Selcuk Journal of Agriculture and Food Sciences

https://dergipark.org.tr/tr/pub/selcukjafsci

Review

(2025) 39(2), 487-493 DOI: 10.15316/selcukjafsci.1477328 e-ISSN: 2458-8377 Selcuk J Agr Food Sci

Silybum marianum (L.) Gaertner: A Review of Its Traditional Uses, Phytochemistry and Pharmacology

İrem Ayran Çolak[1,*], Sadiye Ayşe Çelik[2]

[1]Selçuk University, Faculty of Agriculture, Department of Field Crops, Konya, Türkiye

HIGHLIGHTS

- Giving information about the history, geographical distribution, and botanical characteristics of milk thistle.
- The use of milk thistle in both traditional and modern medicine.
- Chemical composition, biological activity, and pharmacological use of milk thistle.

Abstract

Silybum marianum (L.) Gaertn., commonly known as "milk thistle", Asteraceae family, is a plant that has adapted to diverse soil and environmental conditions across all continents. Originally grown in Southern Europe and Asia, it is now found worldwide. Milk thistle has been used for medicinal purposes for over 2000 years, primarily for treating liver disease such as cirrhosis and hepatitis, as well as protecting the liver from toxic substances. The therapeutic effects of milk thistle are attributed to the flavonoid complex silymarin, which is most abundant in the ripe seeds (achenes) of the plant. Pharmacological studies have shown that this plant has antioxidant, anti-inflammatory, antitumor, hepatoprotective, and liver regenerative effects. All parts of the plant are also used medicinally. In addition, Milk thistle has essential uses, including the food industry as a supplement, food use as fresh or fried vegetables, livestock feeding, the cosmetic industry, bioenergy production, biocidal activity, and phytoremediation.

Keywords: Milk thistle, *Silybum marianum* (L.) Gaertn.; silymarin; traditional medicine use; chemical composition; biological activity

1. Introduction

Milk thistle [*Silybum marianum* (L.) Gaertner] has a long history of medicinal use that dates back over 2000 years. The ancient Greek physician Dioscorides was one of the first to document the use of milk thistle for the treatment of snake bites, while Pliny the Elder noted its application for the removal of bile when mixed with honey. During the Middle Ages, it gained prominence as a remedy for liver conditions and as an antidote for liver toxins (Post-White et al. 2007).

Milk thistle is an annual or biennial herbaceous plant belonging to the Asteraceae family. In general, rosette leaves emerge in the first year, and in the second year, the stem grows to a height of 30-150 cm between the rosette leaves (Demirezer et al. 2007). The plant is distributed in the Mediterranean countries, North Africa,

Citation: Ayran Çolak İ, Çelik SA (2025). *Silybum marianum* (L.) Gaertner: A review of its traditional uses, phytochemistry and pharmacology. *Selcuk Journal of Agriculture and Food Sciences* 39(2), 487-493. https://doi.org/10.15316/selcukjafsci.1477328
***Correspondence:** irem.ayran@selcuk.edu.tr
Received date: 02/05/2024
Accepted date: 24/03/2025

Asia Minor, and Southern Russia (WHO monographs 2002). It is also widespread in many parts of the European continent, North and South America, and is found in the wild in Australia. It is widespread in the western, northern, and southern regions of our country. Additionally, it can be found up to 700 meters on roads, field edges, and empty fields in Türkiye (Davis 1975; Zeybek and Haksel 2010).

The large spiny leaves of the plant display white spots that resemble milk, which is the basis for the English name "Milk Thistle" (Baytop 1999). Another reason why it is called Milk Thistle comes from the belief that the white liquid veins and white spots were formed when the milk of Mary, who breastfed Jesus Christ, dripped on the leaves of this plant (Baser 2008). The botanical name of this plant is *Silybum marianum* (L.) Gaertner and its synonym is "*Carduus marianus* L.". This plant is commonly referred to by several names, including "Marian thistle, wild artichoke, variegated thistle, St. Mary's thistle, crown of Jesus, holy thistle, Venus thistle, heal thistle, and wand of God's grace" (Tenney 1995; Baytop 1999). The names known in Turkish are "akkız, devedikeni, deve kengeri, kengel, kıbbun, meryemana dikeni, sütlü kengel, şevkülmeryem, uslu kenger" etc. names (Baytop 1999; Demirezer et al. 2007).

