Himachal Journal of Agricultural Research 49(2): 232-237 (2023)

Physico-chemical characteristics of wild amla (*Emblica officinalis*) and indigenous medicinal plants from Himalayan region

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Manuscript Received: 25.10.2023; Accepted: 07.11.2023

Abstract

This study aimed to analyse the physico-chemical composition of seven medicinal plants including wild amla (*Emblica officinalis*), *Kadipatta* (*Murraya koenigii*), *Bhavadi* (*Ocimum basilicum*), *Bana* (*Vitex negundo*), *Mulethi* (*Glycyrrhiza glabra*), *Milk thistle* (*Silybum marianum*) and *Umre* (*Ficus glomerata*). Standard procedures were employed to analyse the physico-chemical compositions of these plants. The physical characteristics varied among all seven medicinal plants. The colour characteristics (L*, a*, b*) also varied among the samples, indicating differences in visual aspects. The pH of the plants ranged from 2.93 to 7.67, while the amounts of reducing and total sugars ranged from 0.26% to 5.11% and 0.32% to 7.27% respectively. The findings of this study enhance the current understanding and potential utilization of these medicinal plants for their nutritional and medicinal applications.

Key words: Wild amla, Indigenous medicinal plants, Physico-chemical characteristics, Himalayan region

The Himalayan region is well-known for its rich biodiversity and, particularly in terms of medicinal plants. These plants have been traditionally used by indigenous communities for their therapeutic properties. One such plant is wild amla (*Emblica officinalis*), which is native to the Himalayan region and widely recognized for its health-promoting benefits. Wild amla, also known as Indian gooseberry, is a deciduous tree that belongs to the Euphorbiaceae family. It grows in the wild, often found at higher altitudes in the Himalayas (Singh *et al*. 2020). It is a considered a general tonic that is beneficial for enhancing both mental and physical health of all age groups. The fruit itself is hard and round, with 6–7 segments and a colour that varies from pale green, when unripe to light yellow after ripening, its unique taste- initially sour, but it becomes sweet after mixing with saliva. Additionally, Amla is referred to as amritphal and tridoshic, believed to have the ability to balance and heal all three doshas in our body according to the Ayurveda medicinal system, making it a divine fruit. The fruit is widely recognized, renowned for its exceptional nutritional profile, which makes it a super fruit. It contains a rich array of phytochemicals including polyphenols, tannins, ascorbic acid and other alkaloids (Dasaroju and Gottumukkala 2014).

Aside from wild amla, the Himalayan region is also home to a diverse range of other indigenous medicinal plants. These plants have been used for centuries by local communities to treat various ailments and promote overall well-being. The medicinal properties of plants are attributed to certain chemical substances that have physiological effects on the human body. Among the most essential bioactive components found in plants are alkaloids, tannins, flavonoids, and phenolic compounds. Even today, plant materials continue to be a valuable resource in the fight against various illnesses, including infectious diseases (Sharma *et al*. 2021). Many of these plants have been extensively studied for their potential as new drugs or as inspiration for the development of therapeutic agents, food additives, agrochemicals, and

industrial chemicals (Chugh *et al*. 2012; Kumbhar and Godghate 2015).

