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The Colours and Fastness Values obtained from Basil (*Ocimum basilicum*) and Lemon Balm (*Melissa officinalis*) Plants of the *Lamiciacae* Family

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Abstract:Until the invention of synthetic dye substances, natural dyes were used for the purpose of dyeing in textiles, food, medicine and cosmetics fields. With the introduction of synthetic dyes, their use increased and the demand for natural dyes decreased. However, as a consequence of studies made, the carcinogenic properties of synthetic dyes were revealed and that they could create serious problems for human health. Therefore, plant dyes have come to the fore again. In this study, an examination was made of the dye properties and colour and friction fastness values of basil (*Ocimum basilicum*) and lemon balm (*Melissa officinalis*) plants. According to the data obtained, basil and lemon balm dyeing were made with different mordants and different colors were obtained. The highest colour fastness values for basil were seen to be obtained with copper II sulphate, iron II sulphate, potassium bi chromate and citric acid mordants. The highest friction fastness values were obtained with copper II sulphate, potassium aluminium sulphate and citric acid mordants. For the lemon balm, the highest colour fastness values were obtained with all the mordants and the highest friction fastness values with acetic acid and citric acid mordants.

Keywords: *Ocimum basilicum*, *Lemon Balm*, Vegetable dye, fatness to light colour, fatness to abrasio

1. INTRODUCTION

Today, around 20,000 plant species are used for medical purposes in the world. In this context, medical and aromatic plants, which are an important part of the Earth's flora, are widely distributed in different floristic regions [1]. Because Turkey is located at the intersection of three floristic regions, there are ten thousand plant species in the natural flora, provided that three of them are endemic. It is known that about 1000 of these plants are used for medical purposes [2]. Turkey is an important gene center for the family of ballibagiller (Labiateae = Lamiaceae) which is among aromatic plants. The family is represented in Turkey with a total of 731 taxa and 546 species, 45 genus [3].

Basil belongs to the *Lamiaceae* family and possesses 65 denier species in the world [4]. Ocimum species are single-year, herbaceous or small-scale herbaceous plants. Leaves are oval and hairless [5]. This plant is widely used in spices, medicines, food and perfumery because of its essential oils. bacillus essential oils, antifungal, antioxidant and insecticide properties as well

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as antiseptics for midwives, expectorants and urinary tracts [6], [7]). Linalool (46%), α-Terpinen (16%), Borneol (4.4%), Linalyl acetate (4.4%), β-Myrecene (2.1%), Thymol (1.7%) and Camphor) [8].

Lemon Balm belongs to Lamiaceae family, a perennial and herbaceous plant [5]. Lemon Balm naturally grows in southern Europe, the Balkans, North Africa and Turkey [9]. The leaves of Lemon Balm are deeply knotty, hairy or oval in shape [5]. The essential oils of the herb are enriched in terms of aldehydes and terpenes with therapeutic effect [10]. The main essential oil components are 39% citronellal, 33% citral (citronellol, linalool) and geraniol. It possesses antioxidant properties due to these phenolic acid components [11]. It has also been determined that it is effective in the treatment of Alzheimer's disease and in the prevention of tumor formation, as well as being used as a sedative, spasm remover, immune system enhancer due to the properties of essential oil. It is also used in perfumery and cosmetics industry due to hydrosol in volatile oil [12].

Today, as a result of the increase in demand for natural dyes, the determination of the colors obtained by different plants and mordants and their light and friction fastness values have become important. In this study; basil and lemon balm, which have important medicinal and aromatic properties, have been evaluated in this context.

2. MATERIAL and METHODS

Rye and son grass plants were used as experimental material. Natural leaves were obtained with the leaves of these plants in two different ways: mordant (8 different mordants, each at 2% and 4% concentration) and without mordant. As a mordant; aluminium sulphate (KAI (SO4) 2), copper sulphate (CuSO4.5H2O), ferric sulphate (FeSO4.7H2O), tartaric acid (C2H2 (OH) 2 (COOH) 2-C4H6O6), acetic acid, zinc chloride, sodium hydrosulphite, copper II sulphate, potassium bi chromate (K2Cr2O7) mordants were used.

