Some Plant Species Used in Cosmetic Preparations

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Some Plant Species Used in Cosmetic Preparations

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1.INTRODUCTION

Cosmetology is a branch of science that examines and develops all preparations and substances designed to be applied to various parts of the body, such as the epidermis, nails, lips, hair, body hair, external genital organs, oral mucosa, and teeth. The main purpose of these substances is to clean, alter the appearance, add fragrance, preserve or correct body odors, and maintain these parts in good condition. For centuries, both men and women have sought to beautify themselves, appear youthful, impress others, prevent the appearance of unwanted marks such as scars, acne, and wrinkles on their faces, protect their skin from environmental factors such as the sun, cold, and wind, remove unwanted body hair, prevent hair loss,

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or change their hair color by producing various products such as dyes, lotions, ointments, and perfumes (Çomoğlu, 2012).

Today, cosmetic products are prepared within various delivery systems such as nanoparticles, microcapsules, and liposomes. In addition to these delivery systems, many substances are incorporated into cosmetics to enhance their beneficial effects on the skin's structure and function. These substances may include those that increase blood circulation, nourish the skin, accelerate cell renewal, and protect the skin from the harmful effects of the sun. In order for these substances to be effective, they must be well-absorbed in the epidermis or dermis layers of the skin. Modern cosmetics today do not conform to the classic definition of cosmetics and have given rise to a new group known as active cosmetics or cosmeceuticals, which lies between cosmetics and pharmaceuticals. These products, which exhibit drug-like effects, are referred to as active cosmetics, cosmeceuticals, dermopharmaceuticals, or dermocosmetics. Cosmeceuticals do not contain substances with distinct pharmaceutical activity or ingredients that require medical supervision. They serve as a bridge between cosmetics and pharmaceuticals (Koluman & Süzgeç-Selçuk, 2016).

Throughout history, humans have used plants for various purposes. They have utilized plants for basic needs such as treating illnesses, nutrition, shelter, heating, and defense, and continue to do so today. In the past, people discovered these uses through instinctive trial-and-error methods, but today, these processes are carried out in a more conscious and scientific manner (Göktaş & Gıdık, 2019).

Recently, plant-based products have gained prominence in cosmetic preparations. Due to the harmful effects of the chemical substances found in many cosmetic products, the use of plant-based ingredients has become a popular alternative. As the side effects of these chemicals became more widely known, the use of plants in cosmetic formulations increased. The cosmetic industry, responding to this growing demand, is continuously introducing new plant-based cosmetic preparations to the market. Plant-based cosmetic products are much easier to break down than their chemical counterparts and generally cause lower toxicity. In addition to these properties, plants are often used in cosmetic formulations due to their numerous beneficial effects, including antioxidant, astringent, antimicrobial, sun-protective, anti-aging, and moisturizing properties (Üstündağ-Okur & al., 2020).

The aim of this study is to compile research on certain plants used in cosmetic preparations. The study will focus on plant species that have frequently been included in the formulations of cosmetic products in recent years.

2. GENERAL INFORMATION

2.1. History of Cosmetics

The term "cosmetics," believed to date back to the 1400s BC, is derived from the Greek word "kosmetikos," meaning "skilled in adornment" (Sarı, 2021).

The history of cosmetics is as old as human history, and throughout the ages, cosmetics have played various and significant roles in people's daily lives. The history of cosmetics and skincare products is closely related to technological developments in different fields. Historically, the rise of more advanced societies led to an increasing demand for cosmetics, and over the centuries, cosmetologists, barbers, and perfumers have embraced and developed cosmetic practices. Moreover, cosmetics discovered through archaeological excavations have revealed many findings related to ancient civilizations (Azak, Sungur, & al., 2018).

Archaeological studies conducted in Ancient Egypt have revealed facial paints and ointment containers, some of which had retained their pleasant fragrances even when discovered, among the items buried with the dead. These products were mostly prepared by priests using seeds, oils, and fragrant plants. The data obtained through these archaeological studies prove that cosmetic products were widely used as early as 4000 BC (Yıldız, 2021).

When examining archaeological remains of the Egyptians, it was found that they used various fragrances and oils, took plant and milk baths, applied various ointments to their faces, and used pleasantly scented bowls to mix these ointments. They mixed charcoal and sulfur to color their eyes and eyebrows. It is known that

Queen Cleopatra exfoliated with sand, used fragrant oils to massage her body, and took milk baths with cosmetic products (Gök, 2022).

The Egyptians' knowledge in the field of cosmetics spread to the Persians, Babylonians, Assyrians, Hebrews, and Greeks. Women in Mesopotamia applied kohl to their eyes and used powder made from dried henna leaves to dye their hair, palms, fingers, nails, and soles of their feet. It is known that various plants such as lilies and roses were cultivated in the Hanging Gardens of Babylon for the production of perfumes (Çomoğlu, 2012).

The Greek perception of cosmetics was influenced by Egyptian culture. In Greek culture, the primary purpose of makeup was to conceal physical imperfections and enhance attractiveness. While it is known that women in Ancient Greece dyed their hair in various colors such as red, black, and blonde, it is also evident that women who wore makeup were not viewed favorably during this period (Yıldız, 2021).

There is limited evidence suggesting that cosmetic products were used in Ancient China as early as 3000 BC. During this time, the Chinese are known to have used pleasant fragrances such as incense and perfume, and they painted their nails in ways that signified their social class (Chaudhri & Jain, 2009).

In Roman culture, the ideal perception of beauty for women included red lips, a pale face, and dark eyelashes and eyebrows. A pale complexion symbolized the upper class, indicating that women did not work outside in the sun. Women in Ancient Rome used face powders to whiten their skin. The Romans used pumice stone to clean their teeth, depilatories to remove body hair, and applied kohl

to their eyes. Similar practices of beautification and hygiene were observed in other civilizations within the Roman Empire. With the fall of the Roman Empire, there was a significant decline in the use of cosmetics in Europe. This was largely due to the church's opposition to perfume and bathing. Meanwhile, in Arab countries, the use of perfume became widespread, as they had long been using oils, aromatic resins, and spices. In Anatolia, people were known to apply kohl to their eyes, use henna, and wear pleasant fragrances. During the Crusades, cosmetics regained popularity in Europe (Akçay, 2019).

With the Renaissance, significant advancements were observed in the cosmetics industry in Europe. During this period, greater emphasis was placed on bathing, hair, and eyes. Louis XIV introduced laws that standardized beauty ideals for women, resulting in a uniform image of women with small, painted lips, colored eyelashes, shaved eyebrows and hair, neck-revealing dresses, and blonde curly hair. In the 17th century, spotted and powdered skin became popular, and wigs were a prominent fashion trend of the era. By the 18th century, scented handkerchiefs and fans had become essential accessories for women. However, excessive use of powder led to indistinguishable rosy cheeks, making it hard to differentiate between healthy and unhealthy individuals, with tuberculosis leaving a notable mark on the period. The fashion for pale skin and heavy use of face powders blocked adequate sun exposure, significantly contributing to the rise in diseases. After 1945, eyes were accentuated with eyeshadow, eyebrows were groomed, hair was shortened, and red lips became a focal point of beauty. Countries like Germany, France, the United States, England, and Italy

established cosmetic companies and their branches to produce cosmetic products. The number of such establishments quickly increased (Yıldız, 2021).

After the 1990s, products such as peptides, anti-aging and scientifically-based dermocosmetic products, herbal active ingredient-based products, organic hair dyes free of ammonia, shampoos without SLS (sodium lauryl sulfate) and SLES (sodium laureth sulfate), natural hair growth reducers, environmentally friendly colored cosmetics, and cosmetics specially designed for children and men captured significant market shares. In the 20th century, makeup became one of the hallmarks of fashion in America and Europe. During this period, when performing arts like musicals, ballet, and theater were particularly popular, prominent leading actors played a key role in fueling this trend. However, the main driving force behind the rapid spread of cosmetics was the film industry (Çomoğlu, 2012).

Today, the use of natural and organic cosmetics is increasingly becoming a popular alternative to synthetic cosmetics containing chemicals. The primary reason for the growing interest in natural or organic cosmetic products is the new generation's awareness of environmental and social responsibility, leading to the emergence of a consumer base that associates health with naturalness. Additionally, modern consumers are bombarded with information through social media channels like internet advertisements and television programs, encouraging them to create their own cosmetic products using natural ingredients. The use of natural and organic products not only conveys messages of hygiene

and cleanliness to consumers but also helps prevent the harmful side effects of synthetic chemicals (İnal, 2023).

Cosmetics, which are consumed more than medicines today, have become indispensable in modern life. Cosmetics are no longer made with simple formulas and components like in the past. Companies with a significant market share in the cosmetics industry are making substantial investments to conduct research and development activities. The interest in cosmetic products is increasing steadily among both women and men. This has led to the cosmetics industry becoming a massive sector in today's economy (Yıldız, 2021).

2.2. Cosmetics and Their Classification

Cosmetics are defined as preparations or substances designed to be applied to various external parts of the human body, such as hair, eyelashes, lips, epidermis, external genital organs, and the mucous membranes of the teeth and mouth. The primary or sole purpose of these products is to clean, scent, alter the appearance, correct body odors, protect, or maintain these parts in good condition (Koluman & Süzgeç-Selçuk, 2016).

Cosmetics are classified based on two main parameters. The first is the application site, and the second is the primary area of effect. According to the application site, cosmetics are categorized into products applied to the hair, skin, mouth, and teeth, as well as powders and pigmented preparations. Based on the primary area of effect, cosmetics are divided into subgroups such as keratin-based substances, sebatrope, direct dermatropics, indirect dermatropics, and film-forming substances (Sarı, 2021).

Table 1. Classification of Cosmetics (Sarı, 2021)

1 – Cosmetics According to Application Site				
Cosmetics Applied to the Skin	Cosmetics Applied to the Hair	Cosmetics Applied to the Teeth and Mouth	Powders and Pigmented Cosmetics	Other Cosmetics
Cleansing creams	Hair nourishing cosmetics	Mouthwash	Eye cosmetics	Depilatories
Cleansing lotions	Hair straightening cosmetics	Dental cleaning preparations	Lip colors	Body powders
Softening lotions	Hair styling cosmetics	Toothpaste	Blush	Bath products
Softening creams	Cosmetics that maintain hair shape		Nail polishes	Foot care products
Basic creams	Hair lightening cosmetics		Face powders	Baby products
Hand creams and lotions	Hair shining cosmetics			
Face masks	Hair sprays (hair lacquers)			
Sterate creams	Shampoos			
Hormone creams	Hair dyes			
Antiperspirant preparations				
Deodorant preparations				

Shaving preparations				
Skin lightening and blemish-removing preparations				
Sun protection and tanning preparations				
Daily creams				
2 – Cosmetics According to Primary Area of Effect				
Keratin-Based Substances				
Film-Forming Substances				
Direct Dermatropics				
Indirect Dermatropics				
Sebatrope Substances				

2.3. Use of Plants in Cosmetics

Historically, plants have been the main source of cosmetic ingredients until methods for synthesizing substances with similar properties were discovered. Mineral, animal, and plant-based extracts have been part of cosmetic formulations since ancient times. In recent years, due to the negative perception of animal-derived extracts, the use of plant extracts in cosmetic formulations has increased significantly (Erdönmez & Yüce, 2023).

People want to look beautiful by using healthy, safe, and natural products. For this reason, cosmetics with natural ingredients, which are believed to be non-toxic, safe, and effective, have come to the forefront (Dwivedi & Jhade, 2021).

2.3.1. Skin Care

The skin is a living organ consisting of the dermis, epidermis, and subcutaneous layers. The skin creates a crucial barrier against the external environment, preventing harmful microbes and chemicals from entering, helping to regulate temperature and fluid balance, and providing protection against sunlight (Aburjai & Natsheh, 2003).

The epidermis, the outermost protective layer, is of ectodermal origin and serves as a point of contact between the environment and the body. The outermost layer of the epidermis, the stratum corneum, is made up of dead cells. Beneath the stratum corneum, there are melanocytes, Langerhans cells, and living keratinocytes. Another important group of cells in the epidermis, melanocytes, produce melanin, which is responsible for the pigmentation of the skin. The dermis, which is of mesodermal origin, is the layer that gives the skin its elasticity and strength. The dermis contains the vascular system, hair follicles, lymphatic system, and neuronal systems. Composed of collagen fibers and primarily extracellular matrix proteins, the dermis also contains numerous fibroblasts and immune cells. The blood vessels in the dermis help regulate body temperature, while the subcutaneous layer aids in protecting the skin from both cold and heat (Pérez-Sánchez & al., 2018).

Natural remedies have been used for centuries to treat skin disorders and inflammation, including conditions such as atopic dermatitis, alopecia areata, and psoriasis (psoriatic disease). Human skin can exhibit a range of symptoms, from erythema (redness) and scaling to simple dryness. These indications are sometimes accompanied by itching and inflammation. To restore the balance of dermal homeostasis of lipids altered by dermatoses and aging, and to protect the skin from harmful agents, both exogenous and endogenous, cosmetic formulations containing completely natural active ingredients have been developed (Aburjai & Natsheh, 2003).

2.3.1.1. Treatment of Dry Skin

Dry skin is associated with a decrease and disruption in the formation of epidermal proteins and lipids. Therefore, the application of a protective film is beneficial for reducing transdermal water loss. Natural plant oils are used for their beneficial effects, and the use of petroleum jelly and mineral oils is also common [Casetti et al., 2011; Aburjai & Natsheh, 2003].

Emollients used to correct mild irritant contact dermatitis, dryness, flaking, and wrinkles moisturize and soften the skin. Occlusives, which help increase the moisture content of the stratum corneum, form a layer of oil on the skin surface that reduces water loss. In cases where necessary, lecithin-derived phospholipids, due to their hygroscopic properties and ability to retain water by increasing hydration levels, serve as excellent moisturizers (Ashawat et al., 2009).

Seed oils and triglycerides, which are rich in fatty acids, help maintain skin hydration by reducing transdermal water loss and provide emollient effects in skin preparations (Aburjai & Natsheh, 2003).

2.3.1.2. Treatment of Hyperpigmentation

Clinically, hyperpigmentation manifests as a brown or blue discoloration of the skin due to the accumulation of melanin in the epidermis or dermis, respectively (Fisk & al., 2014).

UV exposure and factors such as oxidative stress contribute to the formation of skin spots by elevating inflammatory mediators that trigger melanogenesis (Kanlayavattanakul & Lourith, 2018). Several plants, including *Betula alba* (bark), *Helianthus annuus* (sunflower oil), *Aloe vera* (leaf gel), *Lithospermum erythrorhizon* (root extract), *Hypericum perforatum* (St. John's Wort extract), and *Simarouba amara* (bitterwood extract), have been proven to reduce transdermal water loss and increase skin hydration in an in vivo environment when applied topically (Casetti & al., 2011).

Arbutin functions similarly to kojic acid and azelaic acid, and is used in skincare for its anti-spot and skin-lightening properties. It is derived from the mature leaves of various plants such as mulberry, bearberry, wintergreen, and pear. Arbutin inhibits tyrosine oxidation, preventing the excessive accumulation of melanin in the skin and reducing color unevenness (Gökce &al., 2016).

The compound glabridin, isolated from the extract of *Glycyrrhiza glabra* (licorice root), a perennial plant from the

Fabaceae family, is one of its active ingredients. Due to its properties such as skin whitening, anti-inflammatory, and antioxidant effects, it is widely used in the formulation of cosmetic products. Hesperidin, a bioflavonoid (vitamin P), is found in the peels and membranes of citrus fruits. Hesperidin is used as a skin brightening agent because it improves skin tone and is effective against yellowing of the skin (Goswami & Sharma, 2020).

2.3.1.3. Anti-Aging Treatment

Skin aging can occur as intrinsic aging and extrinsic aging. Intrinsic aging is related to genetic structure and develops over time. One of the main mechanisms of cellular aging is telomere shortening. Extrinsic aging, on the other hand, results from external factors and is preventable. It has been reported that 80% of skin aging is caused by sun exposure (Şen, 2016).

The use of plant extracts as active ingredients in cosmetic formulations is quite common. The leaf extract of *Myrtus communis* (Myrtle tree), which has anti-aging effects on the skin, is stated to support the skin by acting as a protector and preventing the loss of tissue elasticity and hardening. It is also mentioned that the sirtuins in rice extract help protect cells from UV damage and oxidative stress, thereby increasing the lifespan of cells (Alğın-Yapar & Tuncay-Tanrıverdi, 2016).

The active compound madecassoside, derived from the *Centella asiatica* plant, has been shown in clinical tests to reduce wrinkles caused by skin aging by increasing collagen synthesis and alleviating inflammatory stimuli. It is used in anti-aging products, often in combination with vitamin C, due to its ability to reduce the

appearance of deep wrinkles and skin stiffness. Galactoarabinan, a high-functioning natural polysaccharide extracted from *Larix sp.* (Larch tree), is used in cosmetics as a film-forming agent. It is applied topically with alpha-hydroxy acids. Enriched with SPF, it helps increase skin firmness and prevents flakiness, which can lead to the formation of fine lines (Alğın-Yapar & Tuncay-Tanrıverdi, 2016).