The Currytree (*Murraya Koenigii*) commonly known as "curry patta" is a native of India that is believed to have tonic and stomachic properties (Ajay *et al*. 2011). It contains bioactive compounds such as alkaloids, essential oils, phenolics, minerals, and proteins (Patterson and Verghese 2015). Sweet basil (*Ocimum basilicum*) known vernacularly as Bhavadi, belongs to the genus Ocimum of the family Lamiaceae is rich in essential oils, as well as polyphenols, flavonoids, and phenolic acids. It has been shown positive effects against viral, fungal, bacterial and some infections (Ismail 2006, Sharma and Sharma 2022). Bana (*Vitex negundo* L.) is a hardy plant, flourishing mainly in the Indian subcontinent. All parts of the plant, from root to fruit, possess a multitude of phytochemical secondary metabolites which impart an unprecedented variety of medicinal uses to the plant. The leaves of bana are antibacterial, antitumorous, astringent, sedative, tonic and vermifuge. Extracts of the leaves have shown bactericidal and antitumor activity (Hansel *et al*. 1965). Mulethi (*Glycyrrhiza glabra* L.) belongs to the Fabaceae family, is used for various clinical applications (Peng *et al*. 2021). One of the main active ingredients is glycyrrhizin, which has a cortisone-like effect. Its bioactive compounds have various beneficial effects, including anti-inflammatory, gastroprotective, antitumoral, antiviral (Ghannad *et al*. 2014), antifungal, antimicrobial, and anticancer properties. The antioxidants of licorice not only inhibit oxidative stress, but also increase the nutritional value of the end product, especially with their mineral, vitamin, polyphenol and anthocyanin contents (Wang *et al*. 2015). Milk thistle (*Silybum marianum*) is a member of family Compositae. Silybin, silibinin are major constituent of milk thistle with maximum amount of biological activity, which contains 90 per cent of herb's component in most preparations (Das *et al*. 2008). Umar also known as gular; umber (*Ficus glomerata*) belongs to family Moraceae (Mulberry family). In the traditional system of medicine, various parts of the plant such as bark, root, leaves, fruits and latex are used to cure dysentry, diarrohoea, diabetes, stomach-ache, piles and also as antioxidant and anticancer agent. The bark is known for its antiseptic, antipyretic, and vermicidal properties, and its decoction is used to treat skin diseases, ulcers, and diabetes. (Nadkarni and Nadkarni 1976).

However, there is a lack of extensive research regarding the physico-chemical properties of wild amla and other medicinal plants. The objective of this study is to examine and analyse the physico-chemical characteristics of wild amla and various other medicinal plants. By conducting this research, we aim to contribute valuable information to the existing knowledge on these medicinal plants. Furthermore, understanding the physico-chemical characteristics of these plants is essential for various applications, such as identifying their potential medicinal properties, determining their nutritional value, and assessing their suitability for various industrial uses.

Materials and Methods

Sample collection

The selected herbs/medicinal plants *viz*. *Kadipatta* (*Murraya koenigii*), *Bhavadi* (*Ocimum basilicum*), *Bana* (*Vitex negundo*), *Mulethi* (*Glycyrrhiza glabra*), Milk thistle (*Silybum marianum*), *Umre* (*Ficus glomerata*) and wild amla (*Emblica officinalis*) used in present investigation were procured from local vicinities of Palampur (HP).

Wild amla **Curry leaf** **Bana** **Bhavadi**

Mulethi root **Umre bark** **Milk thistle seeds**

Fig.1. Medicinal plants used in the study

Medicinal plants parts used in the study

Common name of Plants	Botanical name	Plant part used
Kadipatta	*Murraya koenigii*	Leaf
Bhavadi	*Ocimum basilicum*	Leaf
Bana	*Vitex negundo*	Leaf
Mulethi	*Glycyrrhiza glabra*	Root
Milk thistle	*Silybum marianum*	Seeds
Umre	*Ficus glomerata*	Bark
Amla	*Emblica officinalis*	Fruit

Determination of physico-chemical parameters

Physical parameters *viz*. Colour, Shape, Weight (g), Length (cm), Width (cm), Diameter (cm) and Chemical parameters viz. pH, TSS (ºB), Titratable acidity (%), Reducing sugars (%), Total sugars (%) were determined using standard method given by (Ranganna, 2010).

Colour (CIE 1986)

Colorimetric analysis (L*, a* and b*) was performed using a reflectance colorimeter KONICA MINOLTA, Chroma-Meter CR-400, according to method CIE (1986). The values L*, a* and b indicated:

L^* (lightness): black at 0 to white at 100

a^* (red to green): positive values are red, negative values are green and 0 is neutral

b^* (yellow to blue): positive values are yellow, negative values are blue and 0 is neutral

Statistical analysis

The data was analysed statistically using samples in triplicates. Mean ± standard deviation was used to express data.