2.1. Preparation of Paint Extract

The leaves of the plants containing the stain were made into small pieces so that the contained stain could pass through the water. Later, 100% of the weight of the wool yarn will be dyed, and the plants will be boiled for 1 hour in water at a rate of 1/20 compared to the dye to be dyed.

2.2. Unmordant Dyeing of Wool Yarns

Hot extracts were obtained using 100% of the plants. The wools, which have been soaked in water for 1 hour, are put into extracts prepared at 1/20 ratio. After reaching the boiling point, it was boiled continuously for one hour. Minor water was added during boiling. It is then rinsed with plenty of cold water and dried in a low light and airy place.

2.3. Mordanting of Wool Yarns

Wool yarns are moored separately with each of the mordants specified in the material section. For this, 2% and 4% mordants were used according to the weight of the wool yarn to be painted, and each wool yarn was treated separately with each mordant. The amount of mordant calculated according to yaw is melted in 1/20 of warm water, pre-moistened wool yarn is pressed into this mordant water. After one hour of boiling, the wools were cooled in boiling water, the resulting wool was then squeezed and dried and ready for coloring.

2.4. Mordant Dyeing of Wool Yarns

Previously mordanted wools were kept in water for at least one hour before starting the dyeing process, and then boiled for 1 hour in a hot extract prepared at 1/20 after being soaked

and allowed to cool. At the end, it was rinsed with plenty of cold water and dried in a low-light airy place.

2.5. Determination of Light Fastness

The determination of light fastness in dyed wool yarns was based on TS 867 (Color Sensitivity Testing Method for Daylight) [13] and DIN 5033 (Farbmessung Begriffe der Farbmetrik) Anonymous 1970) prepared by Turkish Institute of Satellarians. Wool yarn samples painted with a blue wool scale (wool fabric strips painted using various blue dyes graded from 1 to 8) were used to determine the light fastness [14], [15]. 1 indicates the lowest light fastness degree, and 8 indicates the highest fastness degree.

2.6. Determination of Friction Fastness

According to TS 717 [16], which is prepared by Turkish Standards Institute [16] and TS 423 (Textile Products Color Difficulty Determination of stains (dye flow) and solmanin (color). The method of using grey scales for evaluation) was done according to [17]. Uncolored cotton gauze color flow is evaluated according to TS 423 with grey scale [17]. Grey gives 1 the worst friction fastness value according to the (flow-staining) scale and 5 gives the best friction fastness degree.

2.7. Identification and naming of obtained colors

The colors obtained in consequence of this painting are named by a commission created in the Sivas Vocational High School/ Carpet & Decoration Program.

3. RESULTS and DISCUSSIONS

According to the obtained data; as a result of painting with different colors and different mordant applications (acetic acid, copper II sulphate, zinc chloride, iron II sulphate, potassium aluminium sulphate, potassium birochromate, citric acid, tartaric acid) lemon mold 1, coffee bean 1, coffee bean 2, almond green 1, almond green 2, coffee bean 3, coffee bean 4, almond green 1, coffee bean 1, coffee bean 2, potato crust 1, potato crust 2, almond green 3, almond green 4, almond green 3, almond green 4, 16 different colors were obtained in total.

The different mordants used provide different colors to be obtained from the plant [18]. For example, a copper sulphate mordant applied in a study on walnut fruit husks ensured that the color obtained was greenish-brown [19]. The mordant application in this study was carried out at two different concentrations of 2% and 4%. According to the obtained data; the highest light fastness values in both mordants (both 2% and 4%) in both concentrations were determined in copper II sulphate (7), iron II sulphate (7), potassium bi chromate (7) and citric acid (7) mordants. The mordants used in vegetable dyestuffs provide better adhesion of the dyes to the material and strengthen the durability ratings. As mordant materials, more water-soluble metal salts are used [20]. The highest light fastness value among the mordants that had been applied to the thyme plant was determined in the ferric sulphate mordant. If the obtained data will be evaluated in terms of friction fastness values; the highest rubbing fastness values were obtained from the zinc chloride mordant (2-3) at the concentration of 2%, while the highest value was reached at the mordant of tartaric acid (2-3) at the concentration of 4% (Figure 1, Figure 2). However, Kayabaşı and Ölmez [22] stated that they provided the highest friction fastness values in mordant-free applications.

