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Review

A Review of the Anti-Inflammatory Skincare Potential of *Epilobium angustifolium* (Fireweed) Inspired by Herbal Tradition

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Abstract: The demand for naturally derived cosmetic ingredients is rising as consumers increasingly prioritize green and environmentally friendly products. Naturally derived ingredients, such as plant extracts rich in polyphenols like flavonoids and tannins, are often perceived as more sustainable and beneficial for skincare. *Epilobium angustifolium* (fireweed) is a circumpolar plant with traditional uses in Northern and Eastern Europe known for its skincare benefits. This review explores the chemical composition, traditional uses, and potential skincare benefits of *E. angustifolium*, focusing on its anti-inflammatory and antioxidant properties. Literature surveys, ethnopharmacological research, and database searches were conducted to investigate the properties of *E. angustifolium*. The plant contains various compounds such as flavonoids, phenolic acids, tannins, steroids, and triterpenes, each with potential skincare benefits. Pharmacological reports suggest that *E. angustifolium* exhibits antioxidant and antibacterial properties, making it a valuable ingredient in skincare products. The availability of *E. angustifolium* in the market as a raw material for cosmetics offers opportunities for formulators to create innovative products with skin-conditioning and anti-inflammatory properties. Understanding the chemical composition and bioactivity of *E. angustifolium* can guide the development of effective and sustainable skincare formulations.

Keywords: *Epilobium angustifolium*; *Chamaenerion angustifolium*; fireweed; willowherb; skincare; anti-inflammatory; antioxidant; raw materials; formulation

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1. Introduction

Plant-derived compounds in topical skin applications have gained significant attention in recent years due to their potential therapeutic benefits and market trends. Consumer interest in naturally derived cosmetic ingredients and additives is growing [1]. Current consumer attitudes tend to favour green and natural-seeming products, and they are growingly aware of the environmental impact cosmetics may have. Naturally derived ingredients are often perceived as more sustainable and environmentally friendly [2]. According to the Finnish Natural Cosmetics Association, Pro Luonnonkosmetiikka ry, the market share of natural cosmetics, especially in skincare, is growing annually [3]. The natural cosmetics market is set to continue its growth trajectory until at least 2028 [4].

Many consumers turn to naturally derived ingredients when making purchasing decisions about skincare. Plant extracts such as chamomile are known to be skin-calming due to their polyphenolic composition. Polyphenols, such as flavonoids and tannins found in plants, often have beneficial properties when used in skincare, such as skin conditioning and skin-protecting properties [5]. Polyphenols are a structural class of chemicals characterized by more than one phenolic ring. These polyphenols will give a plant extract its anti-inflammatory properties [5].

This review addresses the possible skincare benefits of *Epilobium angustifolium* (fireweed) based on traditional knowledge and scientific evidence. *E. angustifolium*, also known as fireweed or willowherb, is a circumpolar plant with traditional uses in Northern and Eastern Europe, known for its skincare benefits [6]. This review will examine its traditional use, chemical composition, and possible current and future use in skincare. It will also explore the recent launches of cosmetic ingredients on the market containing *E. angustifolium*. Moreover, *E. angustifolium* has emerged as a botanical ingredient with promising cosmetic possibilities, mainly due to its notable anti-inflammatory properties.

Different review articles have explored the antibacterial activity of *E. angustifolium* [7], its skincare potential [6,8,9], and its history in Northern America [10]. This review aims to connect the existing literature with commercially available cosmetic raw materials containing *E. angustifolium* and suggest potential cosmetic products where such raw materials could be utilised.

2. Traditional Uses and Background

E. angustifolium was mentioned in the first ever botany book written in Finnish, the Flora Fennica, in 1860. It was mentioned as an edible plant and is ideal for use as pillow stuffing and cow feed [11]. The Finnish and Swedish names maitohorsma and mjölkört mean "milk herb", as it was said to promote milk production in cows [12]. *E. angustifolium* has a long history for treating skin irritation, scrapes, and burns in the Nordic ethnobotanical tradition [13].

Historically, *E. angustifolium* has been used to brew tea and to help with stomach and urinary tract problems. Topically, it has been used to treat scrapes, wounds, burns, and skin infections like poultices and salves [11–13].

E. angustifolium has been traditionally used in Turkey for treating mouth wounds, skin disorders, burns, skin irritation, swelling, and boils [6]. In addition, *E. angustifolium* has been used in traditional medicine across Estonia, Indian tribes, and southern Poland for wounds [14]. Furthermore, it was known as "original Russian tea", or Koporje Tea, and used widely in Russia before the introduction of oriental teas [14–17]. *E. angustifolium* has also been used by Native Americans to treat skin infections and rectal bleeding [18].