2.3.1.4. Antioxidant Treatment

Antioxidants, which protect cell membranes, neutralize free radicals and toxic oxygen molecules, preventing oxidative stress in body tissues. Molecules such as alpha-lipoic acid, ubiquinol (coenzyme Q-10), vitamins A, C, E, and B, polyphenols, idebenone, and kinetin are among the most preferred substances in products for antioxidant purposes (Şen, 2016).

Antioxidant compounds obtained from plants can generally be classified into three groups: carotenoids, flavonoids, and polyphenols. Carotenoids, which are structurally similar to vitamin A, include various retinoids such as retinoic acid. Polyphenols contain different molecules like oleuropein, rosmarinic acid, and hypericin. Flavonoids have both UV protection and antioxidant properties (Kole & al., 2005).

Flavonoids such as apigenin, catechin, epicatechin, alfaglycosylrutin, and silymarin are polyphenolic compounds found in fruits and plants. These compounds exhibit antioxidant capacity due to their free phenolic groups(Ashawat & al., 2009).

The green tea, which has antioxidant properties and is derived from the *Camellia sinensis* plant, contains epigallocatechin,

epicatechin, and epicatechin-3-gallate. The coffee extract obtained from the *Coffea arabica* fruit, the pomegranate extract derived from the *Punica granatum* plant, which contains phenolic compounds, and the grape seed extract from *Vitis vinifera*, which contains proanthocyanidins from the flavonoid group, all have very strong antioxidant properties (Şen, 2016).

2.3.1.5. Acne Treatment

Acne is a dermatological condition that usually occurs during adolescence and requires prolonged treatment, often leading to inflammation and scarring (Conforti & al., 2021).

The essential oil derived from *Melaleuca alternifolia* (Myrtaceae) through steam distillation is rich in monoterpenes and lipophilic, making it an effective volatile oil. Its use in acne treatment is attributed to its anti-inflammatory and antibacterial properties. Various plants, such as *Aloe vera*, resveratrol, *Camellia sinensis* (green tea), *Hamamelis virginiana* (witch hazel), *Artocarpus incisus* (breadfruit), *Alpinia officinarum* (galangal), *Impatiens balsamina* (balsam), and *Sophora flavescens* (sophora), are also reported to be used in acne treatment due to their antiandrogenic, anti-inflammatory, and antibacterial effects (Topaloğlu-Demir, 2020).

Vitex agnus-castus (chaste tree), which is thought to exert its effect by altering the secretion of LH (luteinizing hormone) and FSH (follicle-stimulating hormone), is recommended for use in patients with acne that worsens during the premenstrual period (Durusoy & Ulusal, 2007).

2.3.1.6. Anti-Irritant and Erythema (Redness) Counteracting

Sensitive skin is a syndrome characterized by the occurrence of unpleasant sensations such as burning, pain, tingling, itching, and stinging. Erythema (redness), edema, and flaking are clinical signs commonly observed in sensitive skin (Zang & al., 2020).

In addition to helping maintain the structure and tone of the skin, plant extracts also serve as anti-irritants, preventing skin irritation. Active components derived from chamomile are used to soothe irritated skin (Ashawat & al., 2009).

2.3.1.7. Dermatitis and Psoriasis

Atopic dermatitis or eczema is a dermatological condition characterized by itching, swelling, redness, and peeling. The biologically active part of turmeric (Curcuma longa) is obtained through the processing of its rhizomes. The main component responsible for most of the biological activity is curcumin. Due to its ability to inhibit phosphorylase kinase activity, it is used in the prevention, treatment, and control of many skin diseases such as psoriasis, eczema, acne, and wounds (Aburjai & Natsheh, 2003).

Capsaicin, found in red chili pepper, is one of the hottest substances known and is effective in the treatment of psoriasis. It exerts its effect by preventing the accumulation of substance P, which is involved in itching and the transmission of pain in peripheral sensory nerve fibers. Borage oil, obtained from the *Borago officinalis* plant, has been reported to be effective in the treatment of infantile seborrheic dermatitis. In Chinese herbal treatments, the most commonly used plants for patients with

psoriasis are **Radix angelicae dahuricae** and *Camptotheca acuminata* (Durusoy & Ulusal, 2007).

2.3.1.8. Antimicrobial and Anti-inflammatory Effects

Antimicrobial substances are used to eliminate infections on the nails, skin, and hair and to extend the shelf life of cosmetic preparations. Natural phenolic compounds and various plant extracts such as *Cinnamomum zeylanicum*, *Cassia tora*, *Curcuma longa*, *Centella asiatica*, and *Psorolea corlifolia*, which inhibit microbial growth or possess bactericidal properties, provide a good alternative to synthetic preservatives. Preventing inflammation is an effective approach to slow down the signs of aging. Various species such as *Crataeva nurvala* (Varuna), *Glycyrrhiza glabra* (Licorice root), and *Calendula officinale* (Marigold) are widely used plants with strong anti-inflammatory properties. In cosmetics, some plants are commonly included in sunscreen formulations due to their anti-inflammatory properties. These herbal cosmetic ingredients influence the fundamental mechanisms of inflammation that occur in the skin when exposed to sunlight (Ashawat et al., 2009).

2.3.2. Hair Care

Hair, which reflects people's personalities and constitutes an important part of the body's appearance, is one of the physical features that distinguishes individuals from others, as it can be shaped, lengthened, and colored (Karabacak & Doğan, 2014).

Various cosmetics such as dyes, shampoos, bleaches, hair conditioners, styling, and setting products have been frequently used

by both women and men since ancient times (Üstündağ-Okur et al., 2020). Bitkiler, saç boyası ve saçın büyümesini uyarıcı etkisinin yanı sıra kepek gibi çeşitli saç ve saç derisi sorunları için de kullanılabilmektedir (Aburjai and Natsheh, 2003).

Eclipta alba, also known as false daisy, is an herb used in Ayurvedic medicine for hair growth. It is commonly found in hair lotions due to its ability to promote hair growth and its effect in darkening hair. This plant is also referred to as "Kesharaja," meaning "king of plants that revitalize the hair." The leaf juice of Amaranth (Cock's comb) flower, used in hair care and treatments, is applied to the hair to prevent premature graying and help restore hair color. In addition to making hair smooth and soft, it also has a stimulating effect on hair growth (Karabacak & Doğan, 2014).

The plants Actinidia chinensis, Acacia senegal, Betula alba, and Citrus medica are included in the formulation of shampoos. On the other hand, plants such as Balanites aegyptiaca, Cananga odorata, Cyperus esculentus, and Magnolia grandiflora are commonly used in hair masks (Koluman & Süzgeç-Selçuk, 2016).

2.3.2.1. Hair Loss Prevention and Hair Growth Stimulation (Inductive) Effect

Recently, many plant extracts have been patented due to their various effects such as preventing hair loss, stimulating hair growth, and strengthening hair. Although the mechanisms are not yet fully clear, it is suggested that these effects arise from the stimulation of both the scalp and hair follicle metabolism, either due to increased blood flow or the anti-testosterone effect, which accelerates the nourishment of the hair follicle. Proanthocyanidins obtained from

grape seeds have been discovered to facilitate cell proliferation in hair follicles in vivo. Studies have shown that *Ginkgo biloba* leaf extract, due to its effects on both the proliferation and apoptosis of cells in hair follicles, helps stimulate hair regrowth and can be used as a hair tonic (Aburjai & Natsheh, 2003).

Thuja orientalis, known as Eastern arborvitae, is one of the plants traditionally used in Asia for addressing hair loss problems. Studies support that *Thuja orientalis* can be used as a hair growth agent due to its stimulatory effect on hair follicles in the resting phase, promoting the transition to the anagen phase. *Angelica sinensis* (Dong Quai, Chinese angelica), which contains phytoestrogens that prevent the formation of DHT (dihydrotestosterone), is used in Traditional Chinese Medicine to promote hair regrowth and prevent hair loss (Karabacak & Doğan, 2014).

2.3.2.2. Dandruff Treatment

Dandruff, which has limited knowledge about its biochemical changes, is an important problem that appears on the scalp and causes disease symptoms. It is also associated with a decrease in fatty acids, cholesterol, and ceramides, as well as a sudden drop in free lipid levels. Dandruff on the scalp, along with problems such as hair loss and flaking, indicates disturbances in the peeling process of the skin. As a result of the disruption of the epidermal water barrier on the scalp, patients become more vulnerable to the harmful effects of environmental pollutants, microbial toxins, and fungi. *Salvia officinalis* (sage) has been used since ancient times to prevent oily hair, dandruff, and hair loss. It has

been reported that *Thymus vulgaris* (thyme), when massaged into the scalp, prevents both hair loss and dandruff formation. *Allium sativum* (garlic), used in Traditional Medicine, is a plant known for its antifungal, antiseptic, and antibacterial properties, and is also used in dandruff treatment (Aburjai & Natsheh, 2003).

2.3.2.3. Lice Repellent Effect

Pediculosis capitis, also known as head lice infestation, is a health problem caused by *Pediculus humanus capitis* and is very common in society. It is frequently observed in childhood (ages 5-13) and is a parasitic infection. Girls are twice as likely to contract *P. humanus capitis* compared to boys (Özsürekçi & Kaya, 2018). Due to their biological degradability and safety, plant-based products are used in the control of head lice (Soonwera, 2014).The oil derived from Anise seed, which has antiparasitic and antibacterial properties, is used in the treatment of head lice (Durusoy & Ulusal, 2007). Lavender essential oil, in addition to being used for dermatitis, ringworm, and psoriasis, is also used in lice treatment. In a study, the effect of lavender oil mixed with tea tree oil on head lice was investigated in 123 children. After one day, the children using the mixture showed a 97.6% reduction in lice, while those using a product containing piperonyl butoxide and pyrethrin showed only a 25% reduction (Duman-Özler, 2017).

2.3.2.4. Hair Dyes

For patients sensitive to oxidative dyes, plant-based dyes are recommended due to their lower likelihood of causing allergies. However, natural dyes have not replaced commonly used hair dyes due to various reasons, such as instability in solutions, color fading,

pH-induced color changes, fading, and oxidation. Another important reason for the limited advancement of natural dyes is that a single natural dye may not always provide the correct color. However, different colors can be obtained by mixing various plants. Since ancient times, henna leaves (Lawsonia inermis) have been used for hair dyeing, and the lawson molecule, a red pigment powder, has also been used for various purposes, such as decorating and dyeing hands and feet (Aburjai & Natsheh, 2003).

Plants such as *Coffea arabica* L. (Rubiaceae), *Curcuma longa* L. (Zingiberaceae), *Lawsonia inermis* L. (Lythraceae), *Matricaria chamomilla* L. (Asteraceae), and *Ricinus communis* L. (Euphorbiaceae) are also included in the ingredients of hair dyes (Erarslan & Ecevit-Genç, 2018).

2.3.3. Eye Area Care

Looking beautiful and attractive is a natural desire for people. The eyes have a significant impact on the perception of a person's health and beauty, and they are central to facial expressions, which convey emotions (Brinda & Tanuja, 2015).

Zea mays, *Zingiber officinale*, *Theobroma cacao*, *Salix alba*, *Ricinus communis*, *Mangifera indica*, *Oryza sativa*, and *Malus domestica* are some of the plants included in the formulations of eye area creams (Koluman & Süzgeç-Selçuk, 2016).

2.3.3.1. Periorbital Hyperchromia (Dark Circles) Treatment

Periorbital hyperchromia (dark circles) is an aesthetic concern related to the face, characterized by discoloration in the lower and upper eyelids. The darkening around the eyes is due to post-inflammatory hemodynamic congestion and dermal melanization. The cause of this color change in the skin is the prominence of melanin and hemoglobin as chromophores and their local accumulation. A study conducted on volunteers has proven that the plants *Pfaffia paniculata*, *Lilium candidum* L., and *Ptychopetalum olacoides* B. are effective against dark circles (Eberlin & al., 2009).

2.3.3.2. Effects Against Under-Eye Puffiness and Bags

Under-eye bags and puffiness are common cosmetic issues. Therefore, there is a need for effective cosmetic products that can smoothly repair under-eye puffiness and slow down the formation of bags. One of the key ingredients in under-eye moisturizing creams is aosain extract (algae extract), which not only treats the swelling under the eyes but also helps tighten wrinkles and protects the skin from potential damage [Poy & Tehrani, 2017; Ashawat & al., 2009].

2.3.4. Body Care

Interest in plant-based products in body care products is increasing day by day among consumers. The plant components frequently used in herbal cosmetic preparations are oils, vitamins, polyphenols, and polysaccharides. Plant extracts with various activities such as antiseptic, antioxidant, and antimicrobial are often included in the content of cosmetic preparations used for body care, allowing people to maintain and improve their beauty. Due to many

properties of plant extracts such as moisturizing, cleansing, low toxicity, pleasant scent, and biodegradability, plant-based cosmetic preparations have gained popularity among the public (Erdönmez & Yüce, 2023).

2.3.4.1. Cellulite Treatment

Cellulite is a cosmetic disorder and physiological condition caused by the accumulation of excess fat within the fibrous network structure of adipose tissue. A large portion of women experience cellulite. The development of cellulite is primarily due to the weakening of connective tissue and the disruption of microcirculation. The appearance of orange peel texture is among the symptoms of cellulite. There are various techniques and inventions to improve the appearance of cellulite and stimulate microcirculation. Additionally, a large number of herbal extracts are added to the content of topical cosmetic preparations for cellulite treatment (Tırnaksız, 2006).

Sweet clover (*Melilotus officinalis* L.) and Japanese milkwort (*Polygala tenuifolia*) plants have microcirculation-enhancing and lipolytic effects, Cola nut (*Cola nitida*), Cocoa (*Theobroma cacao*), and Coffee (*Coffea arabica*) plants suppress lipogenesis and increase lipolysis, while Soy (*Glycine max*), Butcher's broom (*Ruscus aculeatus*), Ginkgo (*Gingko biloba*), and Hibiscus (*Hibiscus abelmoschus*) plants are used in cellulite treatment due to their peroxisome proliferator-activated receptor (PPAR) agonist properties (Alğın-Yapar, 2017).

2.3.4.2. Treatment of Striae Distensae (Stretch Marks)

Although striae distensae represent dermal lesions with multifactorial pathophysiology, their mechanisms of formation have not been fully explained. Various factors, such as the systemic or topical use of corticosteroids, pregnancy, weight changes, puberty, and conditions like Cushing's and Marfan syndromes, are associated with the presence of striae. Striae gravidarum, a form of striae distensae, occurs in approximately 90% of pregnant women. Several factors play a role in the pathogenesis of striae gravidarum, including mechanical stress on the skin, pre-existing dermal lesions, and hormonal changes. A study reported that a cream-based formulation containing *Croton lechleri* resin extract and *Punica granatum* seed oil was beneficial in preventing and improving skin changes caused by striae (Bogdan & al., 2017).

Natural oil derived from cocoa beans has been used in many cultures and is known for its excellent moisturizing properties. Cocoa butter is a plant rich in polyphenols such as catechins. Studies have proven that the use of cocoa butter reduces stretch marks in women with striae gravidarum. In another clinical study, a cream containing *Centella asiatica* was found to be effective, resulting in a 60% reduction in striae gravidarum [Mansoor & al., 2023; Buchanan & al., 2010].

2.3.5. Oral and Dental Care

Oral and dental health is a vital part of overall well-being. Oral diseases are a common health issue worldwide. While numerous agents with antibacterial and antimicrobial properties have been researched to protect against oral pathogens, their side

effects have increased the use of plants in oral and dental care. *Salvadora persica*, commonly known as the "arak tree," is used in oral hygiene through brushes (miswak) made from its branches and roots. Studies have shown that tea tree oil disrupts bacterial membrane permeability, allowing ions to enter the bacteria and consequently impairing their metabolic activity. Due to its antifungal and antibacterial properties, tea tree oil is widely used in many toothpaste formulations (Ercan & Gülal, 2015).

People often turn to teeth whitening methods to achieve a brighter smile. While some opt for professional treatments from dentists, others use over-the-counter products. Tooth sensitivity and mild gum irritation are common issues associated with teeth whitening. Despite these side effects, teeth whitening remains popular. Whitening agents containing carbamide peroxide and hydrogen peroxide, when used in high concentrations, can cause a range of adverse effects on teeth. As an alternative to these compounds, natural ingredients such as *Aloe vera*, **Salvadora persica cortex**, and **Tea tree essential oil** offer safer and gentler options for teeth whitening [Gami-Benahmed & al., 2022; Mansoor & al., 2023].

3. PLANT SPECIES USED IN COSMETIC PREPARATIONS

3.1. *Achillea millefolium* L.

Achillea millefolium L. is a perennial plant belonging to the genus *Achillea* in the family Asteraceae, which is the largest family of vascular plants. Commonly known as "yarrow," "thousand-leaf herb," "milfoil," "candle flower," "carpenter's herb," "ayvadana," "woundwort," "thousand-leaf," and "yarrow claw" among others, it is widely recognized in traditional uses [Ali & al., 2017; http 1].