As a result of different mordants (acetic acid, copper II sulphate, zinc chloride, iron II sulphate, potassium aluminium sulphate, potassium birochromate, citric acid, tartaric acid) applied to the psyllium plant; eight different colors were obtained, including boiled chickpeas 1, boiled chickpeas 2, pimento 1, pimento 2, coffee beans 1, coffee beans 2, olive oil green 1, olive oil green 2. Barber [18] reported that in copper mordant applications, the colors obtained

from the plants are more greenish in color. When potassium bi chromate mordant is used, more burgundy color is obtained [23]. When copper sulphate mordant is applied on the walnut fruit coat, it is providing brown close to khaki and greenish brown color [19]. The highest light fastness value at all concentrations (2% and 4%) of all mordants in the study was 7. The highest friction fastness values were obtained from the citric acid (3-4) mordant at a concentration of 2%, while at the concentration of 4% copper II sulphate (3), zinc chloride (3) and potassium birochromate (3) mordants (Table 1, Table 2). Iron mordant applications show increased light fastness values in plants [24]. Akan [21] was obtained the highest friction fastness value as the result of dyeing the apple leaf with mordants of vine stone and citric acid.

Table 1. Colors Obtained at 2% Concentration of Mordant Application Result

Plants	Mordants	Colors	Light Fastness Value	Friction Fastness Value
Basil (*Ocimum basilicum*)	Acetic acid	Lemon mold 1	5	2
	Copper II sulphate	Coffee Beans 1	7	2
	Zinc chloride	Almond green1	4	2-3
	Iron II sulphate	Coffee bean 3	7	1-2
	Potassium aluminium sulphate	Almond green1	4	1-2
	Potassium bi chromate	Coffee beans 1	7	2
	Citric acid	Potato crust 1	7	2-3
	Tartaric acid	almond green 3	4	2-3
Lemon Balm (*Melissa officinalis*)	Acetic acid	Boiled chickpeas 1	7	2
	Copper II sulphate	Pimento 1	7	3
	Zinc chloride	Boiled chickpeas 1	7	3
	Iron II sulphate	Coffee beans 1	7	2
	Potassium aluminium sulphate	Boiled chickpeas1	7	2
	Potassium bi chromate	Olive oil green1	7	3
	Citric acid	Boiled Chickpeas 1	7	3-4
	Tartaric acid	Boiled chickpeas	7	2-3

Table 2. Colors Obtained at Mordant Application Result at 4% Concentration

Plants	Mordants	Colors	Light Fastness Value	Friction Fastness Value
Basil (*Ocimum basilicum*)	Acetic acid	Lemon mold 1	5	2
	Copper II sulphate	Coffee Beans 1	7	1-2
	Zinc chloride	almond green1	4	1-2
	Iron II sulphate	Coffee bean 3	7	1-2
	Potassium aluminium sulphate	almond green1	5	2
	Potassium bi chromate	Coffee beans 1	7	1-2
	Citric acid	Potato crust 1	7	2-3
	Tartaric acid	almond green 3	4	2-3
Lemon Balm (*Melissa officinalis*)	Acetic acid	Boiled chickpeas 1	7	2-3
	Copper II sulphate	Pimento 1	7	3
	Zinc chloride	Boiled chickpeas 1	7	3
	Iron II sulphate	Coffee beans 1	7	1-2
	Potassium aluminium sulphate	Boiled chickpeas1	7	2
	Potassium bi chromate	Olive oil green1	7	3
	Citric acid	Boiled Chickpeas 1	7	2
	Tartaric acid	Boiled chickpeas	7	2

Conflict of Interests

Authors declare that there is no conflict of interests.

4. REFERENCES

[1] Arslan, N., Gurbuz, B., & İpek, A. (2001). The cultivation and breeding studies on some medicinal and aromatic plants in Ankara. *Workshop on agricultural an quality*.

[2] Arslan, N., Yılmaz G., Akınerdem F., Özgüven M., Kırıcı S., Arıoğlu H., Gümüşçü A., & Telci İ. (2000). *Turkish agricultural engineer. 5. technical congress, National Library Vol*. 1. Ankara, 453-483.

[3] Baser, K.H.C. (1994). Essential oils of Labiatae from Turkey. Recent results, *Lamiales Newsletter, (3),* 6-11.

