International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 24, 2019, pp.-9370-9372.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Review Article

HENNA (*LAWSONIA INERMIS* L.): FROM PLANT TO PALM

NEERAJ[1,2]*, DALAL N.[2], BISHT V.[3] AND DHAKAR U.[4]
[1]Department of Agriculture, Jharkhand Rai University, Ranchi, 835222, Jharkhand, India
[2]Centre of Food Science and Technology, Chaudhary Charan Singh Haryana Agricultural University, Hisar, 125004, Haryana, India
[3]Department of Silviculture and Agroforestry, Banda University of Agriculture and Technology, Banda, 210001, Uttar Pradesh, India
[4]Department of Home Science, Banasthali Vidyapith, Vanasthali, 304022, Rajasthan, India
*Corresponding Author: Email - phogatneeraj23@gmail.com

Received: December 11, 2019; Revised: December 26, 2019; Accepted: December 27, 2019; Published: December 30, 2019

Abstract: Henna (*Lawsonia inermis* L.) is flowering plant with varied cosmetic uses and has high *in-vitro* pharmacological activity. It is cultivated as a plantation crop in semi-arid and arid zones to yield henna leaves. The leaves are harvested and dried to reduce their moisture content for further processing and reduce microbial spoilage. The dried leaves are cleaned to remove foreign matter, cut to reduce leaf size for grinding, ground to form powder and screened to prepare homogenous henna powder. Crop can be harvested multiple times in a year and presents a scope of agriculture in regions with less rainfall and has potential as medicinal crop.

Keywords: *Henna (Lawsonia inermis L.), Microbial spoilage*

Citation: Neeraj, *et al*., (2019) Henna (*Lawsonia inermis* L.): from plant to palm. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 24, pp.- 9370-9372.

Academic Editor / Reviewer: Sathyanarayana, B. Ljevnaic Masic

Introduction

FAO estimated Henna (*Lawsonia inermis* L.) is a flowering plant, the sole species in the genus *Lawsonia* in the family Lythraceae [1]. It is cultivated as a hedge plant and as a commercial crop for its dye. Henna, a traditional product with religious associations, has been widely used over the centuries for medical and cosmetic purposes in Africa, Asia, the Middle East and many other parts of the world. The plant contains carbohydrates, proteins, flavonoids, phenolic compounds, alkaloids, tannins, Xanthones, terpenoids, quinones and fatty acids [2]. It is commercially cultivated in Afghanistan, India, Iran, Libya, Morocco, Pakistan, Somalia, Sudan and Yemen. At the present time, the Pali district of Rajasthan state is the region in India with the highest henna cultivation. Traditionally in India, mehndi is applied to hands and feet. Henna symbolizes fertility. Its use became popular in India because of its cooling effect in the hot Indian summers. Henna leaf extract has been used since ancient times to dye skin, hair, fingernails, leather, silk and wool. The dye extract of the leaves contains, lawsone (2-hydoxy-I,4-naphthoquinone), a reddish-orange pigment, as its major constituent (up to 5%) [2]. The flowers, seeds, roots, stem and bark of henna plant also contain other polyphenols, xanthones, alkaloids and terpenoids. The compounds exhibit a wide variety of biological activities such as, antimicrobial, antiparasitic, antisickling, antipyretic, analgesic, hypoglycemic, anti-inflammatory, immunostimulant and antioxidant effects [3-7].

Cultivation and harvesting

Henna plant requires less watering and hence can easily grow in arid and semi-arid regions. It presents a unique opportunity for agriculture in water-scare regions. Seeds are sown in the month of March-April. Saplings transplanted in the field at 30 x 30 cm spacing in the month of August. It can also be grown easily from stem cuttings. One or two irrigation and weeding's are required after rainy season. The leaves along with whole branches are cut/picked in the month of March-April for the 1st harvest [1]. Henna may be harvested 3-5 times a year, with the early July crop being the best, and the February crop being the weakest.

The harvested leaves can be sorted, graded, and sieved manually/mechanically, to remove straws, fruits, branches and dust, for further processing [17].

