Lawsonia inermis L.: A rainfed ratoon crop

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Abstract: *Lawsonia inermis* L. is a leaf based perennial dye crop commonly called henna or mehndi. Cosmetic and pharmaceutical companies largely depend upon materials procured from naturally occurring stands. Though abundantly found earlier, today concerns are about the possible extinction of the plant. Since it is a rain-fed ratoon crop, it should be cultivated by farmers for its good regeneration ability. The plants procured from Jodhpur and Kalyan, showed morphological differences strongly influenced by environmental factors and geographical distribution. The quantitative estimation of Lawsone in plants procured from Jodhpur and Kalyan showed variation.

Key words **:** *Lawsonia inermis* L., ratooncrop, lawsone.

Introduction

Lawsonia inermis is a leaf based perennial dye crop belonging to the family Lytheracae. It is commonly called as henna or mehndi. The plant is self-pollinated woody shrub. In India, Henna is mostly grown in the states of Rajasthan, Gujarat, Madhya Pradesh and Punjab. Rajasthan henna farms normally produce body art quality henna (Khandelwal, 2002). Leaves of henna contain Lawsone, the active ingredient responsible for its dye properties. Physical conditions influence the dye properties and percentage of Lawsone in henna. Normally the concentration of Lawsone found in leaves is between 0.5 to 1.5% (Simon *et al*, 1984). Henna can be grown on wide variety of soil and climatic conditions. However deep, fine sandy soil is good for henna cultivation. The plant thrives well under arid to tropical and warm temperate climatic conditions. It need moderate rainfall of around 40 mm and temperature of about 30^0-40^0C. Climate plays a dominant role in the production of quality leaf crop. The rainfall distribution is important and Henna requires dry sunny periods along with cool nights for proper growth. Rains at harvesting (Sept-Oct) stage or just after harvest spoils the produce and lower the market value (Shukla *et al*., 2012).

In the present investigation effect of geographical distribution on morphological characteristics and Lawsone content of *Lawsonia inermis* L. was studied. Henna plants growing in Jodhpur and Pilani (Rajasthan); Kalyan, Thane and Badlapur (Maharashtra) were investigated.

The climate of Rajasthan is hot and arid with low and erratic rainfall, high evapo-transpiration and poor soil physical and fertility conditions. The average daily maximum temperature in summer is 45^0C and in winter average mean daily minimum temperature is 9.9^0C. The average annual rainfall in the district is 41 mm. In such conditions cultivation of henna provides some assured income to the farmers because of its drought hardness and deep root system (http://www.cazri.res.in/) (Table 1).

In Maharashtra, the climate of Thane district is characterized by an oppressive summer, dampness in the atmosphere nearly throughout the year and heavy south – west monsoon rainfall from June to September. The average daily maximum temperature in summer is 32.9°C and in winter average mean daily minimum temperature is 16.8°C. But in the interior parts of the district, the average daily minimum temperature is slightly lower in the winter season and the average daily maximum temperature is higher in the summer. The average annual rainfall in the district is 2293.4 mm. Two types of soils have been observed in the district viz., medium to deep black and reddish colored soil (Gupta, 2009) (Table 1).

Materials and Methods

Henna plants growing in Jodhpur and Pilani (Rajasthan); Kalyan, Thane and Badlapur (Maharashtra) were collected. Morphological study was done for plants from both the regions.

Leaves of *Lawsonia inermis* L. from field grown plants from Kalyan (MS) and Jodhpur (Rajasthan) were collected (February-May and October-January) separately and dried, powdered and stored in air tight containers separately.

Authentication of the plant (S.H.-1533) was done at Blatter Herberium, St. Xavier's College, Mumbai. The specimen voucher was deposited in the Blatter Herberium, St. Xavier's College, Mumbai.

Moisture content was calculated for leaves of *Lawsonia inermis* L. procured from Jodhpur and Kalyan. Dried leaf powder from Kalyan (MS) and Jodhpur (Rajasthan) were used separately for analysis. 1 gm of powder was weighed and placed in a test tube and 10 ml of 50% methanol was added. Samples were vortexed for 10 minutes and left to stand overnight at room temperature (28 ± 2^0C). The extracts were filtered through Whatmann No. 41 paper (E. Merck, Mumbai, India) and the filtrate was used for experimental work. Standard solution of lawsone (1mg/ 1ml) was prepared in 50% methanol.