3. Chemical Profile of *Epilobium angustifolium*

3.1. Botanical Overview

E. angustifolium is a perennial circumpolar plant that grows in open areas and pastures in the Northern Hemisphere, including Northern Europe, Northern Asia, Northern America, and Greenland [19]. The *E. angustifolium* plant will grow to be 50–150 cm in height with thin green leaves and pink flowers [20]. The *Epilobium* genus (Onagraceae) consists of around 200 species worldwide. Twenty-six different species can be found in Europe [5]. *E. angustifolium* (also called rosebay willowherb, fireweed, great willowherb, depending on the region) is prevalent in Northern and Eastern Europe ethnobotanical tradition. In Finland, it is the most common perennial plant that grows on the sides of roads, in clearings, and after forest fires [13].

E. angustifolium is a hardy plant that can easily find suitable growth conditions in the most unlikely places [21]. (See Figure 1). It is good to note that plants grown so near roads or other possible polluted areas should not be used for cosmetic purposes. Plenty of locations other than roadsides where *E. angustifolium* is found are more suitable for growing for cosmetic purposes.

E. angustifolium is also referred to as *Chamaenerion angustifolium*. In this article, it will be called *E. angustifolium* because it is listed in the International Nomenclature of Cosmetic Ingredients (INCI) by that name [22].

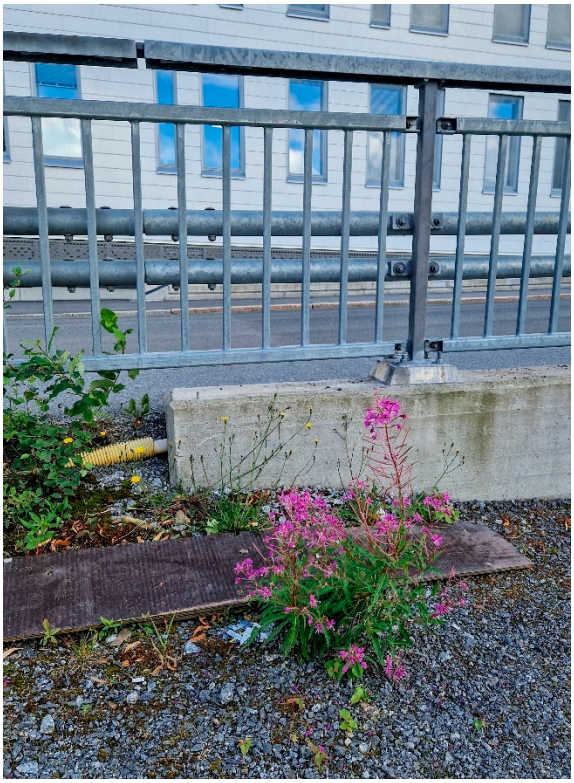

Figure 1. *E. angustifolium* plant in bloom growing by the side of a road in rubble. Photograph by Jaana Ailus, July 2024.

3.2. Relevant Constituents

E. angustifolium has a complex chemical composition. This review will investigate the constituents that have potential skincare benefits.

3.2.1. Flavonoids (See Table 1)

Flavonoids are polyphenols that are a group of plant compounds with antioxidant properties. Flavonoids tend to be responsible for the colouring of plants. Their antioxidant properties lend to skin soothing and protection when used in skincare. Flavonoids are soluble in inorganic solvents and insoluble in water [23]. This means they will be more challenging to incorporate into completely water-based formulations, and the use of solubilisers in the final formulation will likely be needed. (Solubilisers such as Polysorbate 20 or Sodium Olivate are surface active ingredients that allow oil-soluble ingredients to be incorporated into water-based systems without compromising the final formulation's clarity). Due to their abundance of colour, they will also influence the shade of the final product if used in high amounts.

Some of the flavonoids of interest present in *E. angustifolium* are Kaempferol, Afzelin (kaempferol-3-*O*-rhamnoside), Quercetin, Isoquercetin (quercetin-3-O-glucoside), Miquelianin (quercetin-3-O-glucuronide), and Myricetin [24,25] (see Supplementary Table S1 for full list).

Table 1. Selected chemical components found in *E. angustifolium* and their possible properties when used topically.

