A Review on Phytopharmacopial Potential of Epilobium angustifolium

Prasad Kadam1*, Manohar Patil2, Kavita Yadav1

ABSTRACT

Nature has been a source of medicinal agents for thousands of years, and an impressive number of modern drugs have been isolated from natural sources which are based on their use in traditional medicine. Epilobium angustifolium L is a perennial herbaceous plant that belongs to the Onagraceae family. It exhibits various therapeutic properties like anticancer, antibacterial, anti-inflammatory, antioxidant, and anti-aging properties. Epilobium angustifolium L. contains polyphenols and secondary metabolites like oenothein B. Information was collected via Medline, PubMed, and Science Direct. Also some data have been collected from scientific journals, books, and reports. This review gives the current information on the chemical composition, traditional uses, and documented biological activities of Epilobium angustifolium L. These studies reveal that Epilobium angustifolium L is a source of medicinally active compounds and have various pharmacological effects. These studies will be helpful to create interest toward Epilobium angustifolium L and may be useful in developing a new direction for further research. Epilobium angustifolium L is a medicinally important plant belongs to Onagraceae family. Extract from the plant is used in the treatment of many diseases for its anti-tumor, antimicrobial, anti-inflammatory, antioxidant, anti-ulcer and many other properties. The medicinal properties of fireweed have been attributed to its high content in polyphenols and more particularly to the most abundant of its secondary metabolites: Oenothein B.

Key words: Epilobium angustifolium L, Oenothein B Pharmacological effects, Herbaceous, Biological activities.

INTRODUCTION

Epilobium angustifolium is a remedial plant that belongs to the Onagraceae family, which contains more than 200 different species. It is called “fireweed” in North America, “rosebay willow-herb” in Great Britain and “maitoohorsma” in Finland.1 Within Epilobium species, E. angustifolium is one of the well-known medicinal plants which is used worldwide in customary medicine. Extracts obtained from rosebay willow-herb shows a variety of pharmacological effects.2 Epilobium taxa has both in vitro and in vivo studies to show many therapeutic properties, including anti-inflammatory, antiandrogenic, antiproliferative, antimicrobial, Antinociceptive, and antioxidanteffects.3 Epilobium angustifolium is widely used in non-traditional medicine to treat gastrointestinal disorders, mucous membrane lesions, such as mouth ulcers, wounds healing, skin sores, swelling.4 In the last few decades there has been a growing interest in phytochemical composition of various parts of Epilobium plants. Ellagitannins is the major bioactive compounds present in Epilobium plants. Some ellagitannins present in the plant exhibit immune modulatory activity.

The main biologically active component in Epilobium taxa is Oenothein B (a dimeric macrocyclic ella-

gittinin) which is present in high concentrations in Epilobiumspecies. Earlier studies on Oenothein B has been revealed significant antioxidant, antitumor, antibacterial, and antiviral activities.5


*Correspondence:
Mr. Prasad Kadam, Marathwada Mitra Mandal’s College of Pharmacy, Sr. No 4/17, Sector No.34, PCNTDA, off Kalewadi Phata Pimpri Road, Thergaon (Kalewadi), Pune-411033, Maharashtra, INDIA.
Phone no: +9198850219875.
E-mail: kadamprasadv@gmail.com

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The aim of this paper is to give comprehensive review on the chemical composition, traditional uses, and documented biological activities of plant belonging to the *Epilobium angustifolium*.

### Botanical Description

*Herbaceous perennial, forming colonies by extensive system of pseudo-rhizomes; stem erect, up to 3 m tall, simple to much branched on top of, glabrous to very pubescent with little upwardly curled trichomes, the inferior parts with exfoliating epidermis; leaf blands linear to broadly elliptic or lanceolate, the abaxial midrib glabrous to very pubescent; inflorescence showy, with from several to 100 flowers; petals pink, 3-17 mm broad, 7-22 mm long; style usually hairy at base; stigma opening 2-3 days after anthesis. Capsule with up to several hundred comate seeds.5*

### Geographical Distribution

*Epilobium angustifolium* is indigenous throughout Canada and most of the United States except for Kansas, Oklahoma, Texas, Missouri, Arkansas, Kentucky, and the southeastern states. In Indiana, Ohio, and North Carolina fireweed is classify as a Endangered species, and in Tennessee it is a Species of Concern. It grows mainly in forest and alpine meadows, in semi-shaded mixed forests and forest edges, and along rivers and streams. This versatile plant can grow almost anywhere. Its main association is as an active colonizer of recently burned areas, behavior that has earned fireweed its name.6,7

### Active Compounds

A variety of polyphenols present in *Epilobium angustifolium*. Three major polyphenol groups have been isolated in *Epilobium angustifolium* extracts: flavonoids, phenolic acids, and ellagitannins. Flavonoids consist of flavonol glycosides, such as akezeln (kaempferol-3-O-rhamnoside), quercetin (quercetin-3-O-rhamnoside), and myricetin (myricetin-3-O-glucuronide). Miquelianin (myricetin-3-O-rhamnoside), and miquelianin (myricetin-3-O-glucuronide). 6,7 Miquelianin is the main flavonoid in *Epilobium angustifolium*, among the flavonoid glycosides that have been identified in *Epilobium* species. Whereas myricetin (myricetin-3-O-rhamnoside) was found to be the main flavonoid in other species. Some of these compounds are active constituents of many medicinal plants that are used in conventional medicines for their neuroprotective, anti-inflammatory, antioxidant, anti-proliferative, and other pharmacological properties. Tellimagrandin I-based oligomeric ellagitannins are relatively high-molecular-weight polyphenols. 8