Figure 3.1. Flower appearance of Achillea millefolium L. (http 2)

3.1.1. Botanical Characteristics of *Achillea millefolium* L.

Achillea millefolium L. is a stoloniferous or rhizomatous plant, typically growing to a height of 10–100 cm. Its stems are usually erect, single or branched, and densely covered with woolly-coarse hairs. The leaves can be sessile or petiolate, lance-shaped or rectangular. Arranged spirally along the stem, the leaves measure 5–20 cm in length and vary in hairiness. The ray florets are white and number between 4–6, while the disc florets can be pink or white. The phyllaries, numbering 20–30 and arranged in 2–3 rows, are lance-

shaped and ovate. The plant is drought-resistant and prefers permeable soils and sunny locations. It emits a very strong and pleasant fragrance (http 1).

A B

Figure 3.2. Images of Achillea millefolium L.: A. Flower appearance, B. Leaf and stem appearance (http 3)

3.1.2. Parts of *Achillea millefolium* L. Used

The parts of *Achillea millefolium* L. (yarrow) that are used include dried flower clusters and aerial parts of the plant (Erdönmez & Yüce, 2023).

3.1.3. Distribution Areas of *Achillea millefolium* L.

Achillea millefolium L. is found in various regions of Turkey, including the Hakkari, Istranca, Upper Murat-Van, Çatalca-Kocaeli, Southern Marmara, Erzurum-Kars, Konya, Western, Eastern, and Central Black Sea, Central and Upper Kızılırmak, and Inner Western Anatolia regions. Worldwide, it is widespread in Europe, Western Asia, and North America [http 3; Ali & al., 2017].

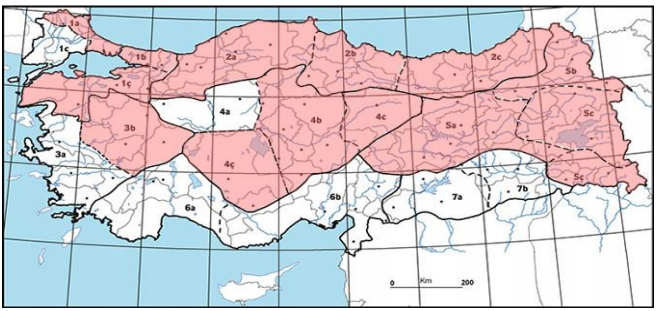

Figure 3.3. Distribution areas of Achillea millefolium L. in Turkey (http 4)

3.1.4. Chemical Composition of *Achillea millefolium* L.

Achillea millefolium L. contains a variety of components, including phenols, flavonoids, sesquiterpenoids, monoterpene hydrocarbons, oxygenated monoterpenes, sesquiterpene hydrocarbons, oxygenated sesquiterpenes, essential oils, and proazulenes (Ali & al., 2017).

3.1.5. Use of *Achillea millefolium* L. in Cosmetic Preparations

It is commonly used in hair care products due to its ability to tighten connective tissue and prevent hair loss. When applied topically as a skin lotion for wounds and acne, it is known to improve the appearance of the skin. It has also been reported to be used in cosmetic preparations for oily hair, due to its cleansing properties and stimulating effects on healing. It can be found in the formulations of creams, tonics, body wash products, hair conditioners, and hair masks [Erdönmez & Yüce, 2023; Erarslan & Ecevit-Genç, 2018; Üstündağ-Okur *et* al., 2020; Koluman & Süzgeç-Selçuk, 2016].

3.1.6. Side Effects and Contraindications of *Achillea millefolium* L.

Due to its main component, sesquiterpene lactones, *Achillea millefolium* L. can cause contact dermatitis. Its use is contraindicated during pregnancy (Erdönmez & Yüce, 2023).

3.2. *Calendula officinalis* L.

Calendula officinalis L. is an annual plant belonging to the Asteraceae (Compositae) family, known for its yellow-orange daisy-like flowers. It is commonly referred to by names such as "marigold," "daffodil," "golden flower," "pot marigold," and "garden marigold" [Khalid & Teixeira da Silva, 2012; Üstündağ-Okur et al., 2020].

Figure 3.4. Field view of Calendula officinalis L. (http 5)

3.2.1. Botanical Characteristics of *Calendula officinalis* L.

Calendula officinalis L. is generally a plant that grows 25–80 cm tall. The stem is typically green, erect, and sparsely branched at the base. The basal leaves are 15–20 cm long, spoon-shaped or rectangular-oval, with edges that are either serrated or smooth. The

stem leaves are 5–15 cm long, rectangular, rectangular-lanceolate, or rectangular-ovate, with a width of 1–3 cm. The phyllaries are rectangular-lanceolate or lanceolate, with the outer ones being more pointed and longer than the inner ones. The tubular flowers have triangular-lanceolate lobes. The ray flowers are orange or yellow and are twice the length of the involucre. Under suitable conditions, it can remain in bloom throughout the year (http 6).

Figure 3.5. Flower view of Calendula officinalis L. (http 7)

3.2.2. Parts of *Calendula officinalis* L. Used

The used part of the *Calendula officinalis* L. plant is its flowers (Göktaş & Gıdık, 2019).

3.2.3. Distribution Areas of *Calendula officinalis* L.

Calendula officinalis L. is found in Western Asia, America, and Southern and Central Europe (Ayran & Kan, 2023).

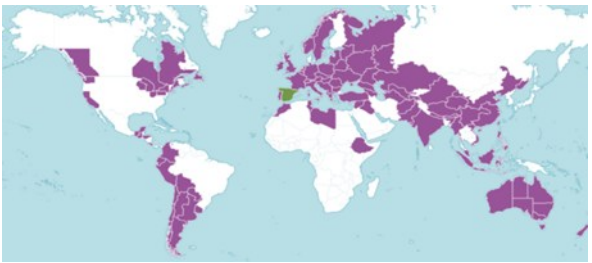

Figure 3.6. Distribution areas of Calendula officinalis L. (http 5)

3.2.4. Chemical Composition of *Calendula officinalis* L.

Calendula officinalis L. contains various components, including flavonoids, carotenoids, essential oils, lipids, terpenoids, quinones, coumarins, carbohydrates, and amino acids (Khalid & Teixeira da Silva, 2012).

3.2.5. Use of *Calendula officinalis* L. in Cosmetic Preparations

It has been reported that the extract made from its flowers, when applied topically, is effective against UV-induced skin damage. The infusion made from the flower extract, which has antiseptic and antifungal properties, is used topically on wounds and scars. The fixed oil obtained from the plant is used as a moisturizer in the formulation of creams. The flowers are also used in baby soaps and shampoos. Due to its antibacterial, anti-inflammatory, nourishing, and moisturizing properties, it is included in hair care products. *Calendula officinalis* L. is found in the formulation of many preparations, including toothpaste, baby oils, serums, gels, lotions, tonics, and cleansing milks [Erdönmez & Yüce, 2023; Erarslan & Ecevit-Genç, 2018; Üstündağ-Okur & al., 2020; Göktaş & Gıdık, 2019; Koluman & Süzgeç-Selçuk, 2016].

3.2.6. Side Effects and Contraindications of *Calendula officinalis* L.

There are no known side effects when used in appropriate therapeutic dosage forms (Erdönmez & Yüce, 2023).

3.3. *Carthamus tinctorius* L.

Carthamus tinctorius L. is an annual herbaceous plant species belonging to the *Carthamus* genus of the Asteraceae family. It is commonly known by names such as "safflower," "dyeing safflower," "asfur," "hasbir," "haspir," "kurtum," and "false saffron" (http 8).

Figure 3.7. Field view of Carthamus tinctorius L. (http 9)

3.3.1. Botanical Characteristics of *Carthamus tinctorius* L.

Carthamus tinctorius L. is an important oil plant species belonging to the Asteraceae (Compositae) family, characterized by being herbaceous and annual. The plant has red, orange, white, and yellow flowers, with white, brown, and occasionally black seeds that have dark lines on them. It forms small heads with seeds inside each branch and can grow up to 80–100 cm tall. *Carthamus tinctorius* L. is highly tolerant of both heat and cold (Kobuk & al., 2019).

Figure 3.8. Flower and leaf view of Carthamus tinctorius L. (http 10)

3.3.2. Parts of *Carthamus tinctorius* L. Used

The used parts of *Carthamus tinctorius* L. are its seeds, flowers, and fixed oil (Erdönmez & Yüce, 2023).

3.3.3. Distribution Areas of *Carthamus tinctorius* L.

The *Carthamus tinctorius* L. species is found in Turkey in Yozgat, Kayseri, Isparta, Elazığ, Siirt, and Amasya; globally, it is distributed in North America, India, Afghanistan, and the Eastern Mediterranean (http 8).

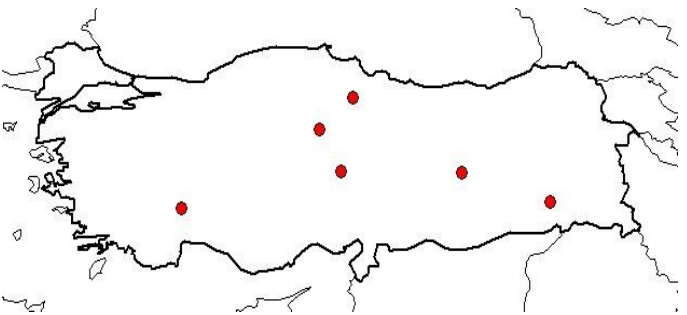

Figure 3.9. Provincial distribution of Carthamus tinctorius L. in Turkey (http 8)

3.3.4. Chemical Composition of *Carthamus tinctorius* L.

Carthamus tinctorius L. contains components such as fixed oil, flavonoids, and carotenoids. The safflower contains 30% yellow pigment and 70% red pigment. Carthamin, a water-insoluble compound, is the primary component of the red pigment. The yellow pigment, carthamin, is water-soluble. Safflower oil contains essential fatty acids (linoleic acid, linolenic acid). A deficiency in these fatty acids can lead to dry skin problems [Erdönmez & Yüce 2023; Ekin, 2005].

3.3.5. Use of *Carthamus tinctorius* L. in Cosmetic Preparations

The alcohol extract of safflower is used in hair tonics. The yellow pigment carthamin is safe for use in shampoos, perfumes, hair creams, and facial creams. Carthamin is particularly found in cosmetic preparations such as lip balms, bath soaps, and lipsticks. The linoleic acid in safflower oil helps maintain the softness of cell membranes, enhancing their vitality and elasticity. Additionally, many natural skin colorant creams have been developed using safflower oil [Kapoor, 2005; Ekin, 2005]

3.3.6. Side Effects and Contraindications of *Carthamus tinctorius* L.

The use of its flowers during pregnancy is contraindicated. When used in appropriate therapeutic doses, it does not have any known side effects (Erdönmez & Yüce, 2023).

3.4. *Centella asiatica* (L.) Urb.

Centella asiatica (L.) Urb. is an annual plant belonging to the Apiaceae family. This plant, which grows in tropical regions, is also

known by the names "Gotu kola" and "Centella" (Demirezer & al., 2007).

Figure 3.10. Field image of Centella asiatica (L.) Urb. species (http 11)

3.4.1. Botanical Characteristics of *Centella asiatica* (L.) Urb.

Centella asiatica, commonly known as Gotu kola, is an annual plant that can be found in humid areas up to 1800 meters above sea level. It is an odorless and tasteless herbaceous climber that grows in wetland areas. Reaching approximately 30-40 cm in height, *Centella asiatica* has elliptical, finely reniform, and orbicular-shaped leaves, along with cylindrical or filiform stems. The flowers, which are small and white or red in color, cluster together to form an umbellate inflorescence. The flowers can be white or light purple-pink in color. The plant has fan-shaped green leaves and hairy, cream-colored rhizomes below the ground. *Centella asiatica* also produces small, grey-brown, reticulate fruits (Demirezer & al., 2007).

A B

Figure 3.11. *Flower image (A) and root image (B) of Centella asiatica (L.) Urb. species (http 11)*

3.4.2. Used Parts of *Centella asiatica* (L.) Urb. Species

The used parts of *Centella asiatica* (L.) Urb. species are the aerial parts (Centellae asiaticae herba) (Süzgeç-Selçuk & Eyisan, 2012).

3.4.3. Distribution Areas of *Centella asiatica* (L.) Urb. Species

The *Centella asiatica* plant is found in India, Asia, Sri Lanka, Madagascar, the Western South Sea Islands, South Africa, Mexico, Colombia, the Southeastern USA, Venezuela, Eastern South America, and certain regions of China (Jamil & al., 2007).

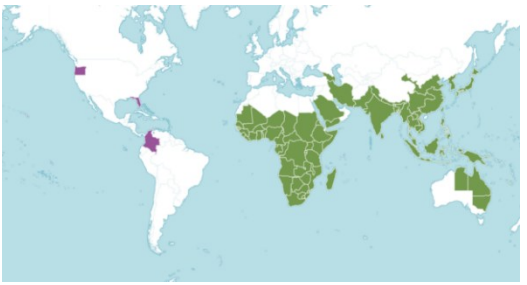

Figure 3.12. Distribution areas of Centella asiatica (L.) Urb. species (http 11)

3.4.4. Chemical Composition of *Centella asiatica* (L.) Urb. Species

The triterpenoid saponins known as "centellosides" are the most important components isolated from *Centella asiatica*, constituting 1-8% of the plant. Centellosides are primarily ursan- and oleanan-type pentacyclic triterpenoid saponins. The most important compounds based on their pharmacological activities are madecassoside, asiaticoside, madecassic acid, and asiatic acid. *Centella asiatica* also contains various triterpenic acids such as brahmic acid, terminolic acid, madasiatic acid, and terminolic acid, along with their glucosides: madasiaticoside, brahminoside, and centelloside. The plant also contains various components including flavonoids, phytosterols, tannins, essential oils, sugars, and amino acids (Bylka & al., 2013).

3.4.5. Use of *Centella asiatica* (L.) Urb. Species in Cosmetic Preparations

Centella asiatica (L.) Urb. (Gotu kola) has cicatrizing and wound-healing properties. Its wound-healing effect is attributed to

triterpenes such as asiaticoside, asiatic acid, and madecassic acid present in its structure. It is used in the treatment of minor burns, surgical wounds, and venous ulcers on the legs. A tincture prepared from the dried aerial parts of *Centella asiatica* is used topically in the form of compresses for the treatment of acne (Acne vulgaris). It supports the proliferation of fibroblast cells and increases collagen synthesis. The extract of the plant is also used in hair growth and hair care. In addition to being used for treating hair loss, it is included in hair care products due to its soothing properties. *Centella asiatica* is found in various cosmetic preparations such as eye creams, serums, gels, and creams [Süzgeç-Selçuk & Eyisan, 2012; Kapoor, 2005; Erarslan & Ecevit-Genç, 2018; Koluman & Süzgeç-Selçuk, 2016].

Gotu kola has cicatrizing and wound-healing properties. Its wound-healing effect is derived from triterpenes such as asiaticoside, asiatic acid, and madecassic acid present in its structure. It is used in the treatment of minor burns, surgical wounds, and venous ulcers on the legs. A tincture prepared from the dried aerial parts of *Centella asiatica* is used topically in the form of compresses for the treatment of acne (*Acne vulgaris*). It supports the proliferation of fibroblast cells and increases collagen synthesis. The extract of the plant is also used in hair growth and hair care. It is used in the treatment of hair loss and is included in hair care products due to its soothing properties. *Centella asiatica* is found in various cosmetic preparations, such as eye creams, serums, gels, and creams [Süzgeç-Selçuk & Eyisan, 2012; Kapoor, 2005; Erarslan & Ecevit-Genç, 2018; Koluman & Süzgeç-Selçuk, 2016].

3.4.6. Side Effects and Contraindications of *Centella asiatica* (L.) Urb.

Centella asiatica is not toxic when used in recommended doses, and side effects are rare. However, especially with external and subcutaneous use, it may cause burning sensations and localized allergic reactions (Bylka & al., 2013).

3.5. *Hamamelis virginiana* L.

Hamamelis virginiana L. is a plant species belonging to the *Hamamelidaceae* family. *Hamamelis virginiana* L. is also known as "Witch hazel" (Naltekin-Aksoğan, 2019).

Figure 3.13. Field view of Hamamelis virginiana L. species (http 12)

3.5.1. Botanical Characteristics of *Hamamelis virginiana* L.

Hamamelis virginiana L., which grows to a height of approximately 4-6 meters, has a shrub or tree appearance and is highly branched. It is known to grow up to 10 meters in height. The trunk diameter can reach up to approximately 40 cm. The older branches are silver-gray or gray-brown, while the younger branches are yellow-brown and hairy. The leaves are alternately arranged,

greenish-brown or green, with short petioles, stipulate, and can be symmetrical ovate or asymmetrical in shape. The flowers of *H. virginiana* are bisexual, with golden yellow, thread-like characteristics. In the fall, the leaves of the plant fall off, and when the fruits from the previous year mature, they are seen in 5-8-flowered axillary clusters. The taste of the leaves is mildly aromatic and bitter, with a faint fragrance. It also has an astringent effect. The bark of the plant is about 2 mm thick and 3 cm wide [Naltekin-Aksoğan, 2019; WHO Monographs, 2002].