Milk thistle, due to its significant chemical composition, serves as an important herbal raw material in both traditional and modern medicine applications, making it a subject of ongoing scientific research. This article aims to provide an overview of the significant information on the biology and chemistry of milk thistle, its historical and current uses, the industries where it is supplied as raw material, and its role in traditional and modern medicine.

2. Taxonomic Classification and Botanical Characteristics

Milk thistle belongs to the family Asteraceae (commonly known as the daisy family), within the subfamily Carduoideae and the tribe Cardueae, and is identified under the genus *Silybum* with the species name *Silybum marianum* (L.) Gaertn. (Sharma and Singh 2023). Milk thistle is one of the plants that does not require specific cultivation conditions; however, its growth is favored by a humid and warm climate as well as fertile soil (Sowińska and Szpunar 2022). The plant resembles a thistle in appearance (Fig. 1f) and is between 30 and 100 cm in height. The stem is longitudinally striate, long and slender, softly hairy, and sparsely. The leaves are hairless, pale green with white speckled spots along the veins, and distinctly toothed and spiny. White spots on rosette leaves (Fig. 1b, c) are due to calcium carbonate accumulation (Zeybek and Haksel 2010). Basal leaves are triangular, lobed, ovate, stalked, and measure 9-26 x 5-12 cm. The upper leaves are simple, ovate-lanceolate in shape. The involucre is 2.5-4 x 2-4 cm in size, with the outer phyllaries recurved and spiny, broadly expanded at the base, the inner ones erect, and the innermost ones lanceolate and not appendaged. The brownish achenes are black-striped and measure 7 x 3 mm. The achenes are topped with white-colored pappus hairs (approximately 15 mm in length) (Fig.1a), which play a crucial role in the dispersal and wind-borne transportation of the fruit (Ceylan 1994; WHO monographs 2002; Demirezer 2011). The flower color of this plant is purple, light pink, and white (Çelik 2009) (Fig. 1d,e). Additionally, as a honey plant, it attracts insects, particularly bees and butterflies. Depending on the region or climate, flowering occurs between April and May or July and August (Davis 1975; Demirezer et al. 2007), and the achenes, source of valuable substances such as flavonolignans, ripen around September and October (Sowińska and Szpunar 2022).

3. Traditional and Pharmacological Uses

Silybum marianum (L.) Gaertn. is native to the Mediterranean region and has a long history of use in traditional medicine. The achenes, leaves, and roots have been utilized for the treatment of various health conditions since ancient times. The Roman naturalist Pliny the Elder was the first to note its medicinal properties, observing that when mixed with honey, the plant increased bile flow, thus linking it to the treatment of liver diseases. During the early Christian period, the plant was dedicated to the Virgin Mary and became known as the Marian thistle. Used for over two millennia, it was described in *Planta Medica* as the "blessed plant from past to future" (Ceylan 1994; Zeybek and Haksel 2010). By the Middle Ages, it was widely recognized that the achenes of the plant had positive therapeutic effects on the liver (Çelik 2009). According

to Baytop (1999), the fruits of *Silybum marianum* are traditionally ground into a powder and mixed with honey in Türkiye. This mixture is used as a remedy for liver disorders, gallbladder disorders, and digestive system issues.

Figure 1. The botanical parts of the milk thistle: (a) achenes and pappus on the seed; (b) the plant seedling; (c) white spots on the rosette leaf; (d, e) flowers of milk thistle; (f) herbaceous plant.

Culinary use of the plant is as follows: the young stems of the Mary's thistle can be peeled and eaten raw or cooked, and they are often used in salads or pickled. Additionally, the fresh leaves, stems, roots, and flower buds of milk thistle can be boiled, and the resulting juice or tea is consumed for its nutritional and medicinal benefits (Marceddu et al. 2022; Herbazest 2024). According to the recipe provided by Demirezer (2021), two teaspoons (5 g) of the plant are added to boiling water, steeped for 10-15 minutes, and then consumed. However, the active ingredient of the plant, silymarin, is not present in this tea as it is poorly water-soluble. Pharmacologically, the above-ground parts of the plant are used as a diuretic (Kroll et al. 2007), antioxidant (Abenavoli et al. 2010), antipyretic, rheumatic pain reducer, and sedative, while the seeds regenerate liver cells (Flora et al. 1998), increase milk secretion, and additionally exhibit effects such as antiviral, antitumor, and anti-inflammatory (Demirezer et al. 2007; Eren and Sar 2020; Sowińska and Szpunar 2022).