Chemical	Class	Properties
Afzelin (kaempferol-3-*O*-rhamnoside) (Figure 2)	Flavonoid	Anti-inflammatory, antioxidant [26]
Isoquercetin (quercetin-3-O-glucoside) (Figure 3)	Flavonoid	Anti-inflammatory, antioxidant [27]
Kaempherol (Figure 4)	Flavonoid	Anti-inflammatory, antioxidant [28]
Miquelianin (quercetin-3-*O*-glucuronide) (Figure 5)	Flavonoid	Immunostimulatory, anti-inflammatory [29]
Myricetin (Figure 6)	Flavonoid	Anti-inflammatory, antioxidant, anti-ageing [30]
Quercetin (Figure 7)	Flavonoid	Anti-inflammatory, antioxidant [29]
Ferulic Acid (Figure 8)	Phenolic Acid	Anti-inflammatory, antioxidant [30]
Oenothein B (Figure 9)	Tannin	Anti-inflammatory, sebum-regulating, antioxidant, antibacterial [24,25]
Oleanolic Acid (Figure 10)	Triterpene	Anti-inflammatory [31]
Ursolic Acid (Figure 11)	Triterpene	Anti-inflammatory, astringent [31]

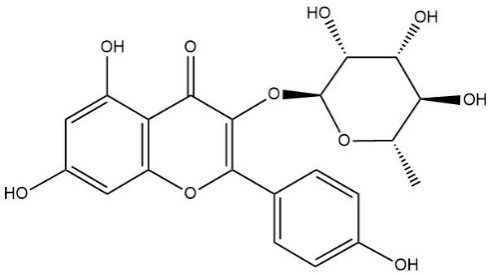

Figure 2. Isoquercetin.

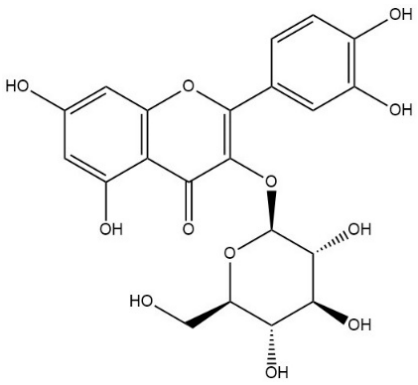

Figure 3. Kaempferol.

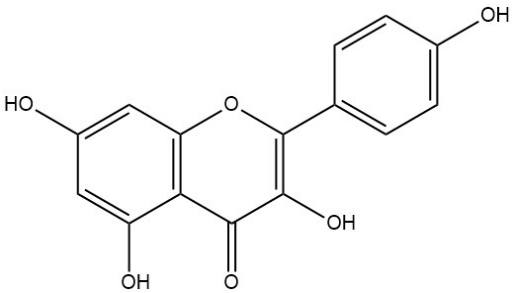

Figure 4. Myricetin.

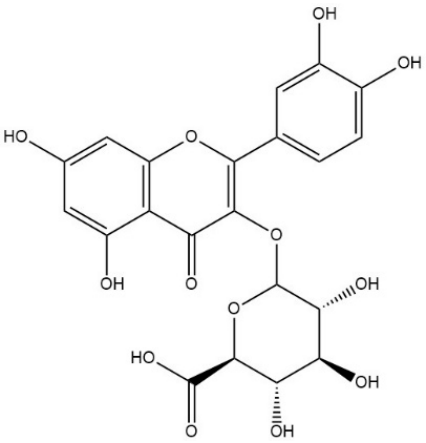

Figure 5. Quercetin.

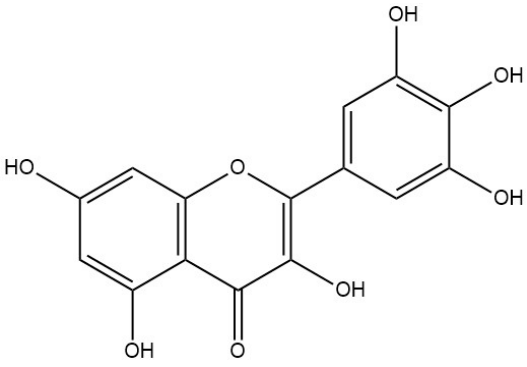

Figure 6. Ferulic Acid.

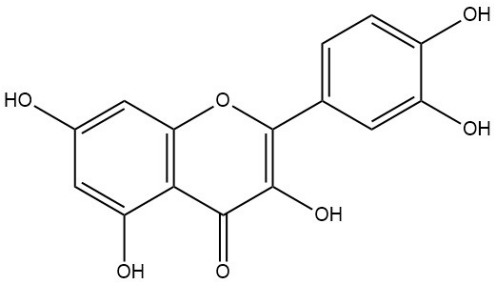

Figure 7. Oenothein B.