3.5.2. Used Parts of *Hamamelis virginiana* L.

The used parts of *Hamamelis virginiana* L. are the leaves (**Hamamelidis folium**), and the dried bark of the stem and branches [Süzgeç-Selçuk & Eyisan 2012; Erdönmez & Yüce 2023].

3.5.3. Distribution Areas of *Hamamelis virginiana* L.

Hamamelis virginiana L. is naturally distributed in the humid forests along the Atlantic coast, extending from the eastern part of North America, from New Brunswick, Nova Scotia, and Quebec to Minnesota, and southward to Georgia, Louisiana, Florida, and Texas. It is cultivated in Europe and subtropical regions, and is commonly found in gardens and parks in Europe [Çubukçu & al. 2002; Expanded Commission E Monographs 2000; PDR for Herbal Medicines 2000; WHO Monographs 2002].

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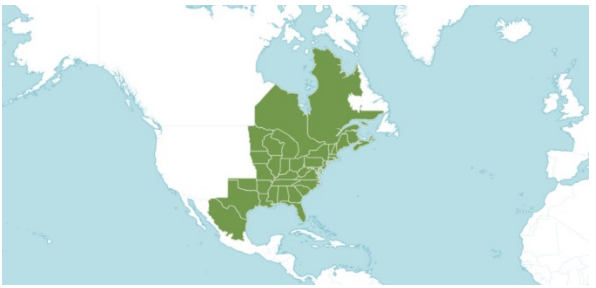

Figure 3.14. Distribution areas of Hamamelis virginiana L. species (http 12).

3.5.4. Chemical Composition of *Hamamelis virginiana* L. Species

The main components of the dried leaf extract of *Hamamelis virginiana* include tannins (a mixture of cyanidin, catechin, gallotannin, and proanthocyanidins), flavonoids (kaempferol, quercetin, isorhamnetin, kaempferitrin), polyphenolic acids (gallic and caffeic acids), and essential oils (mainly aliphatic alcohols, aliphatic esters, and small amounts of safrole). It contains tannins made up of gallotannins, proanthocyanidins, and catechins. The tannin present in it is called "hamamelitannin." Hamamelitannin is a mixture containing flavonoids and galloilhamamelose [Qinna, 2013; Heinrich & al., 2012].

3.5.5. Use of *Hamamelis virginiana* L. in Cosmetic Preparations

Hamamelis virginiana is used in the treatment of acne. It has refreshing and astringent effects. It is applied to skin blemishes, skin irritation, eye redness, skin lesions, bruises, and contusions. Witch hazel is also found in the composition of shaving lotions. The

gallotannins, proanthocyanidins, and gallates in its composition act as powerful free radical scavengers. Various clinical studies have shown that the topical application of *Hamamelis virginiana* is effective in treating inflammatory conditions such as atopic dermatitis, burns, and UV exposure [Fathima & al., 2011; Heinrich & al., 2012].

Hamamelis virginiana is used in hair preparations due to its cleansing properties for the hair and scalp. It is a highly important plant for diaper rash and wound care. It is found in the composition of various cosmetic preparations such as shower gels, lip balms, cleansers, creams, eye creams, and serums [Erarslan & Ecevit-Genç 2018; Süzgeç-Selçuk & Eyisan 2012; Koluman & Süzgeç-Selçuk 2016].

3.5.6. Side Effects and Contraindications of *Hamamelis virginiana* L.

The essential oil of *Hamamelis virginiana* contains safrole, which is known to have carcinogenic effects. However, safrole is present in trace amounts, so it does not raise concern [Newall & al., 1996].

3.6. *Matricaria chamomilla* L.

Matricaria chamomilla L. species is a member of the Asteraceae family. It is commonly known by various names such as "Mayıs Papatyası" (May chamomile), "Papatya" (Chamomile), "Babunç", "Adi Papatya", "Tıbbi Papatya" (Medicinal chamomile), "Akbubaç", and "Papaçya" in Turkish (Özdemir & al., 2021).

Figure 3.15. Field image of Matricaria chamomilla L. species (http 13).

3.6.1. Botanical Characteristics of *Matricaria chamomilla* L.

Matricaria chamomilla L. is a plant that grows 20-40 cm in height, with a smooth, erect stem. The plant's leaves are narrowly pinnatisect, and its branches grow upward. The flower heads, called capitula, consist of ligulate and tubular flowers, each approximately 10 mm in diameter. The tubular flowers are male, with five teeth and yellow in color, while the ligulate flowers are female, with three teeth and white in color. The interior of the capitulum is hollow and cone-shaped. The capitula contain essential oils, and when distilled, the oil turns blue due to the compound called chamazulene it contains [Baytop, 1999; Heinrich & al., 2004].

Figure 3.16. Capitulum image of Matricaria chamomilla L. species (http 14)

3.6.2. Parts of *Matricaria chamomilla* L. Used

The used parts of *Matricaria chamomilla* L. are its flowers (Kole & al., 2005).

3.6.3. Distribution Areas of *Matricaria chamomilla* L.

The medicinal chamomile is commonly found in vacant fields and along roadsides in Turkey. *Matricaria chamomilla* var. chamomilla is found in Istanbul, Muğla, Aydın, and Antalya, *Matricaria chamomilla* var. papulosa is found in Muğla, and *Matricaria chamomilla* var. recutita is found in Balıkesir, Kocaeli, Kastamonu, Izmir, Ankara, Denizli, and Adana. Worldwide, it is naturally grown in Western Asia, Australia, North America, and Southern and Eastern Europe [Özdemir & al., 2021; Davis, 1975].

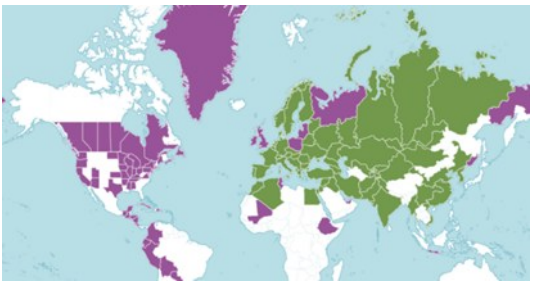

Figure 3.17. Distribution areas of Matricaria chamomilla L. species (http 13)

3.6.4. Chemical Composition of *Matricaria chamomilla* L.

Matricaria chamomilla contains approximately 8% flavonoids. The flavonoid glycosides it contains include apigenin-7-O-glucoside, apigenin glucoside acetate, and their aglycones, such as chrysoeriol, luteolin, and apigenin. Flavonol glycosides include hyperoside, rutin, and their aglycones, such as patuletin, isorhamnetin, and quercetol. Flavonoids with methoxy groups include chrysosemol, jaseidinem, and chrysoinettin. The flower heads, called capitula, contain essential oil, which is blue in color due to the compound chamazulene. The essential oil composition also includes various terpenes such as bisabolol oxide B, bisabolol oxide A, bisabolene oxide A, spatulenol, levomenol ((-)-α-bisabolol), ß-trans-farnesene, and trans-en-in-disikloether. The chemical composition of the plant also includes hydroxycoumarins (herniarin, umbelliferone), choline, phenolic acids, fatty acids, polysaccharides, amino acids, and mucilage [Herbal Medicine, 2000; PDR for Herbal Medicine, 2000].

3.6.5. Use of *Matricaria chamomilla* L. in Cosmetic Preparations

The *Matricaria chamomilla* plant has properties such as skin rejuvenation, smoothing, and cleansing. It is frequently included in hand and body lotions, aftershave formulations, deodorants, sun care products, and lipsticks due to its (-)-α-bisabolol content. *Matricaria chamomilla* L. is also used in the treatment of bad breath. It nourishes the hair and scalp, adds shine to the hair, prevents dandruff, and has a soothing effect on the hair. *Matricaria chamomilla* is found in various cosmetic preparations, including body wash products, lip serums, masks, tonics, creams, lotions, hair lightening creams, hair protectors, shampoos, hair tonics, hair care balms, hair conditioners, hair lightening liquids, eye creams, and serums [Fathima et al., 2011; Gomes-Carneiro & al., 2005; Erarslan & Ecevit-Genç, 2018; Koluman & Süzgeç-Selçuk, 2016; Akbulut & Karaköse, 2023]

3.6.6. Side Effects and Contraindications of *Matricaria chamomilla* L.

Matricaria chamomilla L. can cause contact dermatitis, conjunctivitis, and anaphylactic reactions. It should not be used by individuals who are sensitive to other known allergens or plants in the Asteraceae family (PDR for Herbal Medicine, 2000).

3.7. *Glycine max* (L.) Merr.

Glycine max (L.) Merr., also known as "soy" or "Chinese bean," is an annual plant species belonging to the Fabaceae

(Leguminosae) family (legumes) [Modaresi & al., 2011; Kurt & al., 2023].

Figure 3.18. Field image of Glycine max (L.) Merr. species (http 15)

3.7.1. Botanical Characteristics of *Glycine max* (L.) Merr.

Glycine max (L.) Merr. is an annual plant species that grows to a height of 0.5-1.5 meters, is hairy, branched, partially climbing, and produces blue-violet or yellow flowers. The leaflets are pointed, broad, and oval, with trifoliate leaves. The sepals can be tubular-campanulate, campanulate, or bilabiate, and the sepals of the plant are short. The style is hairless, and the stamens are either monodelphous or diadelphous. The fruit is approximately 10 cm long, hairy, and a legume that can contain 2-5 seeds. The spherical seeds vary in color from white to yellowish-green or brownish-black [PDR for Herbal Medicines, 2004; Samuelsson, 2004].

3.7.2. Parts of *Glycine max* (L.) Merr. Used

The parts of *Glycine max* (L.) Merr. used are its seeds (Kurban, 2018).

3.7.3. Distribution Areas of *Glycine max* (L.) Merr.

The native region of *Glycine max* (L.) Merr. is China, where it has been cultivated for food use for many years. It is the most consumed and widely grown legume in the world. In Europe, its cultivation has not been successful due to the requirement for a warm climate. Today, it is widely cultivated in East Asia, as well as in the United States, India, and South America [Murray & Pizzorno 2006; Samuelsson, 2004].

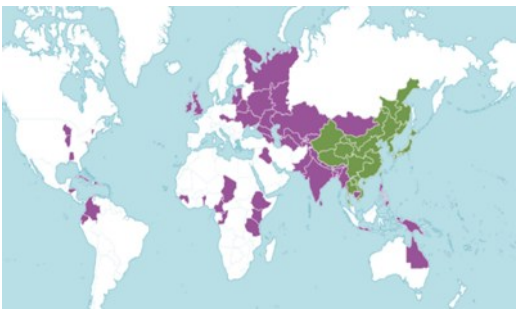

Figure 3.19. Distribution areas of Glycine max (L.) Merr. (http 15)

3.7.4. Chemical Composition of *Glycine max* (L.) Merr.

Glycine max (L.) Merr. contains various types of carbohydrates, minerals, proteins, and vitamins. Protein and fat

make up about 60% of the total dry weight of soybeans. Soy protein is a crucial plant for the human body, as it is rich in pantothenic acid, niacin, choline, vitamins B1 and B2, and all essential amino acids. Another important compound found in soybeans is phytoestrogens. These compounds are plant-derived analogs of estrogen, which is found in vegetables and fruits and has a diphenolic structure. Phytoestrogens contain all the physicochemical and physiological properties of estrogens. Soybeans contain various active compounds such as isoflavones (genistein, the main isoflavone), glycitein, daidzein, saponins, and lunasins. Genistein, the main isoflavone in soy, dilates blood vessels and increases nitric oxide release, which enhances vascular flexibility [Modaresi & al., 2011; Šošić-Jurjević & al., 2011].

3.7.5. Use of *Glycine max* (L.) Merr. in Cosmetic Preparations

The oil derived from *Glycine max* (L.) Merr. is commonly used in hair and body products due to its cost-effectiveness and excellent moisturizing properties. *Glycine max* is particularly found in the composition of various cosmetics such as gels, lotions, creams, cleansers, oils, protectants, eye creams, shampoos, lip balms, and body washes. A clinical study reported that a combined extract obtained from plants like Tea (Camellia sinensis), Gotu Kola (Centella asiatica), and Soybean (*Glycine max*) significantly improved skin firmness and elasticity, indicating its potential use in anti-aging cosmetic preparations. Additionally, it has been proven that the extracts from these plants are safe not only at the ocular level but also for human skin [Athar & Nasir 2005; Koluman & Süzgeç-Selçuk 2016; Tilaar & al., 2017].

3.7.6. Side Effects and Contraindications of *Glycine max* (L.) Merr.

Individuals who are hypersensitive to soy isoflavones or products containing soy isoflavones should avoid using them [Holzhauser & al., 2009].

3.8. *Echinacea purpurea* (L.) Moench

Echinacea purpurea (L.) Moench (Purple Coneflower) is a perennial herbaceous plant species belonging to the Asteraceae (Compositae) family [Cozzolino & al., 2006].

Figure 3.20. Field view of Echinacea purpurea (L.) Moench species (http 16)

3.8.1. Botanical Characteristics of *Echinacea purpurea* (L.) Moench

Echinacea purpurea is a perennial herbaceous plant with a tall, strong, branched, and either glabrous or slightly soft-hairy stem, ranging from 60-180 cm in height. The basal leaves are ovate to ovate-lanceolate with an acute apex, the edges are slightly serrated

or sharply incised; the petioles can be up to 25 cm long, with the lamina being 15 cm wide and 20 cm long, tapering toward the base, usually heart-shaped at the base, 3-5 veined, and decurrent. The stem leaves are petiolate below and sessile above, 1.5-8 cm wide, 7-20 cm long, rough on both surfaces; the bracts are linear-lanceolate, hairy on the outer surface, narrowing towards the base, and later becoming membranous. The flower heads are purple-red, 5-10 mm wide and 1.5-3 cm long. The bracteoles are 9-13 mm long, the corolla of the tubular flowers is 4.5-5.5 mm long, and the lobes are 1 mm long. The achene is 4-4.5 mm, the pollen grains are yellow and haploid (WHO Monographs, 1999).

A B

Figure 3.21. Echinacea purpurea (L.) Moench species: A. Flower imageB. Root image(http 16)

3.8.2. Used Parts of *Echinacea purpurea* (L.) Moench

The used parts of *Echinacea purpurea* (L.) Moench are its flowers, leaves, roots, and essential oils obtained from the aerial parts (Kurban, 2018).

3.8.3. Distribution Areas of *Echinacea purpurea* (L.) Moench

Echinacea purpurea (L.) Moench is not naturally grown in Turkey. The plant, which grows naturally in the USA, is cultivated in Europe [ESCOP Monographs, 2003; WHO Monographs, 1999]

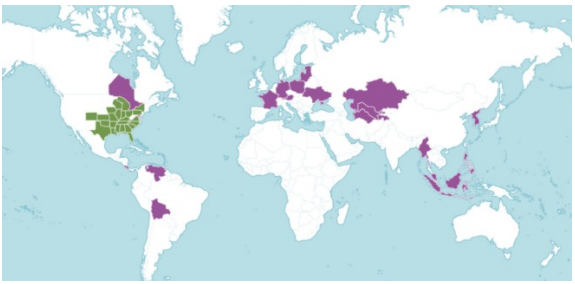

Figure 3.22. Distribution areas of Echinacea purpurea (L.) Moench (http 16)

3.8.4. Chemical Composition of *Echinacea purpurea* (L.) Moench

Echinacea purpurea (L.) Moench contains various components such as essential oils, polysaccharides, flavonoids, alkylamides, polyacetylenes, and caffeic acid derivatives. Caffeic acid, chicoric acid, echinacoside, isobutylamide, and caffeic acid derivatives are found in the plant's roots, which has led to an increase in demand for the plant. The essential oil of *Echinacea purpurea* (L.) Moench contains caryophyllene oxide, caryophyllene, borneol, and germacrene D. The plant also contains minerals such as iron, manganese, lithium, strontium, nickel, zinc, and copper [Cozzolino & al., 2006; Jones & al., 2009; Nyalambisa & al., 2017; Ražić & al., 2003].