HPTLC was performed on silica gel 60 F_{254} HPTLC per-coated plate (10 cm X 10 cm) of 0.2 mm thickness, for the quantification of lawsone in samples of *Lawsonia inermis* L. 8mm bands of sample and standard were applied with an automatic Camag Linomat V sample applicator. The chromatogram developed inpre-saturated Camag twin through chamber with mobile phase, toluene: ethyl acetate: acetic acid (5: 4: 1 v/v/v), for 20 minutes, at room temperature (28°C±2°C). After drying HPTLC plate scanning profiling was carried out with a Camag TLC scanner III at a single wavelength 254 nm. Determination of lawsone amount was calculated by comparison of area measured for the sample to that of the standard. Each sample was analyzed in triplicate.

Results and Discussion

The lawsone content is the principal quality parameter of henna which is significantly influenced by weather and its geographical distribution. In the present study non-significant variation was found in the morphological characteristics and lawsone content due to location within the state (Kalyan, Thane and Badlapur of Maharashtra; Jodhpur and Pilani of Rajasthan). Therefore further studies were restricted to Kalyan (Maharashtra) and Jodhpur (Rajasthan).

The morphological difference between leaves of *Lawsonia inermis* L. procured from Kalyan and Jodhpur is shown in Table 2 and Table 3. The work carried out here has led to the development of HPTLC fingerprint patterns for leaf powder of *Lawsoni inermis*L. procured from Kalyan and Jodhpur. The marker lawsone was detected and quantified (Plate 2). The developed fingerprints showed distinct variation in lawsone content and was found to be maximum in leaf powder procured from Jodhpur (0.061µg/mg) than leaf powder procured from Kalyan (0.043µg/mg) (Table 4 and Plate 3 and 4).

The study revealed that colour, number and leaf size showed morphological variation in the *Lawsonia inermis* L. procured from Jodhpur and Kalyan. These differences were strongly influenced by environmental factors (soil texture, soil chemical characteristics and annual rainfall) and geographical distribution. The quantitative estimation of Lawsone in plants procured from Jodhpur and Kalyan showed variation. This quantification data can be used as a diagnostic tool to identity and determine the quality and purity of the plant material. However, cosmetic and pharmaceutical companies largely depend upon materials procured from naturally occurring stands.

Abundantly found earlier, today concerns are about the possible extinction of the plant. It is an important export oriented dye crop, but it is also a ratoon crop. It can be cultivated by farmers for its good regeneration ability in dense plantation, mainly as rain-fed crops. Henna cultivation has been found an economically viable agri-enterprise. If planted as short rotation forestry plantation, it maintains continuous soil cover through foliage and also helps in building a cleaner environment. Henna based agro-forestry system may also help farmers in drought proofing strategy.

Table 1: Climatic conditions in different regions

Rajasthan:		
Period	**Temperature**	**Rainfall**
January to March	10^0C - 27^0C	4mm – 7mm
April to June	24^0C - 45^0C	11mm - 30mm
July to September	21^0C - 35^0C	100mm - 165mm
Octoberto December	13^0C - 30^0C	3mm - 8mm
Kalyan:		
January to March	16^0C - 30^0C	NA
April to June	32.9°C - 40^0C	250 mm - 320mm
July to September	20^0C - 25^0C	1730.5 mm -2588.7 mm
Octoberto December	16.8^0C - 25^0C	91mm-103mm

Table 2: Morphological study of leaves of *Lawsonia inermis L.* (Kalyan)

Sr. no.	Leaves	Length (cm)
	Young leaves	2.0-2.5 ± 2.57
	Old leaves	3.0-3.5 ± 2.89
	No. of leaves/branch	40-50 ± 3.10
	Attachment of leaves	2 leaves/internode
	Colour of leaves	Dark green
	Branch length	16-25 ± 2.43
	pH	7.1-8.0
	Moisture content	63.6% ± 0.03

Table 3: Morphological study of leaves of *Lawsonia inermis L.* (Jodhpur)

Sr. no.	Leaves	Length (cm)
	Young leaves	2.2-2.8 ± 2.45
	Old leaves	3.5-4.5 ± 3.34
	No. of leaves/branch	50-60 ± 3.38
	Attachment of leaves	2 leaves/internode
	Colour of leaves	Light yellow green
	Branch length	25-35 ± 2.97
	pH	8.6-8.9
	Moisture content	71.9% ± 0.01