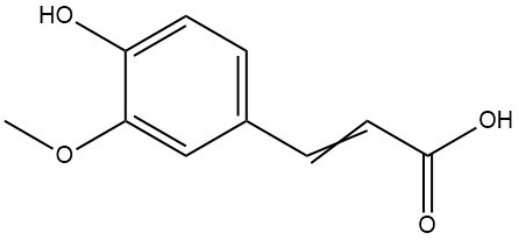

Figure 8. Oleanolic Acid.

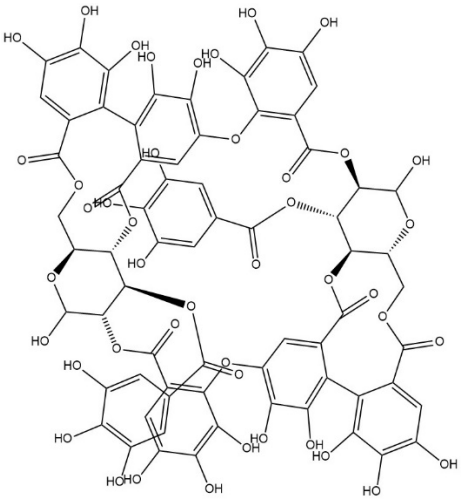

Figure 9. Ursolic Acid.

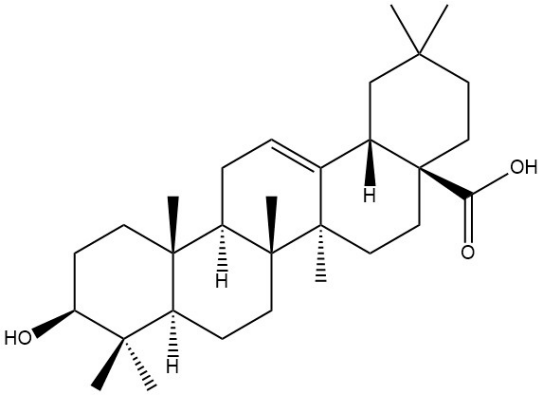

Figure 10. Afzelin.

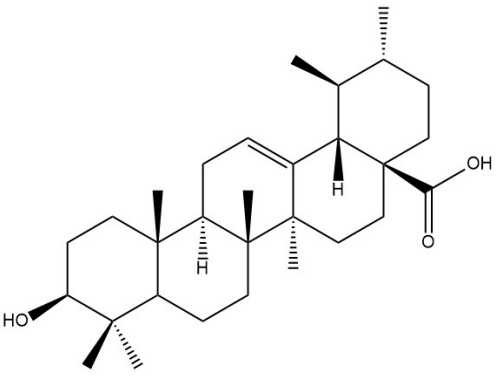

Figure 11. Miquelianin.

3.2.2. Phenolic Acids and Their Derivatives (See Table 1)

Phenolic acids are a diverse group of plant-based compounds characterized by an aromatic ring with one or more hydroxyl groups. In terms of polyphenolic structure, they have the simplest chemical structure. In skincare, phenolic acids and their derivatives also work as antioxidants and have anti-inflammatory properties. Phenolic acids and their derivatives are widely used in beverages [28,32] and, therefore, have better water solubility than other components of *E. angustifolium*.

A phenolic acid present in *E. angustifolium* is Ferulic acid [23,25] (see Supplementary Table S1 for a complete list of phenolic acids and their derivatives).

3.2.3. Tannins and Related Compounds (See Table 1)

Tannins are also a group of polyphenols found in plants. When used in skincare, they have antioxidant and anti-inflammatory properties, protecting the skin from free radicals-induced damage. Tannins are water-soluble and, therefore, easier to incorporate into cosmetic formulations.

The most notable tannins or related compound in *E. angustifolium* is Oenothein B. [25,28]. (See Supplementary Table S1 for a complete list of tannins and related compounds).

3.2.4. Triterpenes (See Table 1)

Triterpenes are naturally occurring plant compounds with a six-carbon ring structure and three isoprene units. One of the most well-known plant actives on the skincare market with anti-inflammatory properties is a triterpene, Madecassoside, a molecule derived from *Centella asiatica* and the active ingredient in all "cica" products [29,30,33,34].

The triterpenes present in *E. angustifolium* are Ursolic acid and Oleanolic acid [24,25]. (See Supplementary Table S1 for a complete list of triterpenes present).

4. Scientific Evaluation of Cosmetic Efficacy

4.1. Anti-Inflammatory Properties

E. angustifolium contains compounds with anti-inflammatory properties, such as flavonoids, phenolic acids, and triterpenes (see Table 1), making it ideal for soothing irritated or inflamed skin. This is carried out by inhibiting the activity of lipoxygenase enzymes. The enzymes responsible for inflammation are inhibited by the compounds present in *E. angustifolium*, thus helping reduce redness, swelling, and discomfort associated with various skin conditions, such as eczema, psoriasis, and acne [12,13,35,36]. The anti-inflammatory action is also necessary for rapid and effective wound healing [14].