Flow Chart for processing of henna leaves

Processing of Henna leaves

Drying

Drying is a major part of henna processing. It involves reducing the moisture content of the leaves such that it can be made into powder. Henna leaves are dried while they attached to the branches for easy handling. This leads to addition of fruits, flowers and twigs in the dried leaves. Traditional drying involves drying in shade or open air drying and is weather dependent. This is cheap and done at small scale. This process if however labour intensive and requires large open shaded spaces. The leaves being dried also need frequent turning to avoid improper drying and microbial attack. If the drying is without shade *i.e*., under direct sunlight, UV radiation can cause undesirable quality and color loss [18].

Using solar and cabinet dryers with alternative sources of energy overcomes the challenges with open air drying. These drying equipment's however are cost intensive and simple unaffordable for small and marginal farmers with less quantity of produce. The need for a low-cost energy dryer led CRIDA to develop a LPG (Liquefied petroleum gas) fuel based dryer. CRDIA conducted a study to evaluate the quality of henna leaves post drying using the LPG dryer. Henna leaves were dried by different drying methods *viz*., open air drying (Sun), shade and LPG based CRIDA dryer at 40ºC, 50ºC, and 60ºC. The dried leaves were powdered and stored in high density polyethylene (HDPE) (40µ thickness) bags and brown paper covers. The stored powder was assessed for color and quality at 3 months interval during 1-year storage. The leaves dried with CRIDA dryer at 50ºC had higher lawsone content and retained better chlorophyll at the end of 1-year storage, as compared to other methods of drying. This temperature was also most energy efficient.

The dried leaves of henna are graded in 3 categories based on their quality [19]:

Table-1 *Chemical constituents and their respective pharmacological activities of respective parts of henna plant*

Plant Parts	Chemical constituents	*In-vitro* pharmacological activity	References
Leaves	Naphthoquinones, polyphenolic components, terpenes and terpenoids, flavonoids,	Antihyperglycemic and hepatoprotective, antioxidant, antibacterial, antifungal, wound healing, antitumor & cytotoxicity, anti-parasitic activity	[3, 5, 6, 8, 9, 10, 11]
Bark and stem	Naphthoquinone, polyphenolic components, terpenes and terpenoids, phytosterols and aliphatic compounds	Anti-inflammatory activity, anti-parasitic activity	[3, 12, 13]
Flowers	Terpenes and terpenoids	Antifungal activity	[7, 11]
Roots	Phytosterols and aliphatic compounds	Anti-parasitic activity	[14]
Seeds	Terpenes and terpenoids, phytosterols and aliphatic compounds	antioxidant activity	[3, 15]
Whole plant	Xanthones, benzopyrones,	Antioxidant activity	[4, 16]

Grade 1: Small green leaves: these leaves are produced from mature stem in the month of October. Lawsone content in these leaves in 3.0%.
Grade 2: yellow-green mosaic leaves: These leaves are also harvested from mature shrubs but in the month of September while leaves are less stiff. The lawsone content in these leaves is 2.4%.
Grade 3: light to dark leaves: Such leaves are harvested from mature plants but are exposed to rain before harvest. Exposure to rain reduces the lawsone content to 2.08%. Exposure to water leads to leaching of lawsone out of the leaf which turn the leaf colour to dark brown and thus reduces the lawsone content of the final product [20].

Post-drying processing

The dried leaves are passed through different stages of processing before being turned into the final powdered product. They are cleaned, cut, ground, and screened before being packaged. The dried henna leaves are first cleaned in perforated rotate cleaning drums. This removes the soil that might be present int the leaves. The cleaned plant leaves are blown out and collected. Fruiting stalks and other branch pieces are further removed through winnowing. The dry and light weight leaves are collected at distance away from the heavier impurities such as stalks, fruits and stones. The cleaned and dried whole leaves are then cut into smaller pieces using a shredder. This helps with easy movement and transportation of leaves. The shredded leaves are then fed into a grinding machine/hammer mill or a pulveriser so that they can be converted into powder of desired particle size/mesh size [17]. Heat is generated during pulverization process that increases browning of powder and loss of pigments [20]. Gridding of henna involves size reduction of the dried product leading to 80-100% value addition [21]. The ground powder is further screened through another aerated rotating drum device to refine the powder. The final powder is of highest purity and is packaged [17]. The product is generally packed in polyethylene packs of different sizes to meet consumer demand and ease of transportation. Processing of henna leaves leads of a processing loss of 12-18% by weight, mostly caused by impurities [17].

