

CHAPTER 8

ECONOMICALLY AND CULTURALLY IMPORTANT USAGE POTENTIAL OF CHICORY (*Cichorium intybus* L.)

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INTRODUCTION

Cichorium intybus L., commonly known as chicory in English and white chicory in Turkish, is an important medicinal plant. It belongs to the Asteraceae family. The most used parts of this plant are its aerial parts, flowers, seeds and roots. All parts of this plant are rich in essential oil, fatty acids, unsaturated sterols, alkaloids, triterpenes, vitamins, flavonoids, tannins, coumarins, saponins, terpenoids, cardiac glycosides, sesquiterpenes, lactones, anthocyanins and phenols. With its rich content, chicory (*Cichorium intybus* L.) is a very valuable healing plant with various pharmacological activities such as antimicrobial, anthelmintic, antimalarial, hepatoprotective, antidiabetic, gastroprotective, anti-inflammatory, analgesic, antioxidant, anti-tumor and anti-allergic. The leaves of the plant can be used as a vegetable, the roots as a coffee ingredient, inulin as a prebiotic fiber, and sometimes as animal feed. (Munoz, 2004). Blue chicory, which was introduced to the world as a forage plant in the 70s and whose varieties were developed, is a plant that attracts attention with its natural spread and density on earth. Blue flowers bloom between April and September. Chicory, which is naturally found in cultivated areas, meadows, rocky slopes and roadsides, can produce large amounts of high-quality forage under suitable conditions. It is quite tolerant to drought. The performance of chicory in animal nutrition is similar to legume plants. All parts of the plant are a very rich source of energy. Chicory seeds, aerial parts and roots contain significant amounts of mineral substances (Fe, Cu, Zn and Mn). Again, different parts of chicory contain varying amounts of ascorbic acid, starch, tannins, reducing and non-reducing sugars. Also

industrial chicory, it is economical because it is used as an inulin source in many agricultural regions around the World (Wang and Cui 2011). Fresh chicory leaves have high it has a special economical importance as a growth factor in probiotic bacteria with its inulin content (Abbas et al. 2015). In recent years, the increase in interest in the use of natural dyes in textile coloring has increased the interest and need for dye plants. Chicory is also a plant rich in natural dyes. Its leaves and roots are used as natural dye. Chicory, which has many different areas of use, reduces nitrate leakage with its deep-rooted roots, thus preventing the formation of acidification and salinity.

1. ORIGIN AND GEOGRAPHICAL DISTRIBUTION

It is a word of ancient Greek origin and was used to describe edible endives. Derived from Greek and Latin, chicory takes its name from the words "cichorium" meaning "field" and "intybus" meaning "cutting" leaves and hollow stems. Pliny records that the plant was called "cichorium" in Egypt. It is stated that it was a widely consumed vegetable in Ancient Egypt. However, this plant is probably *C. endivia*, which is closely related to *C. intybus*. The plant, thought to originate from Egypt and Indonesia, has been cultivated in Europe since the 16th century. Chicory is native to Western Asia, North Africa and Europe, but geographically it is widely distributed in Africa, Asia, Europe, Australia, North America and South America. (Nieddu et al., 1999). The wild chicory plant, which is distributed along roadsides and waste areas, was brought to North America by European colonists. Also common in China and Australia (Street et al., 2013).

There are 10 species worldwide and 5 species (5 taxa) in our country. In our country's geography, *Cichorium endivia* L. (bostan hindibası), *Cichorium glandulosum* Boiss. & A.Huet (akkanak), *Cichorium pumilum* Jacq. (dünek), *Cichorium spinosum* L. çukur otu) *Cichorium intybus* L. hindiba) species are distributed and their synonymous are given in Table 1.

Table 1. *Cichorium* species and their synonyms distributed in Türkiye
(Bizimbitkiler<https://bizimbitkiler.org.tr/list.html>)

Synonym name	Valid name
<i>Cichorium byzantinum</i> Clem.	<i>Cichorium intybus</i>
<i>Cichorium intybus</i> var. <i>eglandulosa</i> Freyn & Sint.	<i>Cichorium intybus</i>
<i>Cichorium glabratum</i> C.Presl	<i>Cichorium intybus</i>
<i>Cichorium intybus</i> var. <i>glabrum</i> (C.Presl) Gren. & Godr.	<i>Cichorium intybus</i>
<i>Cichorium perenne</i> Stokes	<i>Cichorium intybus</i>
<i>Cichorium rigidum</i> Salisb.	<i>Cichorium intybus</i>
<i>Cichorium divaricatum</i> Schousb.	<i>Cichorium pumilum</i>
<i>Cichorium endivia</i> subsp. <i>divaricatum</i> (Schousb.) P.D.Sell	<i>Cichorium pumilum</i>
<i>Cichorium intybus</i> subsp. <i>pumilum</i> (Jacq.) Ball	<i>Cichorium pumilum</i>
<i>Cichorium endivia</i> subsp. <i>sativum</i> Cout.	<i>Cichorium endivia</i>

Although *C. intybus* is distributed in all regions of our country, other species are not common. *C. endivia* is produced as a salad plant, especially in the Marmara region (Figure 1).