4. Chemical Composition of The Milk Thistle

The most notable component of *Silybum marianum* is silymarin (1.5-3%), which belongs to the flavonolignans. The chemical formula of silymarin is $C_{25}H_{22}O_{10}$. Silymarin consists of subcomponents such as silybin (silibinin A and B), isosilybin, silychristin, and silydianin. The mature seeds are the part used as a drug in pharmacology, while all parts of the plant are traditionally used; in short, silymarin is found in the seeds of the plant and not in other organs such as the leaves, stems, and flowers (Gruenwald et al. 2004; Kren and Walterova 2005; Tanker et al. 2007; Kocaman and Dabak 2015). In addition to these, the plant contains several other essential chemical constituents, including flavonoids, fixed oils, polyenes, sterols, organic acids, and small amounts of mucilage substances (Zeybek and Haksel 2010). The flavonoids present in *Silybum marianum* include apigenin, luteolin, kaempferol, quercetin, naringenin, and taxifolin. The steroids identified in the plant consist of beta-sitosterol and beta-sitosterol glucosides. Fumaric acid (3.3%) is one of the organic acids found in the plant. The seeds of *Silybum marianum* contain 20-30% fixed oil, which is particularly rich in unsaturated fatty acids such as linoleic acid and oleic acid. Furthermore, the seeds serve as a source of vitamin E, phytosterols, and proteins (Gruenwald et al. 2004; Çelik 2009; European Pharmacopoeia 2011).