4.2. Antioxidant Activity

Rich in antioxidants, such as those outlined in Table 1, *E. angustifolium* helps protect the skin from oxidative stress caused by free radicals. Antioxidants scavenge free radicals and, therefore, reduce the damage caused by oxidation. Antioxidants work by neutralising these potentially harmful molecules. By this mechanism, *E. angustifolium* extract can help prevent premature ageing signs, such as fine lines, wrinkles, and hyperpigmentation, promoting a more youthful appearance. Fireweed contains various phytochemicals, such as polyphenols and flavonoids, contributing to its antioxidant properties. These components help neutralize free radicals in the body, reducing oxidative stress and protecting cells from damage [8,13,35].

4.3. Antibacterial and Antimicrobial Effects

E. angustifolium exhibits antibacterial and antimicrobial properties, which can be beneficial for addressing skin concerns related to bacterial infections or acne. This botanical extract supports a clearer, healthier complexion by inhibiting the excessive growth of harmful bacteria on the skin's surface, such as *Propionibacteria acnes* [7,35,36].

4.4. Astringent and Sebum-Regulating Benefits

E. angustifolium has astringent properties, which can help tighten and tone the skin, minimizing the appearance of enlarged pores. *E. angustifolium* also helps regulate sebum production, making it a suitable natural remedy for oily or acne-prone skin by balancing oil levels and reducing excess shine [14]. *E. angustifolium* contains Oenothein B (Figure 9), a bioactive molecule that is known to have sebum regulating (due to anti-5-α-reductase inhibition) and anti-inflammatory properties. Fireweed extract is often used in products targeted at dandruff [24,25,37].

4.5. Skin Soothing and Healing Properties

E. angustifolium is also known for its soothing and healing effects on the skin. It can help alleviate itchiness, redness, and discomfort, making it a valuable ingredient in formulations targeting sensitive or damaged skin. One of the components in *E. angustifolium*, Oenothein B (Figure 9), also influences wound healing and reduces inflammation by inhibiting hyaluronidase enzymes and inhibiting COX-1 and COX-2 cyclooxygenases. Bioactive compounds in *E. angustifolium* support the skin's natural repair processes, promoting overall skin health and well-being [7,8,12,13,38].

4.6. Anti-Ageing Properties

Due to its antioxidant content and skin-protective qualities, *E. angustifolium* contributes to anti-ageing skincare regimens by combating environmental stressors and supporting collagen production. As mentioned in Section 4.2, the antioxidant properties of *E. angustifolium* allow for the prevention of many age-related skin concerns, such as fine lines and hyperpigmentation. Regularly using products containing this botanical extract may help maintain skin elasticity, firmness, and radiance over time [12,13].

5. Potential Applications in Cosmetic Formulations

Due to its many potential beneficial properties, *E. angustifolium* lends itself to numerous cosmetic applications. Different potential product categories are explained as follows, and examples of products currently on the market are named.

5.1. Moisturisers

E. angustifolium is an ideal candidate for different moisturisers that provide hydration and soothing for the skin. Moisturisers are a vast product category, encompassing most face cream-type products. Moisturisers often come in the form of emulsions, and therefore, extracts are easy to incorporate into them because less consideration must be paid to the solubility of the extract. Moisturisers can be oil-in-water or water-in-oil emulsions and are widely used in various product categories. Some examples of commercial moisturisers on the market using *E. angustifolium* extract are Bobbi Brown Vitamin Enriched Face Base (New York, NY, USA), Lumene Nordic Bloom Vitality Anti-wrinkle & Revitalize Rich Day Cream (Kauklahti, Finland), and Rocky Mountain Soap Co Essential Face Cream (Vancouver, BC, Canada).

5.2. Serums

E. angustifolium can also be incorporated into various water- or oil-based serums. Serums are usually used for added skincare benefits, tend to have a higher price point and target specific skin needs. They can come in several different formats. Serums can be water- or oil-based or come in an emulsion form.

Some serums with *E. angustifolium* include Paula's Choice Repairing Serum with Ceramides + Beta-Glucan (Seattle, WA, USA), Nörre Nordic Rebalance Clearing and Purifying Face Oil Serum (Helsink, Finland).

5.3. Shampoos

As mentioned in Section 4.4, *E. angustifolium* has been historically linked to treating scalp conditions such as dandruff, making it an optimal addition to shampoos. Shampoos are rinse-off products used to cleanse the hair. Some shampoos containing *E. angustifolium* are Derma E Scalp Relief Shampoo (Simi Valley, CA, USA) and Sirona Dandruff Control Shampoo (Mumbai, India).