Quality evaluation of Henna

The quality of henna is defined by its colour, purity, dyeing property and fineness [22]. The color of henna powder depends on quality of leaves which in turn depends on the quality of leaves. The color of leaves can vary from olive-green to brown depending on harvesting season [Table-2].

Table-2 *Henna powder color and dye content as affected by time of harvest [20]*

Month of harvesting and curing	Powder color	Lawsone content
June	Rusty brown	2.38%
July	Greenish brown	2.68%
August	Brown	2.75%
September	Yellowish brown	2.60%
October	Green	2.82%

Quality parameters for commercial production and analysis of henna are regulated by Indian Standard- Specification of Henna powder [22] and Indian Standards-Methods of test for Henna Powder [22].

Henna powder may be mixed with synthetic black dyes like PPD (para-phenylenediamine) to impart black color. This color can be detrimental to skin and can be detected by HPLC [20]. Another possible way of adulteration is adding leaves of different species in henna. Leaves of *Khejri* or *Jal* are commonly added. Leaves of amli (*Cassia auriculata*, used in leather tanning) are also used as adulterants [19].

Table-3 *Quality parameters for Henna powder (IS-11142-1984) (% dry mass)*

S	Parameter	Requirement (Percentage)
1	Moisture and volatile matter (percent by mass), maximum	10
2	Cold water extract (percent by mass)	25-32
3	Crude fibre (percent by mass)	15-Oct
4	Mineral matter (percent by mass)	12-Aug
5	Acid insoluble ash (percent by mass)	6-Mar
6	Extraneous sand (percent by mass), maximum	5
7	Presence of extraneous dyes	To pass the test (Detected by chromatogenic analysis)
8	Lawsone content (percent by mass), minimum	1.0

Conclusion

Henna is a plantation crop with less water requirement than traditional crops and is sustainable for agriculture in semi-arid regions. Its technology for processing is passed down through generations and presents a scope for small scale industries and entrepreneurship among farmers. Its wide cultural and religious use makes sure that demand is present and also presents a scope for export. Development of quick adulteration techniques will help boost exports while maintaining the product standards. Extending the farming to larger areas with suitable climate and more research in energy saving and cheap processing methods are the way forward.

Application of research: Mehndi holds cultural significance in India and other parts of the world. Applying it on the body for decorative purposes constitutes its major use while its medicinal properties also mark its use in traditional medicine. Henna being a drought-tolerant crop with lesser water requirements creates an opportunity for farmers in semi-arid areas in India to increase their income. Henna being a plantation crop, might be easier to grow and can give returns for a longer time than seasonal crops which needs planting every year. This review sheds light on growing, post-harvest processing and applications of the henna plant. It aims to bring attention to this multi-functional plant and increase awareness about it. Henna, with its export potential, can help farmers and help set up small scale industries

Research Category: Post Harvest Technology

Acknowledgement / Funding: Authors are thankful to Jharkhand Rai University, Ranchi, 834010, Jharkhand, India and Chaudhary Charan Singh Haryana Agricultural University, Hisar, 125004, Haryana, India; Department of Silviculture and Agroforestry, Banda University of Agriculture and Technology, Banda, 210001, Uttar Pradesh, India

****Principal Investigator or Chairperson of research: Neeraj**
University: Jharkhand Rai University, Ranchi, 835222, Jharkhand, India
Research project name or number: Review study

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Jharkhand Rai University, Ranchi, 835222, Jharkhand, India

Cultivar / Variety / Breed name: Henna *(Lawsonia inermis L.)*

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Kumar S., Singh Y. & Singh M. (2005) *Henna: Cultivation, improvement and Trade, Central Arid Zone Research Institute, Jodhpur, India.*

[2] Berger S. & Sicker D. (2009) *Wiley-VCH Verlag Gmbh and Co.,Weinheim,Germany*, pp. 191-206.

