

CHAPTER 12

USING THE STEMS AND LEAVES OF THE CHERRY PLANT (*Cerasus avium*) WITH SOME TEXTILE FIBERS AS AN ORGANIC DYESTUFF

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INTRODUCTION

Some plants' leaves, stems, seeds, bark, roots, among other parts, are used as natural dyes. Historically, when it comes to fruit-bearing plants, mainly their fruit parts have been utilized for consumption, while their other parts have not been considered for dye production. Nowadays, within medicinal and aromatic plants, efforts have begun to explore and utilize all parts of the plants, particularly those remaining parts beyond the fruit, which were previously seen as waste, for various purposes. These plant parts termed as waste have been incorporated into natural dyeing research. In this study, experiments were conducted using cherry stems and leaves to dye wool fibers, although cherries are primarily grown for their fruits intended for consumption

Cherry stems have been the subject of numerous studies in the field of alternative medicine. Cherry stems (CS) are a by-product extensively used as a traditional remedy for urinary tract disorders in Eastern European countries. Ethnopharmacological evidence supports the use of CS in aqueous preparations (infusions and decoctions). However, there has been limited data reported previously on the phytochemical profile and pharmacological potential of CS hydroalcoholic extracts. In this context, a 70% hydroethanolic cherry stem extract and cherry stem decoction (CSD) were evaluated for their phenolic profile, in vitro antioxidant and tyrosinase inhibitory potential, and in vivo diuretic activity. LC-DAD-ESI/MSⁿ revealed the presence of flavonoid-type compounds, particularly flavanones (naringenin glycosides), as the main constituents in both preparations. Overall, our findings indicate

the potential use of CS preparations as promising mild diuretic agents and encourage further research on the correlation between their chemical compositions and bioactive potentials (Babota et al., 2021). By-products derived from various plant materials are extensively utilized as promising sources of bioactive nutrients and are considered cost-effective, eco-friendly, and sustainable alternatives compared to standard raw materials (Fierascu et al., 2020).

Additionally, recent studies have revealed the significant accumulation of secondary metabolites in plant residues. For instance, research has shown that a substantial portion of the overall polyphenol content in various food industry residues exists in a form known as non-extractable polyphenols (NEP), which possess noteworthy properties such as antioxidant, antitumor, and hypocholesterolemic effects (Dzah et al., 2020). This suggests that utilizing more by-products as crucial sources of phytochemicals associated with health benefits could be a primary objective in the future (Babota et al., 2021).

Cherry stems (CS) stand as primary residues obtained after the harvesting and processing of cherry fruits. Despite being classified as waste in the food industry, these materials are also used in traditional folk medicine and unconventional therapies (Babota et al., 2021).

Primarily known for their diuretic and soothing properties, the herbal remedy (*Cerasorum stipites*) is employed (Bastos et al., 2015; Aires et al., 2017; Švarc-Gajić et al., 2018; Nastić et al., 2020; Peixoto et al., 2020).

In Central and Eastern European countries, especially in Romania, based on ethnopharmacological recommendations, cherry stems are commonly utilized as an adjunct in the treatment of kidney stones, mild urinary tract infections, edema, and hypertension. In the Encyclopedia of Romanian Ethnobotany, Butura et al. describe the use of cherry stems as infusions or decoctions in the Carpathian regions for the treatment of kidney disorders. Various traditional decoction recipes involve cherry stems, along with aerial parts of horsetail (*Equisetum arvense*), leaf buds of mountain pine (*Pinus mugo*), and corn stigmas (*Zea mays*) (Butura, 1979).

Moreover, in Romania, among the general population, they are used for their diuretic properties (for cystitis or kidney stones) and also for obesity (Pârvu, 2006).

There have been relatively few phytochemical and pharmacological studies conducted on CS. The majority of available studies in this field have intensified over the last 5 to 10 years, primarily focusing on both qualitative and quantitative evaluations of the main constituents in the extracts and assessing their potential bioactivities. In a comparative study conducted by Bastos et al., (2015) examining the hydrophilic compound profile comparing fruits and stems, they demonstrated the richness of cherry stems in citric, malic, and oxalic acids (Bastos et al., 2015). The same study assessed the phenolic profile of hydroalcoholic extracts obtained from stems, identifying sakuranetin-5-O-glucoside, catechin, naringenin-7-O-glucoside, and aromadendrin-7-O-hexoside as the major components. Other studies revealed the presence of

significant amounts of hydroxycinnamic acids (cis-3-O-p-coumaroylquinic acid, chlorogenic acid, and trans-3-O-p-coumaroylquinic acid): quercetin and sinapic acid (Demir et al., 2020; Peixoto et al., 2020). Corroborating the presence of these compounds, various in vitro bioactivities have been evidenced for CS extracts: antioxidant, antitumor, antidiabetic, and antibacterial effects (Bastos et al., 2015; Aires et al., 2017; Demir et al., 2020; Peixoto et al., 2020).

Except for the in vitro antibacterial effect on *E. coli* strains, only a few studies have focused on evaluating the actual benefits of CS in the treatment of urinary tract disorders (Aires et al., 2017).