Results and Discussion

Physical characteristics

The data presented in Table 1 provides information on the colour and shape of various plant parts, as well as their weight, length, width, and diameter. The colour of the amla, bana leaf, bhavadi leaf, curry leaf, milk thistle seeds, mulethi root, and umre bark ranged from light greenish yellow to dark brown. The shapes of these plant parts varied, with spherical, pinnate, narrowly oblong, elliptic lanceolate, and conical shapes observed. The umre bark had a distinct long and slender shape. The mean weight of the amla, bana leaf, bhavadi leaf, curry leaf, and mulethi root were 14.94±0.05, 0.12±0.05, 0.14±0.05, 0.13±0.05, and 4.13±0.05 g, respectively. The milk thistle seeds had an average weight of 22.12±0.05 g per 1000 seeds. The mean length of the amla, bana leaf, bhavadi leaf, curry leaf, milk thistle seeds, and mulethi root were 2.23±0.05, 4.44±0.05, 3.39±0.05, 3.71±0.05, 0.53±0.05, and 3.43±0.05 cm, respectively. The width of the bana leaf, bhavadi leaf, curry leaf and milk thistle seeds were recorded as 2.06, 2.02, 2.03, and 0.30 cm, respectively. The mean diameter/thickness of the amla, bana leaf, bhavadi leaf, curry leaf, milk thistle seeds, mulethi root, and umre bark were found to be 2.96±0.04, 0.06±0.04, 0.06±0.04, 0.07±0.04, 0.29±0.04, 1.01±0.04, and 0.91±0.04 cm, respectively. These findings are consistent with previous studies conducted by Anyaoha (2013), and Nassar *et al*. (2013). Mishra *et al*. (2009) reported

Table 1. Physical characteristics of amla fruit and medicinal plants

Samples	Color	Shape	Weight (g)	Length (cm)	Width (cm)	Diameter/ Thickness (cm)
Amla	Light greenish yellow	Spherical	14.94±0.05	2.23±0.05	-	2.96±0.04
Bana leaf	Pale green	Pinnate	0.12±0.05	4.44±0.05	2.06	0.06±0.04
Bhavadi leaf	Green	Narrowly oblong	0.14±0.05	3.39±0.05	2.02	0.06±0.04
Curry leaf	Dark Green	Elliptic lanceolate	0.13±0.05	3.71±0.05	2.03	0.07±0.04
Milk thistle seeds	Greyish brown	Conical	22.12±0.05/ 1000 seed weight	0.53±0.05	0.30	0.29±0.04
Mulethi root	Brown	-	4.13±0.05	3.43±0.05	-	1.01±0.04
Umre bark	Light brown	Long and slender	-	-	-	0.91±0.04

Values are triplicate determinations and represented in Mean ± SD

similar mean weight and length measurements for a wild variety of amla. The results obtained in our study contribute to the existing body of knowledge and support the findings of previous research in this field.

The data presented in Table 2 provides information about the colour (L*, a*, b*) values of selected medicinal plants, which can give an understanding of their visual characteristics. The L* value represents lightness, and the results in Table 2 indicate that all the medicinal plants fall within the lightness range. The a* value indicates a colour spectrum ranging from red to green. It can be observed from the data that amla, bana, bhavadi, and curry leaves all have negative values for a*, indicating that they are in the green range. On the other hand, milk thistle seeds, mulethi root, and umre bark have positive values for a*, indicating that they fall within the redness range. The b* parameter represents a spectrum from yellow to blue. In this case, amla, bana, bhavadi, curry leaves, milk thistle seeds, mulethi root, and umre bark all have positive values for b*, which suggests that they fall within the yellow range. It is evident that most of the plants exhibit lightness and fall within the green and yellow colour ranges. These findings can provide useful information for further research on the visual properties and potential health benefits of these medicinal plants.