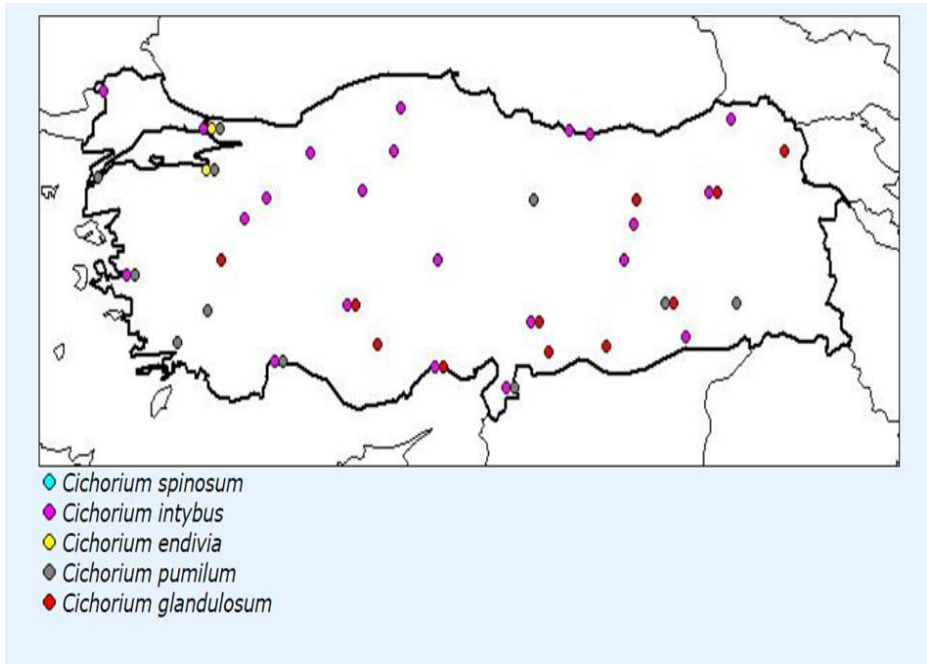


Figure 1. *Cichorium* species distributed in the geography of our country (Turkish Plants Data Service)

2. MORPHOLOGY

Cichorium intybus L., known as chicory, is an upright, very woody and perennial plant. The plant is 1-1.5 m tall, has a fleshy taproot, is approximately 75 cm long and has broad basal leaves. The leaves have a stalked-lanceolate structure and are unlobed. Its flowers are generally purple-blue, but rarely pink or white. Flowers are hereditary. (Figure 2). Chicory is a plant that is extremely resistant to high temperatures and drought and can remain green for a long time due to its rosette growth habit and deep and wide root system (Kiers et al., 1999). It is also resistant to cold and can survive at -40 degrees.



Figure 2. General appearance of chicory (*C. intybus*) (original photo)

3. CHICORY AS A MEDICINAL PLANT

In the past, Chicory was grown as a medicinal herb by the ancient Egyptians. In the 1970s, it was discovered that the root of *C. intybus* contained up to 40% inulin. It is estimated that approximately 36.000 plant species contain inulin, and most of the inulin is commercially obtained from the roots of the chicory plant. *C. intybus* has been grown as an industrial source of inulin from past to present. Inulins are a group of natural polysaccharides produced by many types of plants, belonging to a class of dietary fibers known as fructans. Inulin is used by some

plants to store energy and is typically found in their roots or rhizomes. It has a negligible effect on blood sugar and is therefore said to be suitable for diabetics. The use of white chicory for therapeutic purposes began with human history. *C. intybus* has traditionally been used to treat fever, diarrhea, jaundice and gall stones. *C. intybus* has various pharmacological activities such as antimicrobial, anthelmintic, antimalarial, hepatoprotective, antidiabetic, gastroprotective, anti-inflammatory, analgesic, antioxidant, anti-tumor, anti-allergic. (Street et al., 2013; Al-Snafi, 2016). Despite its long tradition of use, the herb is not described in the European Pharmacopoeia or any official pharmacopoeia of a European Union Member State (Al-Snafi, 2016). In folk medicine in our country, the roots are boiled for cancer and kidney stones, the leaves are used as an ointment for wounds, the ash obtained by burning the roots in the oven is mixed with butter for wound healing and as an ointment for the treatment of skin disorders, and the aboveground parts are used as tea for hemorrhoids, liver diseases and urinary tract infections. is used (Street et al., 2013; Sezik et al., 1991).

4. CHICORY IN ANIMAL NUTRITION

Chicory (*Cichorium intybus* L.) is a perennial plant used as animal feed in many parts of the world. Forage chicory produces large amounts of high-quality forage under favorable conditions in the warm season. Animal performance on chicory is similar to that on legumes and is superior to grass-based pastures.



Figure 3. Animals grazing on the roadside (original photo)

Providing quality feed at the end of the summer season, chicory has a high digestibility rate, non-structural carbohydrate content and is rich in minerals. It prevents swelling and parasite formation in animals (Athanasiadou et al., 2007).