[4] Baytop, T. (1994). *Dictionary of Turkish plant names* T: D: K: Yay. No: (578), Ankara, 508.

[5] Davis, P. H. (1982). *Flora of Turkey and the East Aegean Islands*, Edinburgh University Press, vol. 7, Edinburgh, 00-307.

[6] Telci, İ. (2005). Determination of Appropriate Form Heights in Reyhan (Ocimum basilicum L.) Genotypes. *GOI. Journal of Agricultural Faculty, Slap.*22 (2), 77-83.

[7] Ceylan, A. (1995). *Medical plants I*. Ege University, Faculty of Agriculture Publications. No: 312.

[8] Tuğrul, Ay, S., Uçar, E., & Turgut, K. (2005). Effects of Different Plant Species on Yield and Quality Characteristics of Reyhan (Ocimum basilicum). *Turkey VI. Field Crops Congress, 5-9 September, Antalya. Research Presentation Volume I*, 493-495.

[9] Tucker, A. O., & Baggio, T. De. (2000). *The big book of herbs*.a comprehensive reference to herbs of flavor and fragrance. Loveland, CO: Interweave Press.

[10] Hener, U., Faulhaber, S,. Kreis, P., & Monsandl, A. (1995). On the authenticity evaluation of balm oil (Melissa of fi cinalis L.). *Pharmazie, (50),* 60-62.

[11] Mencherini, T., Picerno, P., Scesa C. & Aquino, R. (2007). Triterpene, antioxidant, and antimicrobial compounds from Melissa oficinalis. *Journal of Natural Products*, (*70)* 1889-1894.

[12] Bağdat, Bahtiyarca, R., & Coşge, B. (2006). The essential oil of lemon balm (Melissa officinalis L.), Its components and usıng fields. *OMÜ Journal of Agricultural Faculty, 21 (1),*116-121.

[13] Anonymous, (1984a). Color fastness test methods for dyed and printed textile products - color fastness test method for daylight. DIN 5033 (Farbmessung Begriffe der Farbmetrik) Anonymous. *Turkish Standards Institute Publications, TS 867; Ankara*.

[14] Özcan, Y. (1984). *Textile fiber and dyeing technique*. Istanbul University Publications, 3176 Engineering Faculty No: 60, Fatih Publishing House, Istanbul.

[15] Çoban, S. (1992). Standard, standardization and fastness controls used in textiles. *Textile and Apparel 2 (5), İzmir,* 341-346.

[16] Anonim, (1978a). Color fastness test methods for printed textile products - Determination of color fastness against abrasion - Determination of color fastness against abrasion. *Turkish Standards Institute Publications TS717, Ankara*.

[17] Anonymous, (1984b). Methods of using gray scales to evaluate paint flow and solman (color change) of color fate determinations of textile products. *Turkish Standards Institute Publications, TS 423, Ankara.*

[18] Barber, J.W. (1990) *Prehistoric textiles*. Princeton University Pres, U.S.p , 471.

[19] Kayabaşı, N., Erdoğan, Z., & Söylemezoğlu, F. (2011). *Turkish handicrafts,* Ankara University Distance Learning Publications, Publication No: 90 Ankara, 142.

[20] Karadağ, R. (2007). *Natural painting*. Publications of the Ministry of Culture and Tourism, (1), 2,38-51.

[21] Akan, M. (2007). Development of dyeing methods for loss of mechanical strength at least in the wool carpet yarn dyed with vegetable dyes having appropriate color, light and friction fastness (Unpublished / Doctorate thesis). *Ankara University, Institute of Science, Department of Home Economics,* Doctorate Thesis, Ankara.

[22] Kayabaşı, N., & Ölmez, F.N. (2000). Advantages and methods of mordanting in vegetable dyeing, III. Approaches and Problems to National Turkish Weaving Symposium Reports 17-18 May Konya, *Selcuk University Publications*, Konya: 112-116.

[23] Kayabaşı, N., & Dellal, G. (2004). A study on the light fastness values of the colors of wool obtained from sheep's leaves with rootbone. *Yüzüncü Yıl University Journal of Agricultural Sciences,* 79-83.

[24] Eyüboğlu, Ü., Okaygün, İ., & Yaraş, F. (1983). Wool dyeing with natural dyes. *Özkur Printing House*, 137 Istanbul.