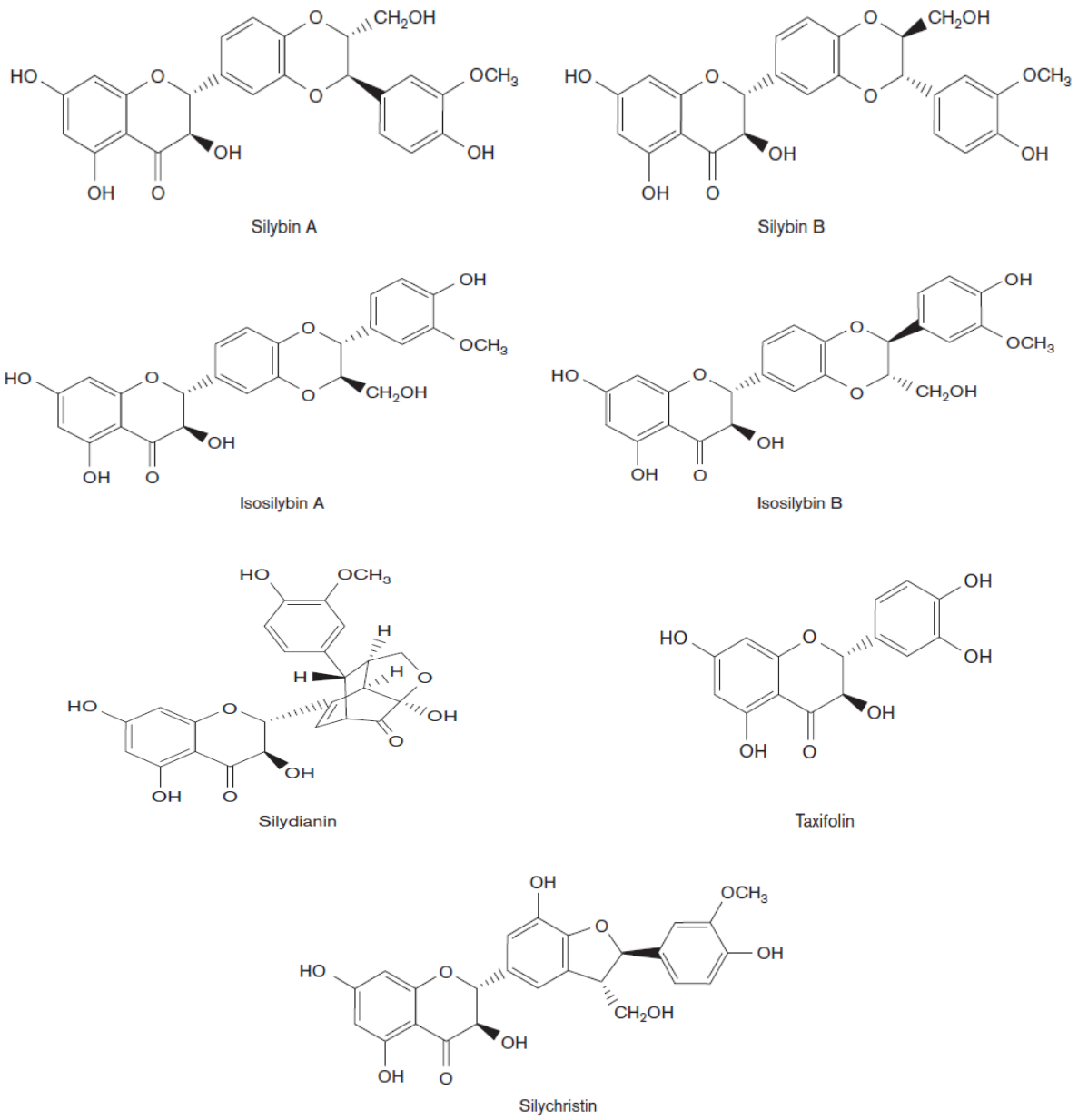

Figure 2. Chemical structure of some components of *Silybum marianum* (Mastron et al. 2015).

5. Uses of Milk Thistle in Cosmetics

Milk thistle, particularly its active compound silymarin, has gained attention in cosmetology due to its antioxidant, anti-inflammatory, and skin-protective properties (Kucharska et al. 2024). Studies have shown that silymarin can suppress oxidative stress and reduce damage caused by skin aging and UV radiation (Kim et al. 2023). For example, milk thistle oil is effective in improving the texture and resilience of chemically damaged hair, which also indicates its potential use in hair care products (Kim and Jeon 2023). Additionally, silymarin has been found to prevent UVB-induced skin cell damage (Emadi et al. 2022) and reduce melanin spots (Feher et al. 2011). These findings demonstrate that milk thistle can be utilized both protectively and reparatively in anti-aging creams, sunscreens, and hair care formulations. Consequently, the oil extracted from the achenes of *Silybum marianum* and its active component, silymarin, are recognized as valuable raw materials in the field of cosmetics.

6. Uses of Milk Thistle in Phytoremediation, Biomass and Biodiesel Production

S. marianum has significant potential for phytoremediation and biomass production due to its ability to grow and thrive in soils contaminated with heavy metals (Zheljazkov and Nikolov 1996). Its tolerance to heavy metals such as cadmium, chromium, lead, copper, manganese, and zinc (Domínguez et al. 2017) makes it a valuable plant for both environmental remediation and bioenergy production (Rady et al. 2018; Elateeq et al. 2020). Additionally, the oil extracted from *S. marianum* seeds is considered a suitable resource for bioenergy production, despite requiring a two-step process due to its high free fatty acid content. This process reduces the free fatty acid level in the oil, enabling its conversion into biodiesel (Ahmad et al. 2014).

7. Use in Animal Feeding

Milk thistle has the potential to enhance milk yield and meat quality in animals by reducing metabolic and oxidative stress due to its flavonolignan content (Krizova et al. 2011; Marceddu et al. 2022). However, its digestibility and energy value are lower compared to many commonly used feed plants (Özinan et al. 2017), and adverse characteristics such as nitrate toxicity are among the factors limiting its use in animal nutrition (Rady et al. 2018). Therefore, the potential benefits of *S. marianum* in animal feeding should be carefully evaluated, considering its method of application and dosage.