In traditional medicine, it's known that cherry stem tea has been used in the treatment of several illnesses. Recently, some health organizations, through publications prepared by Medical Publishing Boards, support the use of natural plant-based sources in alternative medicine and strive to promote their widespread adoption. The benefits of cherry stem and its positive effects on various conditions have been indicated. Cherry stem aids in preventing inflammation in the body, assisting in the cleansing of the kidneys and urinary tract. It reduces the likelihood of infections in the urinary system and decreases edema in the body. Acting as a detoxifier, it facilitates the elimination of toxins. Its potassium content acts as a natural diuretic. It's effective against skin issues like blemishes, acne, and blackheads. It helps prevent the formation of kidney stones. When consumed, it reduces conditions like stress and depression, aids in falling asleep, and shows resistance

against body fat and cellulite. Additionally, it plays a role in reducing bloating and pain during menstruation (Anonymous, 2023a).

1. CHERRY PLANT (*Cerasus avium*)

Sweet cherry (*Prunus avium*) trees can grow up to approximately 10 meters if left unpruned, averaging around 5-6 meters. Dwarf varieties (*Cerasus avium*) are considered 'dwarf' when they reach heights of 1.5-2 meters. Cherry trees are deciduous. They can thrive in warm, dry, or semi-arid climates, although they typically prefer cooler climates. They favor deep, well-drained soil enriched with compost and decomposed manure. Protection from direct sunlight and strong winds is advisable. While they can grow in hot and dry climates, they also flourish in shaded areas (Anonymous, 2023b).

Appearance and Characteristics of the Cherry Tree:

The cherry tree is tall and slender. It is a deciduous plant that sheds its leaves in winter and blossoms on bare branches in spring. The leaves emerge after the blossoms. Fruits, on the other hand, ripen in the summer months (Figure 1). Despite growing in the same soil and region, there are species that bloom and bear fruit at different times.

Sweet cherries are the most commonly found variety in markets. They have a thick, rich, and almost plum-like texture. Sweet cherries grow in hardiness zones 5 to 7; they are self-sterile and are best suited for an orchard or large garden. As they need cross-pollination, you will need at least two or three trees. If space is limited, dwarf, self-pollinating 'Stella' cherry tree varieties are planted. They take up less space and

ensure pollination. Cherry trees typically do not bear fruit before four years. From a mature, standard-sized sweet cherry tree, you can harvest between 30 to 50 liters of cherries annually. From dwarf cherries, you can yield between 10 to 15 liters of fruit. It's advisable to plant cherry trees in spring or early summer when the soil is softer and has higher moisture content. Apply mulch and water thoroughly. After the fruit blossoms, cover the trees with wildlife-safe nets to protect the fruits from birds. Plant cherry trees in a sunny area with good air circulation; avoid planting them near larger trees or buildings that might shade the cherries. Ideally, cherry trees need at least 6 hours of sunlight daily. Cherry trees thrive in well-drained soil with a pH of 6.0-7.0 (Anonymous, 2023c).



Figure 1. Leaves and fruit of cherry tree (Kaynar, 2020)

In Figure 1, immature fruit, leaves, and fruit stems of the cherry plant are observed.

Cherry trees favor a warm growing season, a period of dormancy during the winter, rainless flowering, and harvest time. Cherries are a type of fruit that requires significant chilling hours; they need over 1000 hours of cold exposure. Irregular flowering and flower shedding occur when this requirement is not met. Approximately 1000 meters in altitude is considered ideal for cultivation. Cherry cultivation should not be practiced in areas where winter temperatures drop below -20 °C. Excessive summer heat is undesired as it promotes the development of double pistils and, consequently, twin fruits, which lack market value. Cherries prefer soils with low lime content, good drainage, and deep, light texture. The water table should be below 1 meter (Anonymous, 2023d).

The plant contains alkaloids, tannins, saponins, flavonoids, polyphenols, proanthocyanidins, cyanidins, and myoinositol. Additionally, various chemical flavonoid types (flavonones, flavans, biflavonoids) are present. In 100 grams of cherries, there are 76.3 grams of water, 2.1 grams of protein, 2.3 grams of fat, 17.9 grams of carbohydrates, 4.6 grams of fiber, 1.4 grams of ash, 125 mg of calcium, 94 mg of phosphorus, 0.015 mg of vitamin A, 90 mg of vitamin C, and 380 kJ/100 g of energy (Nurfitria et al., 2020, Anonymous, 2023e). In addition to these components, cherry plants also contain trichome cells. Secondary plant formation Metabolites are found in all tissues and cells, but biosynthesis occurs in specific tissues or cells, influenced by

differentiation and developmental levels. In the structure of cherry leaves, there are glands that produce sap-containing juice and secrete wax when touched (Kuntorini et al., 2013).