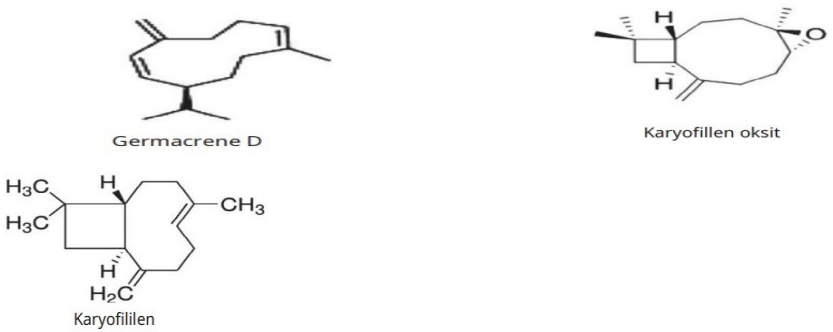

Figure 3.23. Some compounds found in the essential oil of Echinacea purpurea (L.) Moench (Nyalambisa & al., 2017)

3.8.5. Use of *Echinacea purpurea* (L.) Moench in Cosmetic Preparations

Echinacea purpurea extract has anti-inflammatory effects and is used to reduce the cutaneous symptoms of atopic eczema. It improves the epidermal lipid barrier in people with atopic eczema and is a promising ingredient for daily skin care. A study has confirmed that *Echinacea purpurea* root extract has wrinkle-preventing, antioxidant, and skin-brightening effects. Additionally, the extract inhibited melanin synthesis and dose-dependently reduced the expression of tyrosinase in B16 melanoma cells. Regarding skin wrinkles, the extract suppressed the expression of collagen-degrading enzymes, MMP-1 and MMP-2, which are involved in the degradation of the extracellular matrix of the dermal layer. Echinacea is included in anti-aging liquids and scrubs (peels). The *Echinacea purpurea* plant also nourishes the hair and scalp and gives shine to the hair [Oláh & al., 2017; Park et al., 2008; Koluman & Süzgeç-Selçuk, 2016; Erarslan & Ecevit-Genç, 2018].

3.8.6. Side Effects and Contraindications of *Echinacea purpurea* (L.) Moench

It should not be used by individuals known to be hypersensitive to plants of the *Asteraceae* family (ESCOP Monographs, 2003).

3.9. *Aesculus hippocastanum* L.

Aesculus hippocastanum L. (horse chestnut) is a fast-growing ornamental tree belonging to the *Hippocastanaceae* family. It is commonly known by various names such as "wild chestnut," "Indian chestnut," "buckeye," and "white-flowered horse chestnut" in the local language [Idris & al., 2020; http 17].

Figure 3.24. Land view of Aesculus hippocastanum L. (http 18).

3.9.1. Botanical Characteristics of *Aesculus hippocastanum* L.

Aesculus hippocastanum L. is a tree species that can grow 25-30 meters tall, with a trunk circumference of up to 2 meters, and typically has a pyramidal appearance. The leaves at the tips of the petioles are usually 10 cm wide and 20 cm long. The smallest

leaves are at the edges, and the compound leaf in the center of the 5-7 foliolate groups is the widest. The leaf edges are serrated and irregular in shape. Most of the flowers are white, though occasionally red, and are predominantly male. The sepals are fused, bell-shaped, and their tips are irregular. The heart-shaped white petals at the base have red-yellow spots. The corolla has curled edges, with 2 lower and 3 upper petals. The flower clusters, which are paniculate in shape, narrow towards the tip and are 25-30 cm long. The male organs have 7 stamens with red anthers, located at the tips of the "S"-shaped filaments, which are longer than the petals. The ovary is 3-carpellate and green, while the spherical fruits are capsule-type with a hard shell, containing 1-3 soft, spiny, red-brown, fine-haired seeds [Baytop, 1999; Bombardelli & Morazzoni 1996; PDR for Herbal Medicines, 2000].

A B

Figure 3.25. Images of Aesculus hippocastanum L. A. Flower image B. Fruit image (http 19, http 20).

3.9.2. Parts of *Aesculus hippocastanum* L. Used

The parts of *Aesculus hippocastanum* L. that are used are its seeds (Kurban, 2018).

3.9.3. Distribution Areas of *Aesculus hippocastanum* L.

Aesculus hippocastanum L. is a tree that is found in the Northern Hemisphere and has a natural distribution in Western Asia. It is widely cultivated along roadsides, in gardens, and in parks in many countries, including those in Europe and America. It is commonly found in the central Balkan Peninsula, especially in the Himalayas, northern Iran, the Caucasus, Greece, and Bulgaria [Blumenthal & al., 2000; Bombardelli & Morazzoni, 1996; PDR for Herbal Medicines, 2000]. Records indicate that it was introduced to Europe (France) from Istanbul at the beginning of the 17th century. *Aesculus hippocastanum* L. is not naturally found in the flora of Turkey [Baytop, 1999; Davis, 1975; Davis & al., 1988; Güner & al., 2000].

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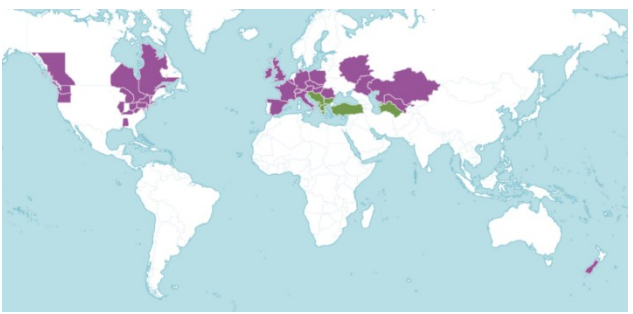


Figure 3.26. Distribution areas of Aesculus hippocastanum L. (http 18)

3.9.4. Chemical Composition of *Aesculus hippocastanum* L.

The *Aesculus hippocastanum* L. species primarily consists of triterpene saponins. The therapeutic active compound, "escin," is found in three different forms: α-escin, ß-escin, and cryptoscin. α-escin, ß-escin, and cryptoscin are a mixture of these compounds. Cryptoscin is composed of 28-O-acetyl compounds, while ß-escin (22-O-acetyl compounds) is a mixture of triterpene aglycones such as protoessigenin and several glucosides derived from barringtogenol-C. In addition, the plant contains hydroxylcoumarins (scopolin, fraxin, and esculin), flavonoids (quercetin, isoquercitrin, kaempferol, and their di- and tri-glucoside derivatives), and in the seed coat, there are sterols, quinones, oligomeric proanthocyanidins, tannins, fixed oils (stearic, palmitic, and linolenic acids), amino acids (guanine, adenosine, and adenine), starch, allantoin, citric acid, and choline [Barnes & al., 2005; Blumenthal, 2003; Blumenthal & al., 2000; ESCOP Monographs, 2003; PDR for Herbal Medicines, 2000; WHO Monographs, 2002].

3.9.5. Use of *Aesculus hippocastanum* L. in Cosmetic Preparations

The *Aesculus hippocastanum* L. plant contains escin, which inhibits elastase and hyaluronidase, reducing edema and permeability in capillaries, while also reducing inflammation through leukocyte inhibition. *Aesculus hippocastanum* is used in the treatment of edema caused by sports injuries, chronic venous insufficiency, and hemorrhoids. Studies have shown that at doses of 100 to 150 mg/day, it reduces venous volume in the lower extremities, alleviating issues such as the feeling of heaviness, itching, and fatigue in the legs. Horse chestnut is one of the plants

used in cellulite treatment due to its ability to increase the impermeability of blood and lymphatic vessels and its antioxidant effects. The plant's seeds nourish the hair and scalp and are used in the treatment of hair loss. It is especially included in the composition of cosmetic preparations such as shampoos, oils, and creams [Süzgeç-Selçuk & Eyisan, 2012; Alğın-Yapar, 2017; Erarslan-Ecevit Genç, 2018; Koluman & Süzgeç-Selçuk, 2016].

3.9.6. Side Effects and Contraindications of *Aesculus hippocastanum* L.

It is contraindicated for use by individuals who are allergic to the Hippocastanaceae family (WHO Monographs, 2002).

3.10. *Hypericum perforatum* L. (St John's Wort)

Hypericum perforatum L., a yellow-flowered, perennial plant species belonging to the Hypericaceae (Clusiaceae) family. *Hypericum perforatum* L. is commonly known by various names such as "St. John's wort," "hundredseed herb," "sheep-killer," "burnweed," "sword herb," and "knapweed" [Altan & al., 2015; http 21].

Figure 3.27. Field image of Hypericum perforatum L. (http 22)

3.10.1. Botanical Characteristics of *Hypericum perforatum* L.

Hypericum perforatum L. is a herbaceous, perennial plant that forms roots from the nodes of its shoots. It has a highly branched stem that can grow to a height of 70-90 cm, and its branched, two-edged root is spindle-shaped. The opposite leaves are linear-oblong in shape. The flowers at the tips of the branches are arranged in an umbel shape. The yellow flowers have 3 clusters of stamens, 5 sepals, and 5 petals. The plant produces seeds within triangular capsules. It generally grows in rocky and stony areas, meadows, uncultivated fields, forest edges, and along roadsides. *Hypericum perforatum* L. blooms from June to September. Its leaves contain translucent glandular dots and are linear, oval, and sessile [Ceylan & al., 2005; Kaçar & Azkan, 2005; Altan & al., 2015].

A B

Figure 3.28. A. Flower image of Hypericum perforatum L. B. Leaf image of Hypericum perforatum L. (http 23).

3.10.2. Parts of *Hypericum perforatum* L. Used

The used parts of *Hypericum perforatum* L. are the flowering aerial parts of the plant (Kurban, 2018).

3.10.3. Distribution Areas of *Hypericum perforatum* L.

Hypericum perforatum L. is found in the Southeastern Anatolia, Mediterranean, Central and Eastern Anatolia, Aegean, Black Sea, and Marmara regions of Turkey, and globally, it is distributed in North Africa, Asia, and Western Europe [Aksu & Altınterim, 2015; Altan & al., 2015].

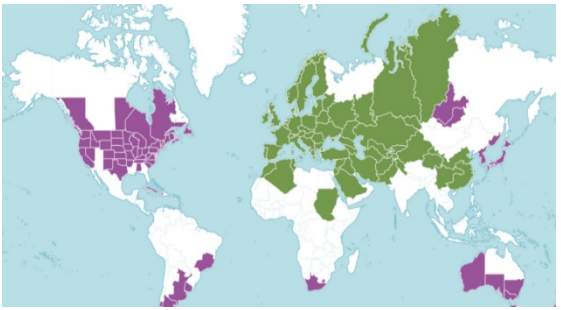


Figure 3.29. Distribution areas of Hypericum perforatum L. (http 23)

3.10.4. Chemical Composition of *Hypericum perforatum* L.

The aerial parts of *Hypericum perforatum* L. contain various components such as naphthodianthrone derivatives (isohypericin, pseudohypericin, hypericin), flavonoids (kaempferol, quercetin, isoquercitrin, kaempferitrin, rutin, hyperoside), biflavonoids (biapigenin), phloroglucinols (adhyperforin, hyperforin), essential oils (monoterpenes, n-alkanes), condensed and catechic tannins (leucocyanidin, epicatechin, catechin), phenolic acids (ferulic acid, chlorogenic acid, caffeic acid), sterols (ß-sitosterol), phenylpropanoids, xanthones (1,3,6,7-tetrahydroxanthone), and vitamins C and A [ESCOP Monographs, 2003; WHO Monographs, 2002].

3.10.5. Use of *Hypericum perforatum* L. in Cosmetic Preparations

The extract of *Hypericum perforatum* L. has been shown in both in vitro and in vivo studies to reduce inflammation and enhance collagen deposition and fibroblast migration, which positively impacts the wound healing process. It has been reported that the anti-

inflammatory and wound healing effects are attributed to phenylpropanoids, biflavonoids, flavonoids, phloroglucinols, and naphthodianthrones. *Hypericum perforatum* L. is included in various cosmetic preparations such as lotions, oils, masks, eye makeup products, shampoos, hair care products, and sunscreens. A study examined the antioxidant and antibacterial properties of *Hypericum perforatum* L. extract and reported that it could be used as a preservative in creams [Altıparmak & Eskitaşçıoğlu, 2018; Koluman & Süzgeç-Selçuk, 2016; Avşar & al., 2018; Kapoor & al., 2023].

3.10.6. Side Effects and Contraindications of *Hypericum perforatum* L.

Individuals with sensitive skin should be cautious due to the risk of photosensitivity, and direct exposure to sunlight should be avoided. Although there are no specific restrictions in the records, its use during pregnancy and breastfeeding is not recommended without consulting a doctor [Çubukçu & al., 2002; WHO Monographs, 2002].

3.11. *Centaurea cyanus* L.

Centaurea cyanus L. is an annual plant species belonging to the Asteraceae family. It is known by various names in the local language, such as "blue cornflower," "bridal crown," "rabbit's foot," "prophet's flower," "crown flower," "blue broom flower," and "dukduk flower" [Lockowandt & al., 2019; http 24; Şenkardeş & al., 2019].

Figure 3.30. Field image of Centaurea cyanus L. species (http 25).

3.11.1. Botanical Characteristics of *Centaurea cyanus* L.

Centaurea cyanus L. is a plant species that typically grows between 15-60 cm. It is branched either densely or sparsely, sometimes from the base. The leaves are sparsely hairy, with the lower parts hairless. The lower leaves are lanceolate or lyrate and are usually withered by the time of flowering. The upper and middle leaves are thread-like or lanceolate, and the middle leaves typically have 1 to 2 long, bristle-like teeth on each side. The upper leaves have smooth edges. The involucre of *Centaurea cyanus* L. is 5-10 mm wide, 10-16 mm long, rectangular, and gradually forms a funnel shape. The filar extensions are blackish or narrowly brown at the edges. The flowers of the plant are blue. The calyx is 3-4 mm long, while the pappus is 2-3 mm long. A popular ornamental plant, *Centaurea cyanus* L. is drought-resistant and prefers sunny areas and dry or moist soils (http 24).

A *B*

Figure 3.31. A. Flower image of Centaurea cyanus L. B. Involucrum image of Centaurea cyanus L. (http 25)

3.11.2. Used Parts of *Centaurea cyanus* L.

The used parts of *Centaurea cyanus* L. are its roots, rhizomes, and flowers [Çankaya, 2018; Kurban, 2018].

3.11.3. Distribution Areas of *Centaurea cyanus* L.

Centurea cyanus L. is found in Turkey, Yugoslavia, Sicily, Romania, Lebanon-Syria, Italy, Greece, the Eastern Aegean Islands, Albania, and Bulgaria (http 25).

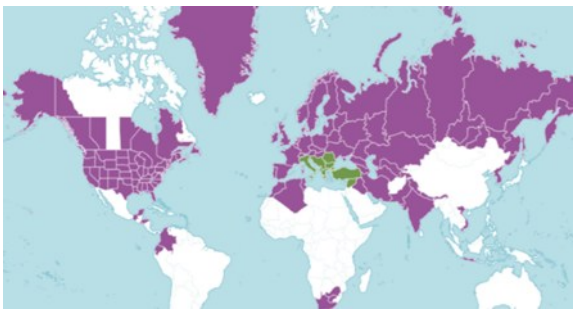


Figure 3.32. Distribution areas of Centaurea cyanus L. (http 25).

3.11.4. Chemical Composition of *Centaurea cyanus* L.

The *Centaurea cyanus* L. species contains various chemical components, including sesquiterpene lactones, mineral salts, amino acids, tannins, catechins, anthocyanidins, coumarins, flavonoids, and phenolic acids (Çankaya, 2018).

3.11.5. Use of *Centaurea cyanus* L. in Cosmetic Preparations

The *Centaurea cyanus* L. plant has various effects, including anti-inflammatory, free radical scavenging, and antiseptic properties. Due to its astringent, tonic, moisturizing, and soothing characteristics, it is used in products for sensitive skin, eye area products, cleansing lotions, pre- and post-shaving products, and gels. Additionally, it is found in cosmetic preparations such as scrubs and shampoos. The flowers of *Centaurea cyanus* L. have nourishing properties for hair and scalp [Çankaya, 2018; Koluman & Süzgeç-Selçuk, 2016; Erarslan & Ecevit-Genç, 2018].

3.11.6. Side Effects and Contraindications of *Centaurea cyanus* L.

In a patch test conducted on human volunteers, it was reported that the inclusion of extracts from *Centaurea cyanus*, *Lactarius piperatus*, and *Ribes rubrum* in a face cream formulation did not cause allergic reactions, irritation, erythema, or itching (Papa & al., 2023).

3.12. *Adansonia digitata* L.

Adansonia digitata L. (Baobab) is a massive tree species belonging to the Malvaceae family. It is commonly found in the hot and dry regions of tropical Africa, reaching heights of up to 25

meters, and is a deciduous tree that can live for hundreds of years(Kaboré & al., 2011).

Figure 3.33. Field view of Adansonia digitata L. species (http 26)

3.12.1. Botanical Characteristics of *Adansonia digitata* L.

Adansonia digitata L., a deciduous massive tree, reaches a height of 20-30 m and can have a trunk diameter of 2-10 m in mature trees. *A. digitata* is highly branched, and its trunk is generally broad and cylindrical. The bark is smooth, ranging from reddish-brown to gray, soft, and has longitudinal fibers. *A. digitata* forms a wide lateral root system extending up to 50 m from the trunk, with root tips typically swollen. However, the main roots of older trees are relatively shallow and rarely extend beyond 2 meters in depth. For this reason, they are very sensitive to strong winds and can be uprooted. Mature trees begin by producing simple leaves in every season, followed by 2-3 leaflet leaves, with mature leaves appearing later. These mature leaves are approximately 5-9 leaflets, 20 cm in diameter. The leaves of young trees are usually simple. The flowering of baobabs consists of a single flower located in the leaf axils near the tips of reproductive branches. The flowers are large,

showy, drooping, and white, appearing before the first rains or at the end of the dry season. They emit a sulfurous scent, particularly attracting bats that play a role in pollination (Rahul & al., 2015).