8. Conclusions

The studies have shown that all parts of *Silybum marianum* (L.) Gaertn. are also used medicinally. Additionally, milk thistle has essential applications, including use in the food industry (e.g., as a dietary supplement and fresh or fried vegetables), livestock feeding, the cosmetic industry, bioenergy production, and phytoremediation. The low soil and climate selectivity, combined with its biological and agronomic characteristics, make milk thistle a reliable alternative for low-input agriculture in sustainable farming systems. In addition, the thorny structure of the plant, the fact that the seeds do not ripen at the same time, and the differences in flowering/ripening stages are issues that need to be studied. In addition, despite its widespread use by the public, it is often confused with other thorny plants because consumers are not fully aware of the botanical differences. Therefore, more genetic, and agronomic research should be conducted on this plant, and reliable field studies are needed to determine appropriate planting, harvesting, and post-harvest treatments to different production targets to increase its production.

Author Contributions: İA, SAÇ: Participated in the examination of contemporary literature about the subject matter, tracking the latest developments and transforming them into this review article.

Funding: No external funding.

Conflicts of Interest: No conflicts of interest.

References

Abenavoli L, Capasso R, Milic N, Capasso F (2010). Milk thistle in liver diseases: past, present, future. *Phytotherapy Research* 24(10), 1423-1432.

Ahmad M, Zafar M, Sultana S, Azam A, Khan MA (2014). The optimization of biodiesel production from a novel source of wild non-edible oil-yielding plant *Silybum marianum*. *International Journal of Green Energy* 11, 589–594.

Baytop T (1999). Türkiye'de bitkiler ile tedavi (geçmişte ve bugün) ilaveli ikinci baskı, Nobel Tıp Kitabevleri, İstanbul.

Başer KHC (2008). Devedikeni *Silybum marianum* (L.) Gaertner. *Bağbahçe* 16, 22-23.

Ceylan A (1994). Tıbbi Bitkiler III. Ege Üniv. Ziraat Fak. Yay., No:500, İzmir. p. 136-144.

Çelik SA (2009) A study on the determination of silymarin and fixed oil components in the seeds of milk thistle (*Silybum marianum* (L.) Gaertner) grown under Konya ecological conditions. Master Thesis, Selcuk University (Unpublished), Türkiye.

Davis PH (1975). Flora of Turkey and the East Aegean Islands, Vol.5. Edinburgh: Edinburgh University Press.

Demirezer LÖ, Ersöz T, Saracoğlu İ, Şener B (2007). Tedavide kullanılan bitkiler. Ankara: Medikal & Nobel Tıp Kitabevi, Ankara.

Demirezer LÖ (2011). FFD monografları tedavide kullanılan bitkiler. Medikal Network Nobel Kitabevi. 2. Baskı. Ankara.

Demirezer LÖ (2021). Tıbbi çay reçeteleri. Hayy Kitap, 2. Baskı. İstanbul.

Domínguez MT, Montiel-Rozas MM, Madejón P, Diaz MJ, Madejón E (2017). The potential of native species as bioenergy crops on trace-element contaminated Mediterranean lands. *Science of the Total Environment* 590, 29–39.

Elateeq AA, Sun Y, Nxumalo W, Gabr AMM (2020). Biotechnological production of silymarin in *Silybum marianum* L.: a review. *Biocatalysis and Agricultural Biotechnology* 29, 1-16.

Emadi S, Ghasemi F, Mohammadi M (2022). Protective effects of silymarin against UVB-induced oxidative damage in human skin cells. *International Journal of Cosmetic Science* 44(1), 56-64.

Eren BH, Şar S (2020). Meryemana dikeni bitkisi: farmakolojik ve folklorik bir değerlendirme. *Lokman Hekim Dergisi* 10 (1), 23-27.

European Pharmacopoeia (2011). 7th Edition, Council of Europe, Strasbourg, France.

Fehér P, Vecsernyés M, Fenyvesi F, Váradi J, Kiss T, Újhelyi Z, Nagy K, Bácskay I (2011). Topical application of *Silybum marianum* extract. *Arad Medical Journal* 14, 5–8.

Flora K, Hahn M, Rosen H, Benner K (1998). Milk thistle (*Silybum marianum*) for the therapy of liver disease. *American Journal of Gastroenterology* 93(2), 139-143.

Gruenwald J, Brendler T, Jaenıcke C (2004). PDR for herbal medicines. 3rd Ed. Montvale, NJ: Thomson Healthcare, p.566-569.

Herbazest (2024). "Milk thistle". https://www.herbazest.com/herbs/milk-thistle (access date: 02.10.2024).