Table 4: Amount of Lawsone in field grown plants (Kalyan and Jodhpur) of *Lawsonia inermis* L. by HPTLC

Sr. No.	Sample	Concentration (µg/mg)±S.D.
1.	Leaf powder (Kalyan)	0.043 ± 3.33
2.	Leaf powder (Jodhpur)	0.061 ± 1.87

Plate 1: Plant of *Lawsoniainermis* L.
1. Kalyan (Maharashtra)
2. Thane (Maharashtra)
3. Badalapur (Maharashtra)
4. Jodhpur (Rajasthan)
5. Pilani (Rajasthan)

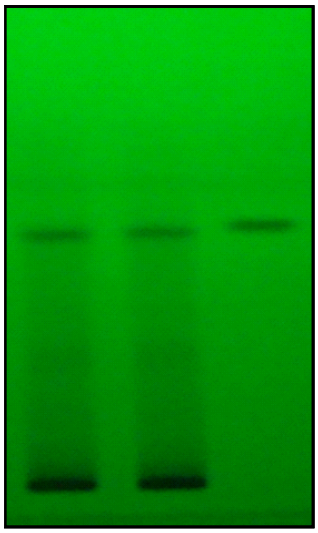

Plate 2:Chromatographic plate of *Laswoniainermis* L

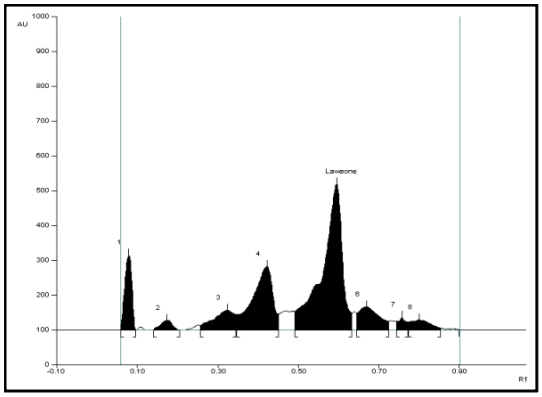

Plate3:Densitogram of leaf powder of *Laswoniainermis* L. procured from Jodhpur

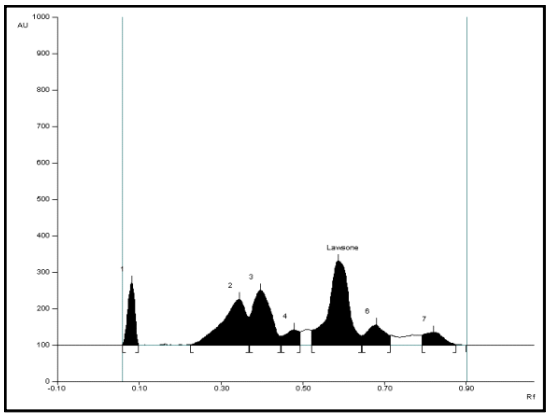

Plate 4: Densitogram of leaf powder of *Laswoniainermis* L procured from Kalyan

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References:

1. **Gupta, S.** (2009). Greater Mumbai district at a glance. Government of India.

2. **Khandelwal, S. K., Gupta, N. K. andSahu, M. P.** (2002). Effect of plant growth regulators on growth, yield and essential oil production of henna (*Lawsoniainermis*L.). *The Journal of Horticultural Science and Biotechnology*, **77(1)**: 67-72(6).

3. **Khemchand, Jangid, B.L. and Rao, S.S.** (2003). Henna: A potential source of non-farm employment and economic development in arid fringes. Agriculture economics Research review, Conference issue, pp. 179.

4. **Simon, J.E., Chadwick, A.F. andCraker, L.E.** (1984).The Scientific Literature on Selected Herbs and Aromatic and Medicinal Plant of the Temperate Zone. Archon Books, pp. 770.

5. **Sukla, M., Regar, R. L. and Jangid, B. L.** (2012). Henna (*Lawsoniainermis* L.) Cultivation: AviableAgri-enterprise in arid fringes of western Rajasthan. Den News, **14**(2).

6. http://www.cazri.res.in/