Figure 3.34. A. Flower and leaf view of Adansonia digitata L. B. Fruit and seed view (http 26)

3.12.2. Parts of *Adansonia digitata* L. Used

The used parts of *Adansonia digitata* L. include its leaves, seeds, fruits, and root bark (Rahul & al., 2015).

3.12.3. Distribution Areas of *Adansonia digitata* L.

The species *A. digitata* L. is commonly found in Southern Africa, in the hot regions of Mozambique, Zimbabwe, Malawi, and especially the Limpopo Province; in West Africa, in countries such as Burkina Faso, Cameroon, Ivory Coast, Benin, Senegal, and Mali; and in East Africa, in countries like Uganda, Tanzania, and Kenya (Kamatou & al., 2011).

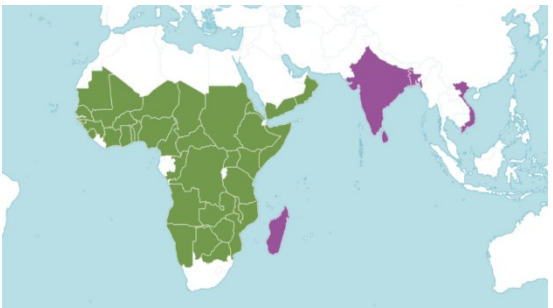


Figure 3.35. Distribution areas of Adansonia digitata L. (http 26)

3.12.4. Chemical Composition of *Adansonia digitata* L.

The oil from the seeds of *A. digitata* L. contains tocopherols (α, ß, γ, and δ), stigmasterol, ß-sitosterol, izofucosterol, cholesterol, campesterol, iron, calcium, thiamine, and lysine. The main hydrocarbons in the seed oil are squalene and n-alkanes. Oleic and linoleic acids are present in high concentrations in the seed oil, while arachidic, stearic, linolenic, and palmitic acids are found in lower concentrations. The fruit pulp contains various organic acids, including ascorbic, succinic, malic, tartaric, and citric acids. Studies have reported that the fruit pulp contains a high concentration of carbohydrates, crude fiber, small amounts of protein and ash, and very little fat. Additionally, vitamins such as A, C, B3, B2, and B1, and minerals including Zn, Na, Mn, Mg, K, Fe, and Cu have also been identified (Kamatou & al., 2011).

3.12.5. Use of *Adansonia digitata* L. in Cosmetic Preparations

Baobab oil, which increases skin elasticity and is easily absorbed by the skin, has moisturizing and soothing properties for irritated and dry skin. It also alleviates pain in burns and rapidly

regenerates epithelial tissues, thereby improving skin elasticity and tone. The fruits of *A. digitata* L. are included in hair care products due to their antifungal, antimicrobial, and antioxidant properties. Studies have shown that Baobab oil, thanks to its antioxidants, helps prevent the appearance of wrinkles and protects the skin against aging. When used alone or in combination with other compounds, it is used in hair care (for brittle, dry hair, and hair breakage) as a mask or for skin healing (in cracks and abrasions). Linoleic acid, found in Baobab seeds, is the most commonly used fatty acid in cosmetic preparations, aiding in the healing process of dermatoses, moisturizing the skin, and used in the treatment of acne vulgaris and sunburns. *Adansonia digitata* L. is frequently found in various preparations such as shampoos, lotions, gels, and creams [Kurban, 2018; Erarslan & Ecevit-Genç, 2018; Kamatou & al., 2011; Koluman & Sügeç-Selçuk, 2016].

3.12.6. Side Effects and Contraindications of *Adansonia digitata* L.

In an irritation patch test, Baobab oil has been proven to be non-irritating with low erythema scores (Komane & al., 2017).

3.13 *Santalum album* L.

Known as "Chandana" in India, sandalwood (*Santalum album* L.) is an aromatic tree species belonging to the Santalaceae family [Sindhu & al., 2010; Aftab & al., 2023].

Figure 3.36. Field view of Santalum album L. species (http 27).

3.13.1. Botanical Characteristics of *Santalum album* L.

Santalum album L. is a leafless tree with slender, drooping branches and can grow to a height of 8-12 meters. The circumference of the tree can reach up to 2.5 meters. The leaves are 3.8-6.3 cm in length and 1.6-3.2 cm in width, elliptic lanceolate, subacute, hairless, with a finely pointed base; the leaf stalks are thin and 1-1.3 cm long. The flowers are brownish-purple in color, with numerous short pedicels. The bark is smooth and gray-brown. The living wood is white and odorless, while the heartwood is yellowish-brown and strongly aromatic. The fruit is dark purple-black, with a hard-shelled endocarp, about the size of a small pea, spherical in shape, and has smooth, fleshy, almost black perianth tubes with edges resembling remnants [Aftab & al., 2023; Sindhu & al., 2010].

A B

Figure 3.37. A. Flower view of Santalum album L. B. Leaf view of Santalum album L. (http 27)

3.13.2. Parts of *Santalum album* L. Used

The used parts of *Santalum album* L. include its roots, leaves, bark, wood, and the oil obtained from its seeds [Aftab & al., 2023; Kumar & al., 2019].

3.13.3. Distribution Areas of *Santalum album* L.

Santalum album L. is a plant species native to the tropical belt of the Indian subcontinent, Northern Australia, and Eastern Indonesia. Its main distribution is found in the drier tropical regions of India and on the islands of Timor and Sumba in Indonesia. *S. album* L. is native to the mountainous regions of South India (Kumar & al., 2015).

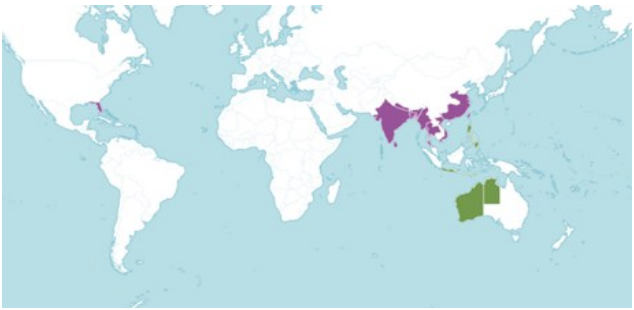


Figure 3.38. Distribution areas of Santalum album L. (http 27)

3.13.4. Chemical Composition of *Santalum album* L.

Phytochemical analysis of sandalwood extracts has shown that the tree is rich in various components, primarily terpenoids, as well as saponins, phenolics, and tannins. The main component of sandalwood oil (*Santalum album* L.) is santalol, a mixture of two isomers, α-santalol and β-santalol. These isomers are the two molecules primarily associated with the characteristic scent of sandalwood. Other fragrant compounds in sandalwood oil include α-santalen, α-santalal, β-santalal, epi-β-santalal, α-santalol, β-santalol, (E)-β-santalol, α-bergamotol, and spirosantalol. Studies have shown that the main component of sandalwood is α-santalol (61%), followed by β-santalol (28%). In addition to these compounds, sandalwood oil also contains cisnuciferol, α-bisabalol, cisbergamatol, epi-β-santalol, γ-curcumen-12-ol, β-curcumen-12-ol, cis-lanceol, and trans-farnesol (Santha & Dwivedi, 2015).

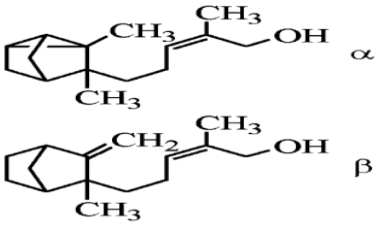


Figure 3.39. Chemical structure of α- and β-santalol (Burdock & Carabin, 2008)

3.13.5. Use of *Santalum album* L. in Cosmetic Preparations

The oil derived from *Santalum album* L. has unique stability and provides the best fixative property for perfumes. Due to its lasting and pleasant fragrance, it is frequently used in the perfume industry. Sandalwood oil plays an important role in addressing various skin issues such as wrinkles, dryness, and peeling. It helps in the regeneration of damaged skin, maintains skin radiance, and improves skin tone. It also protects the skin from microorganisms, parasitic attacks, and various infections. Topical application of sandalwood oil aids in the healing of acne, bruises, scars, and burns. Sandalwood oil reduces hair loss, promotes hair growth, and enhances hair shine. A combination of sandalwood with natural balms like sesame and lavender, when applied to the scalp, helps to eliminate dandruff. *Santalum album* L. is used in cellulite treatments due to its effects on increasing the impermeability of blood and lymphatic vessels and its antioxidant properties. Due to its excellent astringent and disinfectant properties, it is also effective in treating skin diseases such as psoriasis. *Santalum album* L. is found in various preparations such as masks, oils, and gels [Kumar & al.,

2019; Aftab & al., 2023; Alğın-Yapar, 2017; Koluman & Süzgeç-Selçuk, 2016].

3.13.6. Side Effects and Contraindications of *Santalum album* L.

It has been reported that *Santalum album* L. can cause pigmentation (Sheehan, 2020).

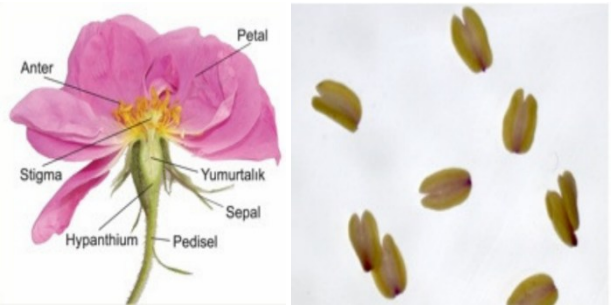
3.14. *Rosa damascena* Mill.

Rosa damascena Mill., also known as "Damask Rose" or "Isparta Rose," is a hybrid plant species in the Rosaceae family. It is a natural hybrid of *Rosa phoenicia* Boiss. and *Rosa gallica* L., both of which are native to Turkey (Dilmen & Göktürk-Baydar, 2016).

Figure 3.40. Field views of Rosa damascena Mill. species (http 28, http 29)

3.14.1. Botanical Characteristics of *Rosa damascena* Mill.

Rosa damascena Mill., a perennial rose species with strongly fragrant flowers, is a thorny, semi-double, shrub-forming plant. The stems that form the plant's canopy bear buds or leaves that produce shoots. In the nodes of the stems, there are smooth, waxy, dark green leaves, each consisting of 3-7 leaflets. The flowers of the Isparta rose are typically 2.5 g in weight and have a diameter of 7.5 cm when fresh. The flower is composed of 65% petals (on average, 30 petals), 20% pistil (40 stigma tips and tubes with the ovary), 10% sepals (5 calyx leaves, 1 hypanthium, and pedicel), and 5% stamens (on average, 90 anthers and filaments). The flowers of the rose are highly cross-pollinated, with both wind and bees playing an important role in pollination. The flowers attract honeybees, providing both pollen and nectar. After fertilization, rose hips (fruits) develop, and their initially green color turns dark red as they ripen. Each fruit contains 1-3 round, dark-colored seeds. The seeds of *R. damascena* weigh approximately 2 g for 100 seeds. Being a natural hybrid (allotetraploid) of *Rosa phoenicia* and *Rosa gallica*, *R. damascena* produces a large number of flowers but very few seeds and fruits (Baydar, 2016).



A B

Figure 3.41. Rosa damascena Mill. species A. Flower image B. Anther image (Erbaş & al., 2015)

3.14.2. Used Parts of *Rosa damascena* Mill.

The flowers of *Rosa damascena* Mill. are the primary source of essential oils in the cosmetic and perfume industries, obtained through distillation (rose water and rose oil) and extraction (concrete and absolute) products (Erbaş & al., 2015).

3.14.3. Distribution Areas of *Rosa damascena* Mill.

Rosa damascena Mill. is produced in Turkey, primarily in Isparta, as well as in Afyon, Burdur, Denizli, and parts of Antalya and Konya within the Göller Region. Globally, it is cultivated in various countries such as Libya, southern Russia, Italy, China, India, Iran, and Bulgaria (Dilmen & Göktürk-Baydar, 2016).

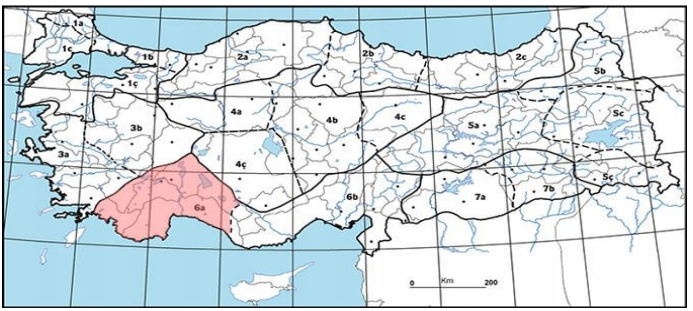


Figure 3.42. Distribution areas of Rosa damascena Mill. in Turkey (http 4).

3.14.4. Chemical Composition of *Rosa damascena* Mill.

The most important aroma components of *Rosa damascena* Mill. include monoterpenic alcohols such as geraniol, nerol, citronellol, and linalool. Additionally, the plant contains various long-chain hydrocarbons such as tricosane, henicosane, eicosane, nonadiene, and nonadane, as well as sesquiterpenes (murolene, humulene), oxides and ethers like methyl eugenol, esters and aldehydes such as geranyl acetate and geranal, and phenols like eugenol (Erbaş & al., 2015).

3.14.5. Use of *Rosa damascena* Mill. in Cosmetic Preparations

Among other scented rose species cultivated worldwide, *Rosa damascena* Mill. is the most economically valuable rose species in the cosmetic and perfume industries due to its distinctive, intense, and sharp fragrance. In addition to being used as a fixative (to enhance the longevity of perfume scents) and fragrance component, rose oil extracted from the flowers of *R. damascena* is also utilized for its antiseptic properties. Rose water, with its

antiseptic effects, is commonly used for treating eczema. *R. damascena* is also beneficial in skin cleansing and healing mouth ulcers. The essential oil extracted from its flowers is used in skin creams, lotions, and ointments for beautifying, protecting from sunburn, and promoting smoothness. *R. damascena* is a key ingredient in various cosmetic products, including lip balms, shower gels, soaps, oils, lotions, serums, masks, gels, sunscreens, tonics, hair care products, creams, and body washes [Baydar, 2016; Örmeci-Kart, 2012; Kurban, 2018; Kapoor, 2005; Koluman & Süzgeç-Selçuk, 2016].

3.14.6. Side Effects and Contraindications of *Rosa damascena* Mill.

The main components of rose oil are citronellol and geraniol, which can be primary allergens. There have been reports of more than 15 cases of type IV allergic reactions to rose oil in cosmetic products and topical pharmaceutical preparations (Bruusgaard-Mouritsen & al., 2020).

3.15. *Melaleuca alternifolia* (Maiden & Betche) Cheel

Commonly known as "Tea Tree," *Melaleuca alternifolia* Cheel is a deciduous tree species belonging to the Myrtaceae family (Homer et al., 2000).

Figure 3.43. Image of the Melaleuca alternifolia Cheel species (http 30).

3.15.1. Botanical Characteristics of *Melaleuca alternifolia* (Maiden & Betche) Cheel

Melaleuca alternifolia Cheel is a small plant that can grow up to 7 meters in height, with a dense crown and whitish, papery bark. The leaves are arranged alternately, sometimes scattered or curled. The leaves are smooth, soft, linear, 10-35 mm long and 1 mm wide. They have distinct glands, making them rich in oil. The flowers form in short, 3-5 cm long spikes, usually from spring to early summer, and are white or cream in color. Small, woody, calyx-shaped fruits, 2-3 mm in diameter, are scattered along the branches (Puvača & al., 2019).

3.15.2. Parts of *Melaleuca alternifolia* (Maiden & Betche) Cheel Used

The parts of *Melaleuca alternifolia* (Maiden & Betche) Cheel that are used are the essential oils obtained from its leaves and fine branches (Kurban, 2018).

3.15.3. Distribution of *Melaleuca alternifolia* (Maiden & Betche) Cheel

Melaleuca alternifolia Cheel is endemic to Australia, and can be found in the southeastern part of Queensland, along the northern coast, and in the neighboring region of New South Wales (Puvača & al., 2019).

Figure 3.44. Distribution areas of Melaleuca alternifolia Cheel (http 30).

3.15.4. Chemical Composition of *Melaleuca alternifolia* (Maiden & Betche) Cheel

The main components of tea tree oil are terpinen-4-ol, γ-terpinen, α-terpinen, 1,8-cineole, p-cymene, terpinolene, α-terpineol, α-pinene, sabinene, aromadendrene, ledene, δ-cadinene, limonene, globulol, and viridiflorol (Lam & al., 2018).