Kim J, Lee YN, Lee J, Lee SG, Kim H, Choi YS, Draelos ZD, Kim J (2023). Efficacy and safety of silymarin containing antioxidant serum as an adjuvant treatment of mild-to-moderate acne vulgaris: a prospective, open-label pilot study. *Journal of Cosmetic Dermatology* 22, 561–568.

Kim J, Jeon H (2023). The effects of silymarin on oxidative stress and UV-induced skin damage. *Journal of Dermatological Science* 45(2), 123-130.

Kocaman N, Dabak DÖ (2015). Hepatoprotektif bir ajan: Silymarin. *Fırat Tıp Dergisi* 20(3), 128-132.

Kren V, Walterova D (2005). Silybin and silymarin-new effects and applications. *Biomed Papers* 149(1), 29-41.

Krizova L, Watzkova J, Trinacty J, Richter M, Buchta M (2011). Rumen degradability and whole tract digestibility of flavonolignans from milk thistle (*Silybum marianum*) fruit expeller in dairy cows. *Czech Journal of Animal Science* 56, 269–278.

Kroll DJ, Shaw HS, Oberlies NH (2007). Milk thistle nomenclature: why it matters in cancer research and pharmacokinetic studies. *Integrative Cancer Therapies* 6(2), 110-119.

Kucharska E, Sarpong R, Bobkowska A, Ryglewicz J, Nowak A, Kucharski L, Muzykiewicz-Szymanska A, Duchnik W, Pełech R (2024). Use of *Silybum marianum* extract and bio-ferment for biodegradable cosmetic formulations to enhance antioxidant potential and effect of the type of vehicle on the percutaneous

absorption and skin retention of silybin and taxifolin. *Applied Sciences* 14, 169. https://doi.org/10.3390/app14010169

Marceddu R, Dinolfo L, Carrubba A, Sarno M, Di Miceli G (2022). Milk thistle (*Silybum marianum* L.) as a novel multipurpose crop for agriculture in marginal environments: A review. *Agronomy 12*(3), 729.

Mastron JK, Siveen KS, Sethi G, Bishayee A (2015). Silymarin and hepatocellular carcinoma. *Anti-Cancer Drogs* 26(5), 475-486.

Özinan L, Alatürk F, Gökkuş A (2017). Meryemana dikeni [*Silybum marianum* (L.) Gaertner]'nin silaj olarak kullanım olanakları. *Turkish Journal of Agricultural and Natural Sciences* 4(1), 88-94.

Post-White J, Ladas EJ, Kelly KM (2007). Advances in the use of milk thistle (*Silybum marianum*). *Integrative Cancer Therapies* (6)2, 104-109.

Rady MM, Semida WM, Hemida KA, Rady MOA (2018). Silybum marianum as a phytoremediator of heavy metals in contaminated soils. *Environmental Science and Pollution Research* 25(3), 1-10.

Sharma R, Singh R (2023). *Silybum marianum* (Asteraceae): an addition to the weed flora of Delhi, India. *Journal of Economic and Taxonomic Botany* 47(1), 38-41.

Sowińska M, Szpunar M (2022). *Silybum marianum* – properties and application in medicine – a review. *European Journal of Clinical and Experimental Medicine* 20(3), 266-271. https://doi.org/10.15584/ejcem.2022.3.3

Tanker N, Koyuncu M, Coşkun M (2007). Farmasötik botanik. Ankara Üniversitesi Eczacılık Fakültesi Yayınları No: 93 p.65-72.

Tenney LMH (1995). Milk thistle; a remarkable flavonoid antioxidant and liver protectant. Woodland Publishing INC. USA.

WHO monographs (2002). World Health Organization monographs on selected medicinal plants. Vol. 2, Geneva. p: 300-311.

Zeybek U, Haksel M. (2010). Türkiye'de ve dünyada önemli tıbbi bitkiler ve kullanımları. Zade Sağlık Yayınları, Konya 265-270.

Zheljazkov V, Nikolov S (1996). Accumulation of Cd, Pb, Cu, Mn and Zn by *Silybum marianum* L. grown on polluted soils. *ActaHortic* 426, 297-426. https://doi.org/10.17660/ActaHortic.1996.426.35