inhibitory activity against both gram negative and positive bacteria⁷.

Phytochemistry

The phytochemical analysis of *Eupatorium glandulosum* extract shows the presence of various constituents like flavanoids, alkaloids, phenolic, glycosides, tannins, saponins and glycosides¹. Flavanoids : Quercetin 7-O-β-D-glucopyranoside (quercimeritrin), 6-Hydroxykaempferol 7-O-(6''-O-caffeoyl)-β-D-glucopyranoside, 6-Hydroxykaempferol 7-O-β-D-glucopyranoside, Quercetagenin 7-O-(6-O-acetyl)-β-D-glucopyranoside, 6-Methoxy-4'-O-methylkaempferol (betuletol), Betuletol 3-O-β-D-galactopyranoside, Quercetagenin 7-O-β-D-glucopyranoside (quercetagenin)⁹. flavonol glycosides: 6-hydroxykaempferol 7-(6''-caffeoyl)glucoside, quercetagenin 7-O-(6-acetyl)-β-d-glucoside and 4'-methylquercetagenin 7-O-(6''-E-caffeoyl)-β-d-glucoside and along with the quercetin, quercetagenin and 7-O-glucosides of 6-hydroxykaempferol^{10,11}.

North Indian origin of *Ageratina adenophora* (Spreng) (syn: *Eupatorium glandulosum*) flower containing essential oil consist of 66% and 28% of monoterpenes and

sesquiterpene respectively. A main constituent of the sesquiterpene part is Amorphene derivatives (10%). Amorphene derivatives: amorpho-4,7-dien-11-ol, 5,8-epoxyamorpho-3,7(11)-diene, amorpho-4,7(11)-diene, muurol-4-en-7-ol, amorpho-4-en-3,8-dione and muurol-4-en-3,8-dione (eupatorenone), and amorph-4-en-7-ol¹². The root contained oil consist 32.5% of monoterpene and 34.3% of sesquiterpene with c-muurolene, b-cadinene, E,E-cosmene, a-phellandren-8-ol and isothymol are 10.1%, 7.0%, 19.9%, 5.9% and 7.5% respectively¹³.

Pharmacology

Anti-oxidant activity

Eupatorium glandulosum plant extract showed highest antioxidant activities in higher concentration. Presence of different compounds of the plant having different antioxidant potentials, extraction solvent is strongly depends on the antioxidant activity of the plant extract. Ethanol and methanol are the most preferred solvent for the extraction of *Eupatorium glandulosum* leaves among them methanolic extract shows antioxidant capacity to various free radicals⁶.

Bala Iyeswarya et al have investigated the antioxidant activities of the *Eupatorium glandulosum* by using the different assaying methods likes Hydrogen peroxide scavenging activity, DPPH free radical scavenging assay, Reducing power activity, Nitric oxide radical scavenging activity, Ability of chelating ferrous ions and Hydroxyl radical scavenging assay. Various concentration of the *Eupatorium glandulosum* extract are tested with these assays and among them 100mg/ml of sample shows high antioxidant activity compared to lower concentration⁶.

Wound healing activity

The gel formulation of the *Eupatorium glandulosum* help to wound contraction. D. V. Gowda et al have investigated the wound healing activities by formulating *Eupatorium glandulosum* into a gel formulation. The initial studies showed that the formulation containing 5% plant extract possessed promising results for spreadability, viscosity, anti microbial studies and pH. The prepared gel formulations are applied on the albino wistar rats for the in vivo studies of the formulation. The result showed that, wound contraction rate is higher and period of epithelization is lesser when the formulation containing 5% of the plant extract. It was concluded that in albino wistar rats the formulation containing 5% w/w aqueous leaf extract posses faster shrinkage of wound area ie wound contraction percentage is more and wound closure time is less when using the gel formulation of *Eupatorium glandulosum* michx using carbopol base compared to the marketed products⁹.

Antibacterial activity

J.M.Sasikumar et al. evaluated the antibacterial activity by determination of minimum inhibitory concentration (MIC) with broth dilution method and agar diffusion method. Gram positive bacteria's like *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus subtilis* and Gram negative bacteria's like *Pseudomonas aeruginosa*, *Salmonella typhi*, *Klebsiella pneumonia*, *Escherichia coli* are used for the study of antibacterial activities. Chloroform, methanol, aqueous, ethyl acetate and

petroleum ether extracts of *Eupatorium glandulosum* shows inhibitory activity against all these bacteria. ie, it's inhibited the growth of both gram negative and positive bacteria⁷.