2. MATERIAL METHOD

The materials used included dried cherry plant leaves, fruit leaves, 2.5 Nm wool carpet yarn, and 9 types of mordant substances: aluminum sulfate, acetic acid, copper II sulfate, iron II sulfate, citric acid, potassium alum. sulfate, potassium bichromate, zinc chloride, and tartaric acid. To prepare the plant extraction, 1000 grams of dry plant leaves and cherry husks were mixed in equal proportions. Initially, they were placed in 20 liters of water at room temperature and boiled until reaching the boiling point. Subsequently, the mixture was stirred at the same temperature for approximately one hour. Afterwards, the plant residues were removed from the boiling water and left to cool. Wool carpet yarns were prepared with mordant substances at 2% and 4% ratios, mixed with water, and boiled for one hour. The resulting mordanted wool was individually boiled with the previously prepared plant extract. Once cooled, the yarns were rinsed with cold water, dried, and obtained as dyed wool yarns.

3. RESULTS

Color samples obtained from dyeing with cherry plant leaves and stems and the names given to these colors are given in Table 1.

Table:1 Color samples obtained from dyeing with cherry plant leaves and stems

MORDAN	EXAMPLE	COLOUR
Aluminum sulfate %2		Cumin 1
Aluminum sulfate %4		Cumin 2
Acetic acid %2		Mustard 1
Acetic acid %4		Mustard 2
Copper II sulfate %2		Cinnamon 1
Copper II sulfate %4		Cinnamon 2
Ferrous II sulfate %2		Roasted coffee beans 1
Ferrous II sulfate %4		Roasted coffee beans 2
Zinc chloride %2		Melon 1
Zinc chloride %4		Melon 2

Table 1. (continued)

MORDAN	EXAMPLE	COLOUR
Potassium aluminum sulfate %2		Mustard 2
Potassium aluminum sulfate %4		Mustardl 3
Potassium bichromate %2		Hazelnut shell 1
Potassium bichromate %4		Hazelnut shell 2
Citric acid %2		Coffee foam 1
Citric acid %4		Coffee foam 2
Tartaric acid %2		Coffee foam 3
Tartaric acid %4		Coffee foam 3
Without mordant		Wheat stalk

In this study, using nine mordant substances Citric acid, Aluminum sulfate, Acetic acid, Copper II sulfate, Iron II sulfate, Zinc chloride,

Potassium aluminum sulfate, Potassium bichromate and Tartaric acidshades of yellow, orange, and brown were obtained. These colors were named as follows: Cumin 1-2, Mustard 1-2-3, Cinnamon 1-2, Roasted coffee beans 1-2, Clove 1-2, Walnut shell 1-2, Coffee froth 1-2-3.abundance of cherries in the country, very few people are aware of the useful leaves containing flavonoids and tannins for textile dyeing. The eco-print dyeing process using Jamaican cherry leaves (*Muntingia calabura*) involved steam fixation techniques for coloration analysis. The study was conducted through an eco-print dyeing experiment, followed by laboratory tests to examine color variations. Middle-aged cherry leaves were selected and steamed for dyeing purposes. Iron (iron sulfate), alum, and calcium carbonate were used as mordants to fix the colors. The steaming process was conducted twice, each lasting 30 minutes. Each fabric was immersed in the mordant solution for 5-10 minutes to facilitate fixation. Dyeing with cherry leaves using alum as a mordant resulted in brownish-yellow, with iron; black-green, and with calcium carbonate; brownish-green colors (Nurfitria et al., 2020). It was observed that the nine types of mordants used in this research showed similarities in color tones obtained in the dyeing process without mordants.

4. CONCLUSIONS

In this study, using nine mordant substances-Aluminum sulfate, Acetic acid, Copper II sulfate, Iron II sulfate, Zinc chloride, Potassium aluminum sulfate, Potassium bichromate, Citric acid, and Tartaric acid-shades of yellow, orange, and brown were obtained. Consequently, it's

observed that mordant substances influenced the hue and intensity of the dyeing process. Similarities can be drawn with the study conducted in Indonesia. The cherry plant is extensively cultivated in our country, and its fruit is widely utilized. The darkest shade was obtained from a dyeing process utilizing Iron II sulfate as the mordant. Successively, the deepest tones were achieved from samples dyed with Copper II sulfate and Potassium dichromate as mordants. It is important to note that while Potassium dichromate resulted in the desired depth of color, it is not recommended for use in items that come into contact with human skin due to health concerns. The lightest shade, wheat straw yellow, was determined from dyeing conducted without any mordant used. Medium-depth colors were obtained with other mordants. Recently, cherry stems have been included among medicinal organic plants, and as seen in various studies, their use in alternative medicine has begun to increase, especially as diuretics, antioxidants, and anti-inflammatory agents. According to the results obtained in this research, dyeing with parts of the cherry plant other than the fruit could be applied in eco-friendly textile production and could serve as inspiration for further investigation.

Dyeing with mixtures of minimal mordant substances along with cherry plant leaves and stems can yield functional benefits and original colors. Additionally, it is suggested that apart from the plant's stems and leaves, its bark, buds, and flowers can also be used as dye materials. Furthermore, its lack of synthetic solvents is predicted to increase

demand, primarily for baby and children's products, leading to the use of all-natural fibers, resulting in sustainable outcomes.

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