[3] Singh A. & Singh D. K. (2001) *Indian J Exp Biol*., 39(3), 263-8.

[4] Uddin N., Siddiqui B. S., Begum S., Bhatti H. A., Khan A., Parveen S. & Choudhary M. I. (2011) *Phytochemistry Letters*, 4(4), 454-458.

[5] Hsouna A. B., Trigui M., Culioli G., Blache Y. & Jaoua S. (2011) *Food Chemistry*, 125(1), 193-200.

[6] Chaudhary G. D., Poonia P., Kamboj P. & Kalia A. N. (2012) *Int J Phytopharmacol*, 3, 66-73.

[7] Jeyaseelan E.C., Jenothiny S., Pathmanathan M.K. & Jeyadevan J. P. (2012) *Asian Pacific Journal of Tropical Biomedicine*, 2(10), 798-802.

[8] Dasgupta T., Rao A. R. & Yadava P. K. (2003) *Molecular and Cellular Biochemistry*, 245(1-2), 11-22.

[9] Arayne M.S., Sultana N., Mirza A., Zuberi M.H. & Siddiqui F.A. (2010) *Molecules*, 15, 2139–2151.

[10] Priya R., Ilavenil S., Kaleeswaran B., Srigopalram S. & Ravikumar S. (2011) *Saudi Journal of Biological Sciences*, 18(4), 353-359.

[11] Satyal P., Paudel P., Poudel A. & Setzer W. N. (2012) Ph*armacologyOnLine*, 1, 31-35.

[12] Ahmed S., Rahman A., Alam A., Saleem M., Athar M. & Sultana S. (2000) *Journal of ethnopharmacology*, 69(2), 157-164.

[13] Liou J. R., El-Shazly M., Du Y. C., Tseng C. N., Hwang T. L., Chuang Y. L. & Hou M. F. (2013) *Phytochemistry*, 88, 67-73.

[14] Gupta S., Ali M., Sarwar Alam M., Sakae T. & Niwa M. (1992) *Indian Journal of Chemistry. Sect. B: Organic chemistry, including medical chemistry*, 31(10), 705-707.

[15] Surveswaran S., Cai Y. Z., Corke H. & Sun M. (2007) *Food Chemistry*, 102(3), 938-953.

[16] Guha G., Rajkumar V., Kumar R. A. & Mathew L. (2011) *Evidence-Based Complementary and Alternative Medicine*, 2011.

[17] Chand K., Jangid B. L., Roy P. K. & Singh Y. V. (2005) (Eds. Manjit Singh, Y. V. Singh, S. K. Jindal and P. Narain), pp. 51-54. Central Arid Zone Research Institute, Jodhpur.

[18] Ertekin C. & Yaldiz O. (2004) *Journal of Food Engineering*, 63, 349-359.

[19] Singh M., Jindal S. K., Kavia Z. D., Jangid B. L. & Chand K. (2005) *(Eds. Manjit Singh, Y. V. Singh, S. K. Jindal and P. Narain), pp. 21-24. Central Arid Zone Research Institute, Jodhpur.*

[20] Roy P. K. and Singh M. & Tewari P. (2005) (Eds. Manjit Singh, Y.V. Singh, S.K. Jindal and P. Narain), pp. 39-40. *Central Arid Zone Research Institute, Jodhpur.*

[21] Rao S.S., Roy P.K., Regar P.L. & Chand K. (2002) *Indian Farming, India.*

[22] BIS (1985) *Indian standard specification for henna powder (IS: 11142-1984), First reprint 1997, Bureau of Indian Standards, New Delhi*, 4-8.