5.4. Sun Protection

E. angustifolium can also be found in sun protection products. Due to its antioxidant and soothing properties, it is an excellent addition to sun protection products and can potentially have a small SPF-boosting effect. As the name suggests, sun protection products are products used to protect the skin from the sun's UV rays. Sun protection products with

E. angustifolium include Bobbi Brown Extra Repair Moisturizing Balm SPF 25 (New York, NY, USA) and Solante Telerubor Tinted SPF 50+ Lotion (Istanbul, Turkey).

5.5. Exfoliants

Interestingly enough, *E. angustifolium* extract can also be found in exfoliating products. These products can irritate the skin, so adding *E. angustifolium* extract can reduce the irritation potential of the exfoliating ingredients, such as acids. Exfoliants come in various forms and can be leave-on or rinse-off products. The exfoliation mechanism can be mechanical (e.g., abrasive beads) or chemical (acids or enzymes). Their primary mechanism of action is to exfoliate the outermost layers of the stratum corneum.

Some exfoliating products that contain *E. angustifolium* are Paula's Choice Skin Perfecting 2% BHA Gel Exfoliant (Seattle, WA, USA) and Emina Ms. Pimple Acne Solution Exfoliating Toner (Guangzhou, China).

6. Existing Commercial Ingredients

E. angustifolium is currently used as a raw material in cosmetic products. Some of the raw materials mentioned in Section 6 may be the ones used in the products in Section 5. *E. angustifolium* is available in ready-made extracts and mixtures from different raw material manufacturers. The raw material data for this section were accessed via company websites and Ultrus Prospector and SpecialChem databases. The databases used, Ultrus Prospector and SpecialChem, are both targeted at formulation scientists and are a place for looking for information and formulation advice on cosmetic raw materials.

It is interesting to note that different solubilities and extraction methods will influence the active components in the finished raw materials. Other extraction methods and solvents will yield different compounds; e.g., water-soluble and oil-soluble extracts will have very different constituents due to their chemical compositions (see Table 1). Combining *E. angustifolium* with other plant extracts can also potentially have a synergistic effect (see Table 2). This is a possible explanation for why the six cosmetic raw materials all have somewhat different recommendations for use and what impact they will have on the skin. From this variety in raw material efficacies, it is clear that *E. angustifolium* extract is a very versatile cosmetic ingredient with great potential, possibly with the potential to compete with other better-known plant-derived actives. The companies producing *E. angustifolium* extract are all European bar one. While the plant grows around the Northern Hemisphere, it would appear to be more prevalent in Europe, possibly due to its rich history in herbal tradition, as mentioned in Section 2.

It should also be noted that all the listed commercial cosmetic ingredients contain the extract of *E. angustifolium* and are not purified or in a more processed form like the before-mentioned triterpene Madecassoside from *Centella asiatica*. Forgoing purification or fractionation lends itself to higher usage levels, as some *E. angustifolium*-containing raw materials are used at up to 5% concentration in the finished formulation.

Table 2. Existing commercial cosmetic ingredients on the market with *E. angustifolium*.

Trade Name	INCI	Claims	Source
Arp 100	Aqua, Alcohol, Serenoa Serrulata Fruit Extract, Epilobium Angustifolium Flower/Leaf/Stem Extract, Cucurbita Pepo Seed Extract	"This product is suitable for use in anti-body hair regrowth products, depilatory products, after-shave skin care products, and deodorant products." [39]	Greentech: https://www.greentech.fr/en (accessed on 15 July 2024)
Canadian Willowherb 5C PF	Glycerin, Aqua, Epilobium Angustifolium Flower/Leaf/Stem Extract	"demonstrates free-radical scavenging abilities, prebiotic benefits, and rapid anti-irritant and soothing efficacy." [40]	Lucas Meyer: https://www.Lucasmeyercosmetics.com (accessed on 15 July 2024)