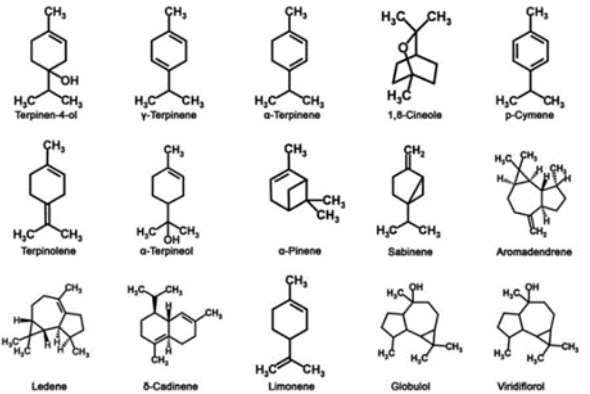


Figure 3.45. Chemical structures of the 15 main components of tea tree oil (Lam & al., 2018).

3.15.5. Use of *Melaleuca alternifolia* (Maiden & Betche) Cheel in Cosmetic Preparations

Tea tree oil (*Melaleuca alternifolia*) revitalizes the skin, helps reduce inflammation, and is used in the treatment of acne, dermatitis, and psoriasis. It is also used for treating insect bites, abrasions, wounds, burns, and cuts. The effectiveness of 5% benzoyl peroxide gel and 5% tea tree oil was compared in 124 acne patients. Tea tree oil was found to be as effective as benzoyl peroxide. Additionally, those treated with tea tree oil experienced fewer side effects such as irritation, dryness, and burning compared to those using benzoyl peroxide. It is effective against blackheads and cold sores. *Melaleuca alternifolia* is a broad-spectrum antimicrobial agent used against microorganisms and is included as an active ingredient in many topical formulations. It is effective against warts, athlete's foot, and ingrown nails. Due to its antiseptic, antifungal, antibacterial, and antiviral properties, it is included in hair care

products. *Melaleuca alternifolia* is used in many preparations such as shampoos, hair protectors, lip balms, oils, mouthwashes, toothpaste, soaps, masks, tonics, lotions, cleansers, and creams [Kavalalı, 2017; Durusoy & Ulusal, 2007; Sürme & Çürük, 2020; Erarslan & Ecevit-Genç, 2018; Koluman & Sügeç-Selçuk, 2016; Tezgül-Çakır & al., 2005].

3.15.6. Side Effects and Contraindications of *Melaleuca alternifolia* (Maiden & Betche) Cheel

Exposure to tea tree oil (*Melaleuca alternifolia*) has been reported to cause allergic contact dermatitis in sensitive individuals (Minghetti & al., 2009).

3.16. *Simmondsia chinensis* (Link) C. K. Schneid

Known as "Jojoba," *Simmondsia chinensis* (Link) C. K. Schneid is a woody, evergreen, perennial shrub from the *Simmondsiaceae* family (Abdel-Mageed & al., 2014).

Figure 3.46. Field image of Simmondsia chinensis (Link) C. K. Schneid. (http 31)

3.16.1. Botanical Characteristics of *Simmondsia chinensis* (Link) C. K. Schneid

Simmondsia chinensis (Link) C. K., a perennial, woody, branched, dioecious shrub. It has a strong taproot system, erect branches with opposite decussate leaves, oval capsule fruits, and shiny black seeds. The plant flowers from February to April, the fruits appear from July to August, and the seeds fully mature in October. The roots have a dark brown surface with fine longitudinal lines. The taproot system consists of several taproots that branch repeatedly under the crown, with a maximum depth of approximately 15m and a diameter of about 15cm. It also contains many adventitious roots and rootlets. Dried roots break easily and have a short, fibrous, brittle texture, are odorless, and have a bitter taste. The young stems are green, hairy, and flexible, 15-75 cm tall, and 2-7 mm in diameter. The leaves vary in color from green to gray, are opposite, decussate, exstipulate, and short-stalked near the stem. The lamina is simple, rectangular-oval, 2-6 cm long, and 1-2.5 cm wide. Both the upper and lower surfaces are the same color and hairy. The flowers are regular, actinomorphic, unisexual, and dioecious. The flower size varies by sex and can reach 2-5 mm in diameter. The flowers are composed of two overlapping calyxes. The fruits are small, green-stemmed, loculicidal, thick capsules. The fruits are oval-shaped, 2-4 cm long, and 1-1.7 cm in diameter. When immature, they have a smooth, shiny, green appearance, but when

mature, they take on a longitudinally wrinkled, dark brown appearance (Ashour & al., 2013).

3.16.2. Parts of *Simmondsia chinensis* (Link) C. K. Schneid Used

The part of *Simmondsia chinensis* (Link) C. K. Schneid utilized is the oil obtained from its seeds (Kurban, 2018).

3.16.3. Distribution Areas of *Simmondsia chinensis* (Link) C. K. Schneid

Simmondsia chinensis is native to the southwestern United States, growing in desert and semi-desert regions, as well as in northwestern Mexico. Due to its high economic value, jojoba cultivation is carried out in various countries, including Argentina, Peru, Australia, Israel, Palestine, and Egypt (Abdel-Mageed & al., 2014).

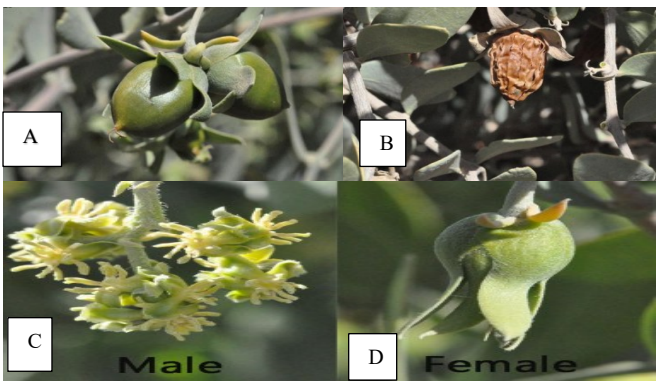


Figure 3.47. Simmondsia chinensis (Link) C. K. Schneid species: A. green fruit B. matured fruit C. male flowers D. female flowers (Al-Obaidi & al., 2017)

Figure 3.48. Distribution areas of Simmondsia chinensis (Link) C. K. Schneid (http 31)

3.16.4. Chemical Composition of *Simmondsia chinensis* (Link) C. K. Schneid

The seeds of *Simmondsia chinensis* contain approximately 50% odorless, light yellow oil. Unlike other vegetable oils, jojoba oil is not a mixture of triacylglycerols. About 97% of the jojoba seed oil by weight consists of straight-chain esters of mono-unsaturated long-chain fatty acids and long-chain primary alcohols. More than 60% of this ester mixture by weight contains cis-11-eicosenoic acid (jojoba acid, C20). Jojoba oil also includes small amounts of free fatty acids, alcohols, phytosterols, tocopherols, phospholipids, and trace amounts of triacylglycerols [Le Dréau & al., 2009; Salgın, 2007].

3.16.5. The Use of *Simmondsia chinensis* (Link) C. K. Schneid in Cosmetic Preparations

Jojoba seed oil, recognized as one of the best cosmetic lipid materials in use today—whether natural or synthetic—is considered

one of the finest cosmetic ingredients globally. This is because *jojoba* seed oil is highly effective for non-comedogenic moisture control and photoprotection on the skin, hair, and the external surfaces of the eyes while being resistant to hydrolysis and oxidation. Jojoba oil exhibits various properties such as antimicrobial, antioxidant, antiviral, and anti-inflammatory effects. It is also used as an emollient agent and is effective against acne, sunburn, and psoriasis. Due to its anti-inflammatory properties, jojoba oil is included in the formulations of creams designed to prevent sensitivity and erythema caused by procedures like laser treatments, UV exposure, rosacea, and chemical peels. The seeds of *Simmondsia chinensis* are utilized in hair care products for their ability to nourish the scalp and hair, increase hair volume, and provide moisturizing benefits. *Simmondsia chinensis* is found in various cosmetic products, including hair conditioners, hair oils, lotions, oils, serums, masks, creams, body milks, gels, and sunscreens. Jojoba oil is also an excellent essential oil diluent and perfume base. [Salgın, 2007; Gad & al., 2021; Durusoy & Ulusal, 2007; Koluman & Süzgeç-Selçuk, 2016; Athar & Nasir, 2005].

3.16.6. Adverse Effects and Contraindications of *Simmondsia chinensis* (Link) C. K. Schneid

Patch tests conducted on humans with jojoba oil have reported no allergic reactions, except in hyperallergic individuals (Gad & al., 2021).

3.17. *Argania spinosa* (L.) Skeels

Commonly known as "Argan," *Argania spinosa* (L.) Skeels is a slow-growing, thorny tree belonging to the family Sapotaceae (Mirpoor & al., 2022).

Figure 3.49. Habitat view of Argania spinosa (L.) Skeels (Laaribya & al., 2017)

3.17.1. Botanical Characteristics of *Argania spinosa* (L.) Skeels

Argania spinosa (L.) Skeels is the only representative species of the Sapotaceae family in Morocco. *Argania spinosa* is a drought-resistant species that can grow up to 10 meters tall and live for an average of 150-200 years. It typically has a thorny, short, and tuberous trunk. *A. spinosa* has fasciculate or alternate, obovate to lanceolate-shaped leaves with short petioles and persistent foliage. The tree flowers in spring, with hermaphroditic flowers that are yellow-green in color. Its fruits appear 9-16 months later, initially green but turning yellow-brown when ripe. The fruit reaches maturity in June, and the fruiting period lasts until October. *A. spinosa* bears seedless, oval-shaped fruits with pointed ends. These fruits typically measure 2-4 x 1.5-3 cm and weigh between 5-20

grams. Of this weight, 55-75% is pulp. The fruit contains a fleshy pericarp and a hard-shelled seed inside, which holds a seed similar to an almond [Mechqoq & al., 2021; El Monfalouti, 2010].

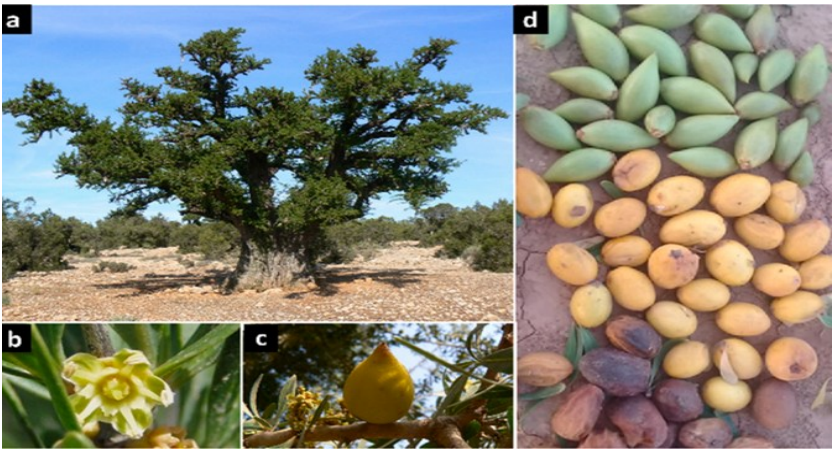


Figure 3.50.(a) General view of Argania spinosa (L.) Skeels, (b) flower image, (c) fruit image, (d) different stages of fruit ripeness (Mechqoq & al., 2021)

3.17.2. Used Parts of *Argania spinosa* (L.) Skeels

The used part of *Argania spinosa* (L.) Skeels is the seed oil (Kurban, 2018).

3.17.3. Distribution of *Argania spinosa* (L.) Skeels

Argania spinosa (L.) Skeels, an endemic plant of Morocco, is also cultivated in desert and semi-desert regions, including the southwest of Algeria, as well as in deserts of South Africa, Spain, Kuwait, Mexico, Tunisia, and Israel (Mirpoor & al., 2022).

3.17.4. Chemical Composition of *Argania spinosa* (L.) Skeels

Argan oil is composed of 99% fatty acids, with the unsaponifiable fraction making up only 1%. The fatty acid content consists of oleic acid (45%), linoleic acid (35%), and palmitic acid (12%). Stearic, behenic, arachidic, linolenic, palmitoleic, and iristic acids make up the remainder. In *Argania spinosa* oil, fatty acids are found in monoglyceride, diglyceride, and triglyceride forms. The unsaponifiable fraction contains various chemical components, such as triterpenoid alcohols, sterols, tocopherols, carotenoid pigments, squalene, and phenolic compounds. Triterpenoid alcohols, which contain complex compounds with a 30-carbon structure and five condensed cyclohexane rings, make up 20% of the unsaponifiable fraction. Major triterpenoid alcohols in Argan oil include β-amyrin, oleanane, ursane, turicallol-type lupane, and butirospermol derivatives. The other chemical compounds, which make up 20% of the unsaponifiable fraction, are generally 27, 28, or 29 carbon tetracyclic sterols. Argan oil contains major sterols characteristic of the *Sapotaceae* family, including spinasterol, schottenol, stigmasta-8,22-dien-3β-ol, stigmasta-7,24-28-dien-3β-ol, campesterol, and stigmasterol. The presence of sterols distinguishes Argan oil from other fixed oils. γ-tocopherol is the major tocopherol compound in Argan oil. Carotenoids, which are unsaturated tetraterpenes composed of 8 isoprene units, make up 42% of the unsaponifiable fraction. Argan oil is rich in phenolic compounds, with hydrocarbons being the primary squalene components (Yazıcı-Bektaş & Gürer, 2022).

3.17.5. Use of *Argania spinosa* (L.) Skeels in Cosmetic Preparations

Argan oil, which has been traditionally used in Morocco for centuries, is considered the beauty secret of Moroccan women. Traditionally, argan oil is claimed to eliminate not only skin acne but also chickenpox disease. It is recommended to improve nail brittleness and reduce various issues such as wrinkles and dry skin. Moroccan women also use this oil to add shine to their hair. Argan oil is an excellent anti-aging skincare oil. Due to its moisturizing properties and ability to prevent signs of premature aging, cosmetic and enriched argan oils are included in the formulations of serums or creams. UV radiation can lead to wrinkles on the skin by causing MMP-mediated collagen degradation. The protective effects of argan oil on the skin are attributed to its high polyphenol content, which is known to prevent collagen breakdown, photoaging due to inflammatory responses, and UV-B-induced wrinkle formation. Several studies have shown that argan oil increases skin elasticity, accelerates wound healing, reduces protein loss in hair, inhibits melanin biosynthesis, protects skin cells from oxidative stress, and reduces water loss in the epidermis. Argan oil can also regulate sebum levels. The seeds of *Argania spinosa* are used in hair care products due to their nourishing, oil-controlling, moisturizing, and shine-enhancing properties. *Argania spinosa* (L.) Skeels is used in a variety of cosmetic preparations such as shampoos, hair masks, balms, soaps, serums, lotions, gels, oils, scrubs, and creams [Guillaume & Charrouf, 2011; Yazıcı-Bektaş & Gürer, 2022; Erarslan & Ecevit-Genç, 2018; Koluman & Süzgeç-Selçuk, 2016].

3.17.6. *Argania spinosa* (L.) Skeels Species Side Effects and Contraindications

Studies have reported that the external use of *Argania spinosa* oil may lead to contact dermatitis (Yazıcı-Bektaş & Gürer, 2022).

3.18. *Vitellaria paradoxa* C.F. Gaertn.

Known as "Karité" or "Shea tree," *Vitellaria paradoxa* C.F. Gaertn. is a perennial woody species belonging to the Sapotaceae family [Karaca & Güzel-Kara, 2024; Asante & al., 2012].

Figure 3.51. Field image of Vitellaria paradoxa C.F. Gaertn. species (Choungo-Nguekeng & al., 2021).

3.18.1. Botanical Characteristics of *Vitellaria paradoxa* C.F. Gaertn.

Vitellaria paradoxa C.F. Gaertn., a deciduous tree, is typically found in dry or semi-arid areas to the north of the humid forest regions. The Shea tree can reach a height of 15-22 meters, with a trunk diameter ranging from 0.5 to 1 meter. *Vitellaria paradoxa* begins to bear fruit after approximately 15 years and can produce

high-quality fruits with high oil content until the age of 30. The fruits, which weigh between 10-57 g and have an annual production of 15-30 kg per tree, are produced from May to August. The fruits of *Vitellaria paradoxa* are typically between 2-5 cm in size and have an oval shape. They consist of a fleshy mesocarp, a green epicarp, and a hard shell or a seed surrounding the endocarp or embryo. During growth, the fruit is initially green, but it turns from yellowish-green to brown as it matures. The seed coat is relatively thin, glossy, and has a wide scar; the seed itself consists of two thick, fleshy, closely arranged cotyledons. The tree has thick bark with longitudinal and deep cracks. The leaves are arranged in dense clusters in a spiral pattern at the tips of thick branches. The petiole length ranges from 5 to 15 cm. Young leaves are rust-red and hairy, while older leaves are leathery, hairless, dark green, shiny, and measure 12-25 cm in length and 4-7 cm in width. Several flowers or leaf scars are clustered in the axils of the uppermost leaves or on leafless branches. The flowers are hermaphroditic and actinomorphic, wrapped with a very small bract at the base of the petiole. The creamy white flowers, which are highly fragrant, are carried on flower stems that are 22-25 cm long [Karaca & Güzel-Kara, 2024; Choungo-Nguekeng & al., 2021].