Anti proliferative activity

Leaf extract of *Eupatorium glandulosum* possessed strong anti-proliferative activity against mitogen induced lymphocytes. D. V. Gowda et al evaluated the anti proliferative activities of the methanolic leaf extract of *Eupatorium glandulosum*. Anti proliferative activity of the leaf extract is investigated by using the antiproliferative assays. Initially analyzed the cell viability of the isolated lymphocytes by trypan blue dye exclusion method it showed the significant range of cell viability and then compared the mitogen induced and normal cell quantity of human peripheral blood lymphocytes. It shows that, in mitogen induced culture cell number is increased. MTT assay is used for the study of the cytotoxic activity. Significant percentage control of growth (cytotoxicity) is observed in the leaf extract of *Eupatorium glandulosum*. When using the 100 mg/ml concentration of plant extract it shows high cytotoxic effects⁶.

Anti-microbial activity

The cream formulations of *Eupatorium glandulosum* have better antimicrobial activity against bacteria than fungi, particularly against *Staphylococcus* and *Bacillus subtilis*. When compared to the standard drugs the cream formulation showed comparable activity against all bacterial strains. Chloroform, hexane, acetone and toluene extract of *E.glandulosam* against the pathogens such as *Staphylococcus aureus*, *Streptococcus pyogens*, *Pseudomonas aeruginosa* and *Escherichia coli* by disc diffusion methods shows the plant extract has antimicrobial activity but higher activity showed by the acetone extract¹.

Monisha desingh et al is performed antimicrobial assay by agar well diffusion method and agar disc diffusion method for solvent and aqueous extract respectively. *Staphylococcus aureus*, *Streptococcus pyogens*, *Pseudomonas aeruginosa* and *Escherichia coli* are used for the analysis. Compared the test and control by measuring the zone diameter. The experiment is repeated three times and result are compared with the standard gentamicin and antimicrobics piperacillin. The results are observed that dried leaf extract of *Eupatorium glandulosum* was possessed antimicrobial activity¹.

Anti-fungal activity

Leaves extract of the *Eupatorium adenophorum* (syn: *Eupatorium glandulosum*) containing cadinene derivatives showed the anti fungal activity against *Sclerotium rolfsii*, *Macrophomina phaseolina*, *Rhizoctonia solani* and *Fusarium oxysporum* (plant pathogenic fungi strains). Mono or dihydroxy group containing polar cadinene derivatives are active against *Rhizoctonia solani* and less polar cadinene sesquiterpenes having inhibitory activity towards the *sclerotium rolfsii*. The essential oil of the plant possessed the antifungal activity and its showed strongest inhibitory activity against *Sclerotium rolfsii*. The aerial parts of the plant containing essential oil having moderated inhibitory activity against *Fusarium oxysporum*².

Toxicity

Regular consumption of the *Eupatorium adenophorum* by horses leads to chronic pulmonary disease mainly in Himalayas, Australia and New Zealand. In queens land and northern south wales it called as a Tallebudgera Horse disease or Numinbah House sickness and the disease is characterized by emphysema, reduce tolerance to excises, pulmonary interstitial fibrosis and alveolar epithelisation, there by farmers losing all their horses and this disease only affected in horse .Horse feeding trails experiments showed some characteristic lesions in the lungs but in the mice, lesions occurred in the liver. The compound 9-oxo-10, 11 dehydroagerophorone, isolated from the *Eupatorium adenophorum* is responsible for the hepatic injury or lesions in mice but till now no mammalian toxicity is reported from these isolated toxins^{15,16}.

CONCLUSION

The *Eupatorium glandulosum* containing various phytoconstituents which is responsible for both medicinal and pharmacological activities. The review shows that the plant having many pharmacological activities like antioxidant, anti proliferative, anti microbial, wound healing and anti bacterial activities than other marketed products. The phytochemical analysis by different solvent shows various compounds in *Eupatorium glandulosum* plant extract. Toluene showed a good response in the extraction of Phenolic Carbohydrates compounds and Hexane showed the presence of Glycosides, Alkaloids, Saponins and Tannins. The acetone extracts showed the presence of Tannins and Phenolic compounds. The chloroform extract showed the presence of Glycosides and Phenolic compounds. This plant containing wide number of potentially active phytochemicals which responsible for various pharmacological activities but till now the plant not yet explored, consider the medicinal properties and wide availability some more investigations are require to find its properties because without any adverse effect it can be used as a safe nutritional supplements and also it can be well used for commercial product. So more studies are requiring to developing more effective and useful formulations from the plant *Eupatorium glandulosum*.