Chicory, a common plant of natural pastures, has been included in breeding studies and varieties have been developed due to its high forage potential. The first variety, "Grasslands Puna", was registered in New Zealand. Later, Puna II and Choice varieties were developed in 2002.

Forage chicory varieties: Puna (Grasslands Puna), Forage Feast, Choice, Oasis, Puna II, Grouse, Six Point. Others varieties known include; Chico, Ceres Grouse, Good Hunt, El Nino and Lacerta. As an alternative forage plant, its use has increased in recent years, especially in grazing.



Şekil 4. Chicory/clover pasture (<httpswwwagricomconz/management-advice/pasture-management/chicory/chicory-grazing-dairy-cows>)

Chicory is a forage plant that is rich in minerals, has high feed quality, is delicious, but has low fiber content (ADF/NDF). It can also be used by growing it together with other forage plants to increase fiber concentration. In arid conditions, it produces grass with high nutritional value in rotationally grazed pastures. Its production is good in the summer period and the hay yield is around 800-1300 kg/da. In these areas, it creates successful mixtures with *T. repens*, *T. pratense*, *L. corniculatus*, *L. perenne*, *D. glomerata*, *S. halepense* (Figure 4).

The dry matter ratio is 25-30% and silage can be made successfully. In some countries, its roots are soaked and used to feed horses. Additionally, grazing chicory may reduce some internal parasites in animals and therefore has the potential to reduce the use of anthelmintics. (Li & Kemp, 2005).

5. CHICORY IN HUMAN NUTRITION

White chicory plant is very rich in nutrients. It contains a number of important compounds such as carbohydrates, phenolic compounds, flavonoids, fat and amino acids, lactones, vitamins, minerals, anthocyanins, inulin, alkaloids, coumarins, sesquiterpenes, unsaturated sterols, chlorophyll pigments, saponins, cinnamic and quinic acid derivatives. Therefore, it is used in many different areas (Molan et al., 2003; Muthusamy et al., 2008). Endive has high potassium, fiber and water content. Its leaves and roots are consumed raw or cooked. It is generally consumed as a fresh salad with a sauce consisting of olive oil and lemon juice. Edible flowers; It is part of many regional cuisines, including Asian, European and Middle Eastern cuisines. In some regions of our country, blue flowers are collected to make jam and syrup. When young roots are roasted, a slightly bitter caramel taste is obtained. It is used as a coffee substitute.

6. AS A NATURAL DYE CHICORY

Dyeing is the art of imparting color to textiles in the form of loose fibre, yarn, fabric or clothing by treating them with a dye. Archaeologists have found evidence of textile dyeing with natural dyes dating back to the Neolithic period. Plant-based dyes such as woad, indigo, and madder were important elements of the economies of Asia and Europe until the discovery of man-made synthetic dyes in the mid-19th century. Although synthetic dyes rapidly replaced natural dyes for the large-scale commercial textile production enabled by the industrial revolution, natural dyes continued to be used by traditional cultures around the

world. In recent years, interest in the use of natural dyes in textile coloring has been increasing. Natural dyes are very compatible with the environment because they are easily degraded. Chicory (*Cichorium intybus* L.) is a plant rich in natural dyes. In some parts of Europe the leaves are used to a limited extent in the production of blue dye. The flowers and leaves of the chicory plant, which has a long history of use, can be used to obtain blue tones from light sky blue to dark dark blue. The flowers and leaves of the plant are collected and boiled in water for a few minutes, then the dye is filtered and used to color fabric, thread or other materials. Natural dyes, which are old and environmentally friendly, also have problems such as the complexity of the dyeing process, limited color tones and inadequate color fastness.



Figure 5. Chicories in the garden and on the roadside (original photo)

However, these problems can be eliminated by using new natural dyes, different mordants and other parameters effective in dyeing. Different colors can be obtained with different mordant or different plant parts. The roots may yield light brown dye. Fresh roots are chopped into small pieces and boiled in water for at least an hour. After straining, alum is added as a mordant, or iron can be added to obtain a darker brown shade.

7. AS ORNAMENTAL PLANT CHICORY

This durable plant, which can grow up to 1.5 meters tall, prefers rich but well-drained soil, preferably in an open and sunny location. Its seeds, which are sown indoors in the spring and then planted later, start to grow with any support from April to the end of September and even the first weeks of October. With its bright, vibrantly colored flowers, it can be used as an ornamental plant in rock gardens, coastal areas, roadsides and parks in landscaping works. It is also an environmentally friendly plant that provides nectar and pollen to bees and other insects.

8. SOIL PROTECTION AND CHICORY

Chicory, a deep-rooted perennial plant, can reduce nitrate leaching and deep drainage, thus reducing the acidification rate of soil and the occurrence of dryland salinity. Chicory, which is an alternative plant that can be used in the evaluation of marginal areas and idle agricultural areas in Türkiye, is a plant with high economic importance and potential, especially in terms of inulin.

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