Table 2. *Cont.*

Trade Name	INCI	Claims	Source
Defenscalp PF	Aqua, Epilobium Angustifolium Flower/Leaf/Stem Extract	"inhibits 5α-reductase activity, decreases sebum production and accumulation, modulates the immune-inflammatory defense system, and reinforces stratum corneum. It also reduces the appearance of adherent and non-adherent flakes and helps soothe scalp irritation" [41]	Lucas Meyer: https://www.Lucasmeyercosmetics.com (accessed on 15 July 2024)
Epilobium Oleoactif	Helianthus Annuus Seed Oil, Epilobium Angustifolium Flower/Leaf/Stem Extract	"substantiated moisturizing and antioxidant activities, providing a double efficacy against free radicals and on hydration for more complete protection." [42]	Hallstar: https://www.hallstarbeauty.com/ (accessed on 15 July 2024)
Epispot	Maltodextrin, Epilobium Angustifolium Flower/Leaf/Stem Extract	"reduces skin shine, improves the appearance of facial pores, and promotes a healthy-looking complexion" [43]	BASF: https://www.personal-care.basf.com/ (accessed on 15 July 2024)
Seborilys SB	Epilobium Angustifolium Flower/Leaf/Stem Extract, Tropaeolum Majus Flower/Leaf/Stem Extract, Terminalia Chebula Extract, Porphyridium Cruentum Extract	"a multifunctional sebum regulator derived entirely from plant sources. It limits sebum production, treats greasy skin, and limits skin irritation. This product is recommended for acneic skin care, greasy skin care, and greasy hair care products." [44]	Greentech: https://www.greentech.fr/en (accessed on 15 July 2024)

6.1. Arp 100 by Greentech (France)

Arp 100 is a cosmetic raw material that contains *E. angustifolium* extract in combination with *Serenoa serrulata* (saw palmetto) fruit extract and *Cucurbita pepo* (pumpkin) seed extract in a base of water and ethanol. This mixture is preservative-free, most likely due to the high ethanol content (25–50%). This product is water soluble with a usage recommendation of 2–5% in a finished formulation [39].

Arp 100 is targeted for the whole body, where hair re-growth after hair removal is unwanted, as well as deodorant products. The potential hair-regrowth activity likely comes from the other two plant extracts, not *E. angustifolium*, as none of the reviewed literature indicates any hair-growth-inhibiting action. *E. angustifolium* is most likely used as a cosmetic ingredient to offer soothing and skin conditioning benefits, as mentioned in Section 4.5.

6.2. Canadian Willowherb 5C PF by Lucas Meyer (France)

Canadian Willowherb 5C PF is a cosmetic raw material that contains *E. angustifolium* extract in a base of glycerine and water. This mixture is preservative-free, most likely due to the high glycerine content. This product is water soluble with a 1–3% usage recommendation in a finished formulation [40].

Canadian Willowherb 5C PF is marketed as an active ingredient by Lucas Meyer, relying heavily on the ethnobotanical tradition of Native Americans, as mentioned in Section 2. Lucas Meyer markets the raw material for several applications, such as anti-irritant, skin soothing, anti-acne, anti-redness, baby care, sensitive skin, hair growth, sun

care, men's care, and post-dermatological treatment. Lucas Meyer states that the extract contains Oenothein B, which inhibits 5-α-reductase and *P. acnes*. The raw material is also said to have free radical scavenging properties and soothing efficacy, as mentioned in Sections 4.2 and 4.5.

6.3. Defenscalp PF by Lucas Meyer (France)

Defenscalp PF is also a raw material by Lucas Meyer. It is a preservative-free water-based solution with *E. angustifolium* extract with a recommended usage level of 0.5–1–5% in a finished formulation. Defenscalp PF won the silver for best ingredient at In Cosmetics Asia in 2016 when it was first launched [41].

As the product's name suggests, this raw material is explicitly targeted at scalp care and is suitable for rinse-off products like shampoo. Defenscalp PF is marketed as a scalp microbiota-friendly ingredient, and its anti-dandruff properties, as seen in Section 4.4. are heavily drawn upon in the marketing literature.

6.4. Epilobium Oleoactif by Hallstar (USA)

Epilobium Oleoactif by Hallstar is the only oil-soluble raw material covered in this review. It contains *E. angustifolium* extract in a base of sunflower seed oil. Due to the absence of water, this raw material does not need a preservation system. Hallstar's proprietary oil-based extraction method, and therefore, it can be assumed that somewhat different constituents will be present in this extract than the other water-soluble ones discussed in this review. No recommended usage level was found for this raw material, but the frame formulations available via Hallstar use Epilobium Oleoactif at 0.5–1% in the final formulations [42].

Hallstar claims that the Epilobium Oleoactif scavenges free radicals and offers hydration. While the antioxidant action is well documented, as seen in Section 4.2., it is likely that the moisturisation that the sunflower seed base provides this raw material offers and not the *E. angustifolium* extract.

6.5. Epispot by BASF (Germany)

Epispot by BASF is the only raw material discussed in this review that is in powder form. Epispot contains *E. angustifolium* extract and Maltodextrin. Due to the absence of water, this raw material does not need a preservation system. The usage level of this water-soluble powdered raw material is 0.2% in the final formulation [43].