From *Epilobium angustifolium* extracts several other oligomeric tannins have been isolated, including oenothelinin A (trimter), and tellimagrandin I-based heptameric ellagitannins. Oenothein B is a macro cyclic ellagitannin. Important biological activity shown by Oenothein B which include antioxidant, immunomodulatory, tumor cell cytotoxicity, enzyme inhibition, and enzyme induction. 9

Ellagic acid which is a marker of ellagitannins occurrence has been detected. *Epilobium* species including the most popular *E. angustifolium, E. hirsutum* and *E. parviflorum*. Valoneic acid dilactone has been reported in *E. angustifolium*. 10

While other quinic acid esters have been only detected in *Epilobium angustifolium* using the HPLC–DAD–MS method. 11 Also Cholesterol, campesterol, stigmasteryl, and sitosterol and its glycosides and esters have been reported from *Epilobium angustifolium*. 1

### Pharmacological Reports

#### Traditional Uses

Fireweed infusion or tea has been reported for the treatment of migrane headaches, insomnia, anemia, delirium tremens, infections, and colds. *Epilobium angustifolium* extracts have been helpful in gastric ulcer; duodenal ulcer; gastritis; colitis; various gastrointestinal disorders, such as dysentery and diarrhea; and prostate or urinary problems, such as urethral inflammation, micturition disorders, prostatic adenoma, and benign prostatic hyperplasia (BPH). 1

*Epilobium angustifolium* infusions due to its astringent, demulcent and emollient properties, were commended by American herbal list since 19th and early 20th centuries as a very effective agent to treat gastrointestinal diseases such as dysentery and diarrhea of different aetiologies well as other bowel and intestinal disorders associated with infection, irritation and inflammation. 1 *Epilobium angustifolium* is used to treat whooping cough, hic cough and asthma. 12 Apoultice made from the leaves of *Epilobium angustifolium* was applied to burns, beestings, aches and in swelling by Gwich’in people. 13 The medicinal properties of fireweed have been attributed to its high content in polyphenols and more particularly to the most abundant of its secondary metabolites: oenothein B 14. *Epilobium angustifolium* has also been used topically as a cleansing, soothing, anti-septic, also healing agent to treat minor burns, skin rashes, ulcers, and for treatment of inflammation of the ear, nose, and throat. 15

#### Antinflammatory activity

*Epilobium angustifolium* aqueous extracts have also been reported to have anti-inflammatory properties which reduced carrageenan-induced paw edema. 1

#### Analgesic activity

Fireweed extracts have been reported to exhibit analgesic properties using hot plate and writhing tests. 13

#### Antiviral activity

*Epilobium angustifolium* extracts administration, prior to influenza virus exposure reduced mortality and increased survival mean time. These effects were even more striking when infection occurred seven days after exposure reduced mortality and increased survival mean time. These effects were even more striking when infection occurred seven days after...
the last administration of the extract, where mortality rate was reduced by 50% and survival mean time was increased fivefold.³

**Anti-tumor activity**

*Epilobium angustifolium* extracts have also been reported to exhibit anti-tumor properties, including inhibition of human prostate epithelial cell PZ-HPV-7 growth. Likewise, treatment of androgen-sensitive human prostate adenocarcinoma cells LNCaP with Epilobium extracts (20–70 μg/ml) resulted in a significant increase in the number of apoptotic cells. Various Epilobium extracts, including extracts from *Epilobium angustifolium*, caused a similar inhibitory effect on the proliferation of human cancer cell lines and inhibited DNA synthesis in human astrocytoma cells 1321N1.¹ In addition, aqueous extract of *E. angustifolium* demonstrated higher antiproliferative activity than ethanol extracts.¹⁶,¹⁷

**Anti-Oxidant activity**

*Epilobium angustifolium* aqueous extracts are able to scavenge superoxide anion (O²⁻) and hydroxyl radicals, as well as inhibit ROS production by stimulated neutrophils.¹

**CONCLUSION**

*Epilobium angustifolium* is a medicinal plant which is widely used in conventional medicine. Oenothein B is biologically active polyphenols present in this plant extract. The remedial effects of *Epilobium angustifolium* polyphenol are mediated by multiple mechanisms, including direct killing of cancer cells and microbes, antioxidant activity, metal Chelation and both pro-inflammatory and anti-inflammatory immune modulation. Further, a better understanding of *Epilobium angustifolium* active molecules and their mechanisms of action is essential for maximizing the therapeutic potential of this interesting plant and ensuring safe use of these compounds as therapeutics.

**CONFLICT OF INTEREST**

The authors declare that they have no conflict of interest.

**ABBREVIATIONS**

HPLC-DAD-MS: High performance liquid chromatography with diode array detection and Mass spectrometry  
BPH: benign prostatic hyperplasia  
PZ-HPV-7: Human papillomavirus type-7LNCaP: Lymph node carcinoma of the prostate  
DNA: Deoxyribonucleic Acid  
ROS: Reactive Oxygen Species

**SUMMARY**

- *Epilobium angustifolium* L.is a medicinally important plant belongs to Onagraceae family.
- Extract from the plant is used in the treatment of many diseases for its antitumor, antimicrobial, anti-inflammatory, antioxidant, anti-ulcer and many other properties.
- The medicinal properties of fireweed have been attributed to its high content in polyphenols and more particularly to the most abundant of its secondary metabolites: oenothein B.

**REFERENCES**