REFERENCE

1. Monisha desingh, Jessy Mathew Jesudas, Prasun Balasubramaniam, Karthikeyan Mayakrishnan, Bharath Ganesan and Ramya Mohan. Phytochemical Analysis and Anti-microbial Activity of *Eupatorium glandulosum*, Int.J.Curr.Microbiol.App.sci 2014; 3(7):882-885.
2. Antonio Carlos Nogueira Sobrinho, Selene Maia de Morais, Elnatan Bezerra de Souza and Raquel Oliveira dos Santos Fontenelle. The genus *Eupatorium* L. (Asteraceae): A review of their antimicrobial activity, J. Med. Plants Res 2017; 11(3):43-57.
3. Monisha desingh, Jessy Mathew Jesudas, Prasun Balasubramaniam, Karthikeyan Mayakrishnan, Bharath Ganesan and Ramya Mohan. Phytochemical Analysis and Anti-microbial Activity of *Eupatorium glandulosum*, Int.J.Curr.Microbiol.App.Sci 2014; 3(7):882-885.
4. M.Bala iyeswarya, K. Manigundan, J. Usha, P. Suganya Devi, A. Shanmuga priya. Phytochemical study of methanolic leaf extract of *Eupatorium glandulosum* L, BioMedRx 2013;1(4): 406-409.
5. Manimaran Sellappan, Nithya and Praveen T.K. Effect of Topical Herbal Formulations on Antimicrobial and Wound Healing Activity, The Open Conference Proceedings Journal 2013; 4: 36.
6. Bala Iyeswarya M, Manigundan K, Usha J, Shanmuga priya, A. Antioxidant and Anti-proliferative activity of methanolic leaf extract of *Eupatorium glandulosum*. L. International Journal of Advanced Research 2014; 2(7):717-723.
7. J.M. Sasikumar, A. Pichai Anthoni Doss, A. Doss. Antibacterial activity of *Eupatorium glandulosum* leaves. Fitoterapia 2005; 76: 240–243.
8. Pei-Yu Liu , Dan Liu , Wei-Huan Li , Ting Zhao , Françoise Sauriol , Yu-Cheng Gu, Qing-Wen Shi, and Man-Li Zhang . Chemical Constituents of Plants from the Genus *Eupatorium* (1904–2014), CHEMISTRY & BIODIVERSITY 2015; 12.
9. D. V. Gowda, Suresh J, Aravind Ram A. S, Atul Srivastava and Riyaz Ali M. Osmani. Formulation and evaluation of topical gel using *Eupatorium glandulosum* michx. For wound healing activity, Der Pharmacia Lettre 2016; 8 (8):255-266.
10. A.G.Ramachandran, R. Gunasegaran, Sujatha Krishnan, Christine Bayet and Bernard Voirin. Flavonol glycosides from leaves of *Eupatorium glandulosum*, Phytochemistry 40(1):283-285.
11. A.G.Ramachandran Nair, R. Jayaprakasam, R. Gunasekaran, Christine Bayet, Bernard Voirin. 6-hydroxykaempferol 7- (6"-caffeoylglucoside) from *Eupatorium glandulosum*. Phytochemistry 1993; 33(5):1275-1276.
12. Peter Weyerstahl, Helga Marschall, Ingo Seelmann, Vijay K. Kaul. Constituents of the flower essential oil of *Ageratina adenophora* (Spreng.) K.et R. from India, 12(6): 387–396.
13. Vivek Ahluwalia , Ritu Sisodia , Suresh Walia , Om P. Sati , Jitendra Kumar , Aditi Kundu
Chemical analysis of essential oils of *Eupatorium adenophorum* and their antimicrobial, antioxidant and phytotoxic properties. J Pest Sci 2014; 87:341–349.
14. Indu Tiwari and Govind S. Rajwar .The Replacement of Grasses and Other Herbs in the Himalayan Grassland by Allelopathic Impacts of Exotic Weed *Eupatorium glandulosum*. New York Science Journal 2010; 3(3):50-54.
15. Oelrichs PB, Calanasan CA, MacLeod JK, Seawright AA, Ng JC. Isolation of a compound from *Eupatorium adenophorum*(Spreng.) [*Ageratina adenophora*(Spreng.)]causing hepatotoxicity in mice. Nt toxins 1995;3(5):350-4.