BASF's Epispot is targeted at rebalancing oily skin and amplifying the skin's antioxidant defense. Rebalancing oily skin is likely due to the sebum-regulating properties, as discussed in Section 4.4. The antioxidant activity is discussed in Section 4.2.

6.6. Seborilys SB by Greentech (France)

Seborioloys SB is another raw material from Greentech. It is a combination of *E. angustifolium* extract with *Tropaeolum majus* (garden nasturtium) flower extract, *Terminalia chebula* (black myrobalan) extract, and *Porphyridium cruentum* (red algae) extract. Besides the extracts, this water-soluble raw material also contains water, ethanol, glycerin, lecithin, maltodextrin, hydroxyethylcellulose, guar hydroxypropyltrimonium chloride, tocopheryl acetate, as well as the preservatives sodium benzoate and potassium sorbate. The recommended usage level in the final formulation is 5% [44].

Greentech states that this cosmetic raw material targets sebum regulation and limits skin irritation, as supported by Sections 4.4 and 4.5. Greentech's supporting literature states that the *E. angustifolium* extract is responsible for the 5-α-reductase inhibition due to its macrocyclic tannins, such as Oenothein B, as seen in Section 3.2.3.

7. Safety Considerations

E. angustifolium boasts a favourable safety profile, making it an ingredient for skincare. *E. angustifolium* is widely used in teas and has no known undesirable side effects [43].

E. angustifolium extract is considered safe for cosmetic use, with no special provisions in the Annexes to the EU Cosmetics Regulation. The CosIng page for *E. angustifolium* extract cites it as a skin conditioning agent.

8. Further Directions

When using plants as the starting material for cosmetic ingredients, factors such as impurities, differences between soil quality, weather conditions, pollutants, and contaminants must be closely monitored. These will all impact; therefore, strict quality control measures must be in place to ensure consumer safety and unchanged quality. In general, plant-based cosmetic raw materials are gaining momentum, and they will gain more market share in the future. With the emphasis on sustainability and circular economy in the cosmetics industry [45], raw materials like *E. angustifolium* extract may gain even more popularity.

E. angustifolium extract and all phenolic compounds have antioxidant properties; it is essential to differentiate the most beneficial components of the plants studied and possibly refine them for use in cosmetics. This refinement will require further investigation into extraction techniques to optimise the yield value for each constituent. It would be of interest to see whether the triterpenes found in *E. angustifolium*, Ursolic acid, Corosolic acid, Maslinic acid, or Oleanolic acid would have similar skin benefits as the triterpene Madecassoside from *C. asiatica*.

It is also worth noting that a fractionation of *E. angustifolium* extract is needed. The existing cosmetic raw materials use the whole plant extract without separating different components. The energy needed for separation may be unnecessary since the components present in the whole extract have such beneficial properties and using them all together may offer more skincare benefits than using only a chosen few. When looking at fractionation, it is essential to remember that some of the chemical components present in the *E. angustifolium* extract are highly sensitive to growth conditions. For example, Ivanauskas, L. et al. observed that the amount of the Phenolic Acid Chlorogenic Acid was at its highest at the late flowering phase of the plant. They also observed that the amount of Oenothein B varied depending on the flowering period [25].

Possible synergies with other ingredients should also be explored, as seen in Sections 6.1 and 6.6. there might be potential benefits of combining *E. angustifolium* with other plant extracts to achieve a more potent cosmetic ingredient. Moreover, the effects of *E. angustifolium* on UV radiation is another possible path to investigate, as its antioxidant properties potentially provide a degree of sun protection.

9. Conclusions

In conclusion, the literature reviewed highlights the diverse benefits of plant-derived compounds in topical skin applications. From their antibacterial and antioxidant properties to their skin penetration capabilities and therapeutic potential, herbal ingredients play a crucial role in modern dermatology and skincare. Further research and formulation development are warranted to harness the full therapeutic potential of these natural compounds for improved skin health and well-being. As it stands, *E. angustifolium* is already used in several cosmetic raw materials with different mechanisms of action, as discussed in Section 6.

As a hardy plant, *E. angustifolium* does not compete with food crops for cultivated land; their potential for development into more refined cosmetic ingredients remains largely untapped. Further investigation on the impact on biodiversity and the local ecosystems should be conducted before harvesting to ensure sustainable sourcing.

Future research avenues may explore novel delivery systems, investigate long-term efficacy, and elucidate the mechanical intricacies of *E. angustifolium*'s anti-inflammatory actions for optimised skincare formulations.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/cosmetics11050156/s1. Table S1: All chemical components found in *E. angustifolium*.

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