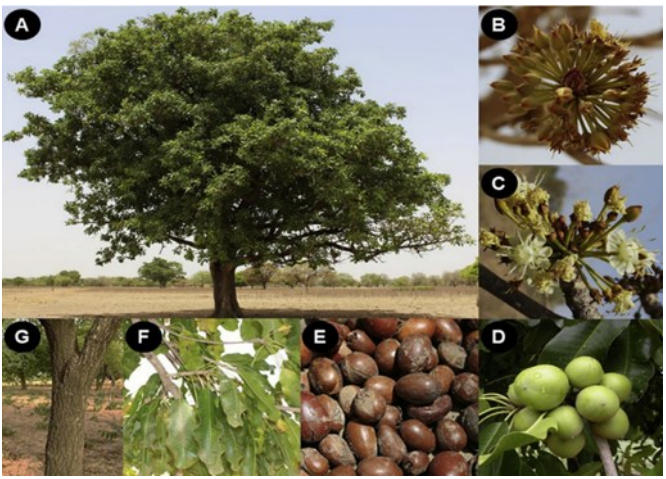


Figure 3.52. The images of Vitellaria paradoxa C.F. Gaertn. (A) General view, (B) Flower bud view, (C) View of blooming flowers, (D) Fruit view, (E) Seed view, (F) Leaf view, (G) Tree trunk view (Dimobe & al., 2020).

3.18.2. Used Parts of Vitellaria paradoxa C.F. Gaertn.

The used parts of *Vitellaria paradoxa* C.F. Gaertn. include its leaves, seeds, fruits, roots, bark, and the oil obtained from its fruits [Karaca & Güzel-Kara, 2024; Kurban, 2018].

3.18.3. Distribution Areas of *Vitellaria paradoxa* C.F. Gaertn.

Vitellaria paradoxa C.F. Gaertn., which grows only in forested savannas in Africa, is found in various countries such as Senegal, Mali, Burkina Faso, Guinea-Bissau, Guinea, Sierra Leone, Ivory Coast, Ghana, Togo, Benin, Nigeria, Cameroon, Chad, and Ethiopia (Alain & al., 2022).

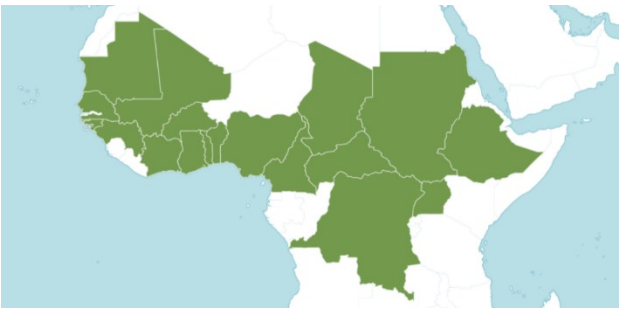


Figure 3.53. Distribution areas of Vitellaria paradoxa C.F. Gaertn. (http 32)

3.18.4. Chemical Composition of *Vitellaria paradoxa* C.F. Gaertn.

Shea butter is characterized by 16 saturated and unsaturated fatty acids. Arachidic, linoleic, palmitic, stearic, and oleic acids are the most abundant. Kerotic, capric, caprylic, caproic, lignoceric, behenic, gadoleic, vaccenic, myristic, and lauric acids are present in smaller amounts. The saponifiable triglyceride fraction of shea butter, which constitutes 90% of the mass of the butter, is primarily rich in oleic and stearic acids. The unsaponifiable fraction of the oil contains various components, with triterpene alcohols (α-amyrin, ß-amyrin, lupeol, butirospermol) as the main components, along with sugars, cucurbits, phenolic compounds, vitamin E, phytosterols, and polyisoprenic hydrocarbons. These chemical compounds are responsible for the medicinal properties of the oil and are promising bioactive compounds for new functional cosmetic formulations. The content of triterpene alcohols in the unsaponifiable fraction of the oil has been examined, and the presence of four triterpene acetates (α-amyrin acetate, β-amyrin acetate, lupeol acetate, and butirospermol

acetate) and four triterpene cinnamates (α-amyrin cinnamate, β-amyrin cinnamate, lupeol cinnamate, and butirospermol cinnamate) has been reported. A study has identified phenolic components in the seeds of *Vitellaria paradoxa* C.F. Gaertn., including epigallocatechin gallate, gallocatechin gallate, epigallocatechin, gallocatechin, epicatechin gallate, epicatechin, catechin, and gallic acid. In addition to these components, the presence of rutin, arbutin, trans-cinnamic acid, and quercetin has also been reported (Karaca & Güzel-Kara, 2024).

3.18.5. Use of *Vitellaria paradoxa* C.F. Gaertn. in Cosmetic Preparations

Various studies have reported that the triterpene alcohols found in shea butter have anti-inflammatory effects. In esterified forms, α/β-amyrin, acetyl, lupeol, and cinnamyl triterpenes are chemical compounds with anti-inflammatory properties. Due to the presence of various polyphenols and tocopherol compounds, the oil also possesses antioxidant properties. Because of its antimicrobial effects, commercial creams and soaps derived from shea butter are used in treating various fungal and bacterial skin infections. Shea butter soap is suitable for individuals with allergies to soaps containing various additives such as triclosan, butylated hydroxytoluene, isopropyl alcohol, and diethanolamine, as well as for treating acne and similar skin disorders. It has been reported that applying shea butter directly to affected skin and mucosal membranes can treat scabies. It is also used topically for the treatment of herpes. The triterpene alcohol esters in shea butter provide protease-inhibiting and anti-inflammatory effects, making it beneficial in high-performance skincare products like sun care

products and sunscreens. The cinnamate esters of triterpene alcohol found in the unsaponifiable fraction of *Vitellaria paradoxa* C.F. Gaertn. oil strongly absorb UV radiation, protecting the skin from harmful UV rays. Shea butter (*Vitellaria paradoxa* C.F. Gaertn.) creams containing unsaponifiable components enhance sun protection synergistically by increasing UV-B radiation absorption. Pure shea butter has proven to have excellent skin-healing properties and acts as an excellent moisturizer. Due to its vitamin E content and fatty acids, it can penetrate deeply into the skin to heal small cracks caused by severe dryness. Additionally, the vitamin E in shea butter helps reduce old scar tissue. Thanks to its vitamin A content, it soothes skin allergies caused by poison ivy and insect bites. Shea butter has been reported to be beneficial for various skin problems, including dry skin, peeling after tanning, skin flaking, blemishes, sunburn, itchy, rough, or bumpy skin, heat-induced skin damage, dermatitis, and eczema. In one study, the application of an over-the-counter moisturizer containing shea butter for two weeks in adults significantly reduced the symptoms of mild to moderate eczema. Shea butter helps prevent photo-aging and slows down the aging process by softening the skin and renewing tissue cells due to its UV anti-erythemic activity. The oil obtained from the seeds of *Vitellaria paradoxa* C.F. Gaertn. is frequently used in hair care products due to its moisturizing, hair and scalp nourishing, and dandruff-preventing properties. It helps restore moisture to hair that has lost its natural moisture due to chemical treatments such as straighteners, curling irons, and perms. It is used alone or with *Aloe vera* for hair loss treatment. Due to its high content of unsaponifiable substances, *Vitellaria paradoxa* C.F. Gaertn. is in high demand by the cosmetic

industry and is found in various cosmetic preparations such as shampoos, hair conditioners, bar soaps, scrubs, masks, gels, lotions, serums, cleansing milks, body oils, eye care products, hand creams, and lip balms. [Karaca & Güzel-Kara, 2024; Abdul-Mumeen & al., 2019; Erarslan & Ecevit-Genç, 2018; Koluman & Süzgeç-Selçuk, 2016].

3.18.6. Side Effects and Contraindications of *Vitellaria paradoxa* C.F. Gaertn.

No allergic reactions have been reported related to the topical or oral use of shea butter (Karaca & Güzel-Kara, 2024).

4. CONCLUSION

Cosmetology is a field of science that examines and develops all preparations and substances designed for application to various parts of the body, such as the epidermis, nails, lips, hair, body hair, and external genital organs, as well as the mucous membranes of the mouth and teeth. Its main purposes are to clean these areas, alter their appearance, add fragrance, preserve or correct body odors, and maintain them in good condition. For centuries, humans, regardless of gender, have created lotions, paints, creams, perfumes, and other products to beautify themselves, appear youthful, attract others, prevent unwanted marks like scars, acne, and wrinkles on their faces, protect their skin from environmental factors such as sun, cold, and wind, get rid of unwanted body hair, prevent hair loss, or change hair color (Çomoğlu, 2012).

Cosmetics, which are consumed more than pharmaceuticals, have become indispensable in today's world. Cosmetics are no longer made from simple formulas and ingredients like they used to be. Companies with a large market share in the cosmetic industry are making significant investments to carry out research and development activities. Interest in cosmetic products is increasing among both women and men. This has led to the cosmetics industry becoming a massive industrial sector today (Yıldız, 2021).

Especially in recent times, plant-based products are becoming more prominent in cosmetic preparations. Due to the harmful effects of chemical substances found in cosmetic products, the use of plant-based products has come to the forefront. As the side effects of these chemicals in cosmetics became known, the use of plants in cosmetic formulations increased. The cosmetic industry,

which has not remained indifferent to this growing demand, is introducing new plant-based cosmetic products to the market every day. Plant-based cosmetic preparations are much easier to decompose than chemicals and cause lower toxicity. In addition to these properties, plants are frequently used in cosmetic preparations due to their many benefits such as antioxidant, astringent, antimicrobial, sunscreen, anti-aging, and moisturizing properties (Üstündağ-Okur & al., 2020).

In our study, current data related to plants used in the cosmetic field were reviewed, and examinations were carried out under the main and subheadings presented in Table 2. According to the results obtained, a detailed study has been conducted on plant species found in cosmetic preparations, and based on the data from scientific sources regarding these species, the areas of use of these plant species are summarized in Table 3. This table, created as a result of our literature review, is open to discussion. For example, while plant species such as *Matricaria chamomilla* L. are used in all the areas we defined, some plant species have only been found to be used in certain areas.

In addition, it is important to pay attention to the use of plants in various fields, including the cosmetic field. Unfortunately, the common belief among the public that "if it's natural, it's harmless" has led to unwanted outcomes. Especially, incorrect applications with phytotoxic plant species can have serious consequences, even the external use of preparations with toxicity that has not been fully researched in pregnant women.

When the preparations listed in the "List of Unsafe Cosmetic Products" published by the Turkish Medicines and Medical Devices Agency are examined, it is observed that many companies and individuals are irresponsibly releasing cosmetic products into the market, which are being used by people. These preparations, produced by individuals who have never received education in any phase of the production of cosmetic products, pose serious threats to human health. Pharmacists, who have acquired sufficient knowledge in the cosmetic field through the courses they took during their five years of education and have become the closest health consultants to the public, can provide the best advice in this field with the phytocosmetic and dermocosmetic products they sell in pharmacies. The legal regulations should especially focus on making pharmacies the sole sales point for cosmetic products, rather than online stores and unlicensed sales centers.

Table 2. According to the results of our literature review, the use of plants in the cosmetic field

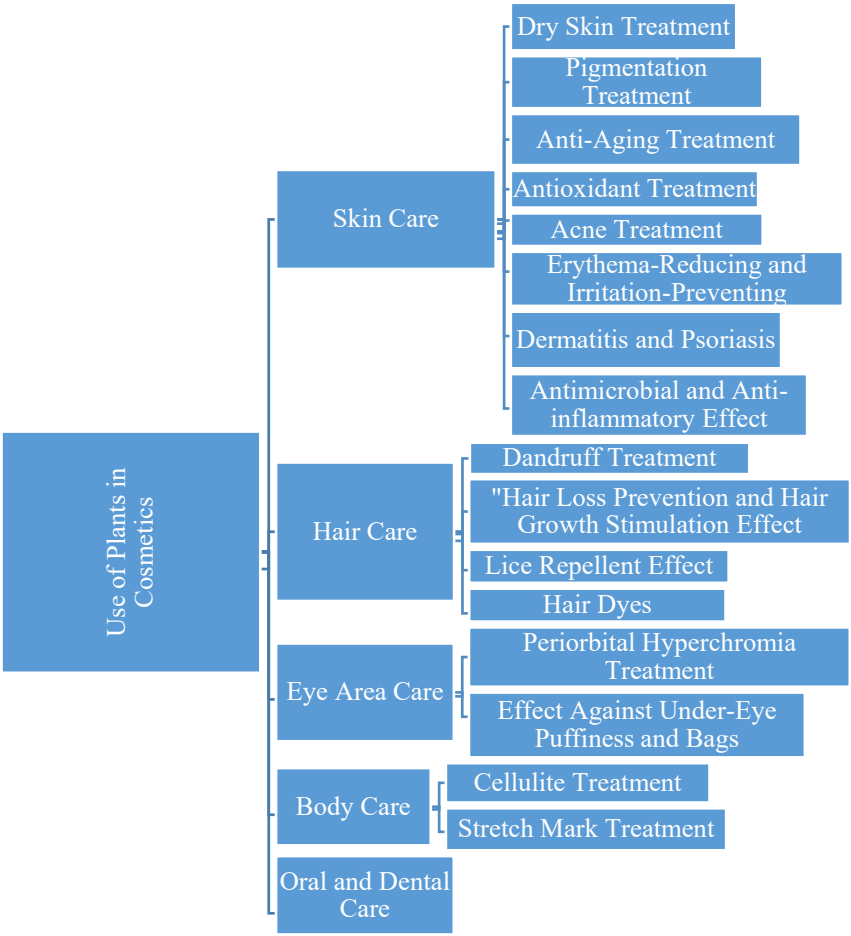


Table 1. General Classification of Some Plants Used in Cosmetics According to the Results of Our Literature Review

Skin Care (General)	**Hair Care (General)**	**Body Care (General)**	**Eye Area Care (General)**	**Oral and Dental Care (General)**
Achillea millefolium L.	*Achillea millefolium* L.	*Achillea millefolium* L.		
Calendula officinalis L	*Calendula officinalis* L.	*Calendula officinalis* L.		*Calendula officinalis* L.
Carthamus tinctorius L.	*Carthamus tinctorius* L.	*Carthamus tinctorius* L.		
Centella asiatica (L.) Urb.	*Centella asiatica* (L.) Urb.	*Centella asiatica* (L.) Urb.	*Centella asiatica* (L.) Urb.	
Hamamelis virgiana L.	*Hamamelis virgiana* L.	*Hamamelis virgiana* L.	*Hamamelis virgiana* L.	
Matricaria chamomilla L.	*Matricaria chamomilla* L.	*Matricaria chamomilla* L.	*Matricaria chamomilla* L.	*Matricaria chamomilla* L.

Glycine max (L.) Merr.	*Glycine max* (L.) Merr.	*Glycine max* (L.) Merr.	*Glycine max* (L.) Merr.	
Echinacea purpurea (L.) Moench	*Echinacea purpurea* (L.) Moench	*Echinacea purpurea* (L.) Moench		
Aesculus hippocastanum L.	*Aesculus hippocastanum* L.	*Aesculus hippocastanum* L.		
Hypericum perforatum L.	*Hypericum perforatum* L.	*Hypericum perforatum* L.	*Hypericum perforatum* L.	
Centaurea cyanus L.	*Centaurea cyanus* L.	*Centaurea cyanus* L.	*Centaurea cyanus* L.	
Adansonia digitata L.	*Adansonia digitata* L.	*Adansonia digitata* L		
Santalum album L.	*Santalum album* L.	*Santalum album* L.		
Rosa damascena Mill.	*Rosa damascena* Mill.	*Rosa damascena* Mill.		*Rosa damascena* Mill.
Melaleuca alternifolia	*Melaleuca alternifolia*	*Melaleuca alternifolia* (Maiden &		*Melaleuca alternifolia* (Maiden &

(Maiden & Betche) Cheel	(Maiden & Betche) Cheel	Betche) Cheel		Betche) Cheel
Simmondsia chinensis (Link) C.K.	*Simmondsia chinensis* (Link) C.K.	*Simmondsia chinensis* (Link) C.K.	*Simmondsia chinensis* (Link) C.K.	
Argania spinosa (L.) Skeels	*Argania spinosa* (L.) Skeels	*Argania spinosa* (L.) Skeels		
Vitellaria paradoxa C. F. Gaertn	*Vitellaria paradoxa* C. F. Gaertn	*Vitellaria paradoxa* C. F. Gaertn	*Vitellaria paradoxa* C. F. Gaertn	

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