Chemical characteristics

The chemical composition of amla fruit and medicinal plants is revealed in Table 3. The pH values of the plants are arranged in ascending order, ranging from 2.93 (amla), 6.07 (umre bark), 6.63 (curry leaf), 6.77 (bhavadi leaf), 7.03 (mulethi root), 7.13 (milk thitle seeds) to 7.67 (bana leaf). The TSS and titratable acidity values also varied among the plants. Amla had the highest TSS value of 9.77(°B) and it was the only plant to have detectable titratable acidity. Mulethi root,

Table 2. Colour (L*, a*, b*) characteristics of amla fruit and medicinal plants

Samples	L*	a*	b*
Amla	81.74±0.07	-1.35±0.22	20.54±0.17
Bana leaf	39.84±0.07	-4.74±0.22	5.65±0.17
Bhavadi leaf	50.47±0.07	-7.82±0.22	13.63±0.17
Curry leaf	38.92±0.07	-3.95±0.22	4.21±0.17
Milk thistle seeds	39.02±0.07	4.27±0.22	4.71±0.17
Mulethi root	45.42±0.07	6.14±0.22	10.64±0.17
Umre bark	42.53±0.07	10.01±0.22	12.45±0.17

Values are triplicate determinations and represented in Mean ± SD

Table 3. Chemical composition of amla fruit and medicinal plants

Samples	pH	TSS (°Brix)	Titratable acidity (%)	Reducing sugars (%)	Total sugars (%)
Amla	2.93±0.06	9.77±0.04	3.07±0.03	5.11±0.03	7.27±0.01
Bana leaf	7.67±0.06	2.13±0.04	ND	ND	0.39±0.01
Bhavadi leaf	6.77±0.06	2.03±0.04	ND	0.26±0.03	0.61±0.01
Curry leaf	6.63±0.06	2.47±0.04	ND	0.50±0.03	1.11±0.01
Milk thistle seeds	7.13±0.06	3.17±0.04	ND	0.88±0.03	1.24±0.01
Mulethi root	7.03±0.06	5.08±0.04	ND	1.92±0.03	3.54±0.01
Umre bark	6.07±0.06	2.67±0.04	ND	ND	0.32±0.01

Values are triplicate determinations and represented in Mean ± SD(ND- Non detectable)

(ND- Non detectable)

milk thistle seeds, umre bark, curry, bana, and bhavadi leaves had TSS values of 5.08, 3.17, 2.67, 2.47, 2.13, and 2.03 (°B) respectively. On the other hand, the values for reducing sugars and total sugars differed between the plants. Amla had the highest values of 5.11 and 7.27 per cent for reducing and total sugars respectively. Bana leaf and umre bark had the lowest content of reducing sugars and total sugars. The pH of a substance can greatly affects its stability and effectiveness as a medicinal ingredient. A lower pH value like that of amla (2.93) suggests that it is more acidic, which may contribute to its herbal properties. On the other hand, bana leaf with its higher pH value (7.67) indicates a more alkaline nature, which could have different medicinal properties. Titratable acidity is a measure of the amount of acid present in a substance and is commonly used to evaluate the quality. The presence of titratable acidity in amla suggests its potential as a natural preservative or flavor enhancer. Additionally, it is noteworthy that Mishra *et al*. (2009) reported a higher TSS value (13.1 °Brix) for wild amla compared to the value mentioned in Table 3 (9.77%). This could be due to variations in the sample source, maturity of the fruit, or differences in analytical techniques. Overall, the chemical composition of amla fruit and medicinal plants provides valuable information for understanding their potential health benefits and applications in traditional medicine. Further research could explore the correlations between these chemical constituents and the observed medicinal effects, as well as investigate the stability and preservation methods for these plants based on their pH values and titratable acidity levels.

Conclusion

The analysis of the seven medicinal plants in this study revealed significant variations in their physico-chemical characteristics. The pH levels ranged from acidic to slightly alkaline, indicating diverse chemical properties. Moreover, the varying amounts of reducing and total sugars can be attributed to the presence of different phytochemicals in each plant. These valuable findings contribute to a better understanding of the nutritional and medicinal properties of these plants, offering potential opportunities for their application in the development of nutraceuticals.

Acknowledgement

The authors are thankful to the Department of Food Science, Nutrition and Technology, CSKHPKV, Palampur for providing necessary laboratory facility and support for carrying out the study.

Conflict of interest: The authors declare that there are no conflicts of interest regarding the publication of this paper.

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