

Leaf Architecture of a Unani drug 'Sarphuka' (*Tephrosia purpurea* (L.) Pers.) : An Aid to Identification

¹*Kiran Negi, ²Aminuddin and
¹M.S.Y. Khan

¹Drug Standardisation Research Unit
(Central Council for Research in
Unani Medicine),
Hamdard University,
New Delhi - 110062

²Central Council for Research in Unani
Medicine, 61-65, Institutional Area,
Janakpuri, New Delhi-110058

Abstract

In nature, different species exhibit remarkable diversity of leaf morphology. In systematic and taxonomic classification, leaf architecture has long been the important criterion and even today it is the best means of identifying a plant species. In view of this, present work is undertaken on the leaf architecture of *Tephrosia purpurea* (L.) Pers. (family : Fabaceae) an important drug of Unani system of medicine, popularly known as "Sarphuka" and is considered as anthelmintic, blood purifier, antitumour, alexiteric and antipyretic in Unani system of medicine . Tender leaves showed good results in treating eczema and other skin disorders. The leaf decoction is used for treating sluggish fever, heart and spleen disorders, cancerous tumors, asthma and digestive complaints. The work focus on the macroscopic features of the leaf blade including leaf characters (leaf shape, size, margin etc.) ; venation and surface characters (stomata, stomatal number, stomatal index, vein islet number etc.) which are important determinant of leaf architecture. All these characters along with the internal architecture of the leaf (microscopical details) provide a framework to facilitate quick identification and selection of the drug from various adulterants.

Keywords: *Tephrosia purpurea* (L.) Pers., *Leaf architecture*, *Stomata*, *Adulterants*, *Stomatal index*.

Introduction

The angiosperm flora exhibits a wide range of leaf architecture. Although foliar architecture as a taxonomic tool has been in use since a long time, the coherent classification of dicotyledons leaf architecture by Hickey (1973) has stimulated a wider interest in the subject. In the recent past, a large number of workers have successfully used these characters in classifying both extinct and extant plant materials of complex taxonomic groups. (Inamdar and Murty, 1981; Jain, 1978; Mishra, 1970; Roth Nebelsick *et al.*, 2001; Singh *et al.*, 1976; Rao and Narmada, 1994). A perusal of literature, however, reveals that the study on leaf architecture of *Tephrosia purpurea* (L) Pers. has received little attention. The present investigation, is therefore, undertaken to provide a framework for quick identification and selection of the drug from various adulterants.

Tephrosia purpurea (L) Pers. belongs to family Fabaceae and is popularly known as "Sarpunkha". Being hot 3° and dry 3° it has been used for centuries

* Author for correspondence

in unani system of medicine to cure various ailments. It possess various pharmacological activities like antidiabetic, antiepileptic, anti carcinogenic, antimicrobial, antibiotic, anti inflammatory, analgesic, antiulcer, anti hyperlipidemic, immunomodulatory, hepato protective and wound healing. Tender leaves showed good results in treating eczema and other skin disorders. The leaf decoction is used for treating sluggish fever, heart and spleen disorders, cancerous tumors, asthma and digestive complaints (Khatri *et al.*, 2008; Joshi, 2000; Kavita and Manoharam, 2006; Kirtikar and Basu, 1988; Lodhi *et al.*, 2006).

Systematic position of *Tephrosia purpurea* (L) Pers.

Kingdom : Plantae
Division : Magnoliophyta
Class : Magnoliopsida
Order : Fabales
Family : Leguminosae (Fabaceae)
Genus : *Tephrosia*
Species : *purpurea* (L) Pers.

Vernacular Names

Urdu : Sarabhuka
Bengali : Bannilgachh, Sarphonka
English : Wild Indigo
Gujrati : Ghodakan, Jhila, Sarpankho, Sharpankho
Hindi : Sarphoka, Sarphonka, Dhamasia
Kannada : Empali, Vajaraneeli, Koggili
Malyalam : Kolinnil, Kozhenjil, Kaatamiri
Oriya : Kolothiyapokha, Mohisiakolothiga, Pokha, Soropokha
Punjabi : Bansa, Bansu, Jhojhru, Sarpankh, Sarphonka
Sanskrit : Banapunkha, Ishupunkhika, Kalashaka, Kalika, Kandapunkha, Kriti, Sharapunkha
Tamil : Kolingi, Paavali, Katkolingi, Kolluk-kay-velu

Distribution

Throughout the plains of India, Ceylon, Mauritius, Tropical Africa & Sub tropical region (2, 10).

Description of the plant

Herb, perennial, 30 – 60 cm. tall, many branched, puberulant, densely spreading villous or glabrescent; stem nearly erect to spreading, with a woody base, ridged; flowers ca. 8mm, calyx 2 – 4 x ca.3 mm, teeth equal, corolla mauve, standard orbicular, white puberulent, ovary with trichomes, with 5 – 8 ovules; legumes lilnear 3 – 5 cm x 3.5 – 4 mm with sparse appressed trichomes, apically slightly curved; seed ca. 6 per legume, grayish brown, ellipsoid ca. 3 x 15 mm, with spots, smooth (Fig. A).

Flowering : March – October

Fruiting : September – December

Material and Methods

Ten *Tephrosia purpurea* (L) Pers. plants from the campus of Jamia Hamdard, New Delhi contributed the material for the present study and details are given in Table 1.

Table 1: Histological Quantitative Study

S.No.	Characters	Number	Range
1.	Stomatal Index		
	(i) On adaxial surface	15.8	11-24
	(ii) On abaxial surface	12.4	6-16
2.	Palisade ratio	4.38	3-6
3.	Vein – islet Number	23 - 28	14-29
4.	Vein – termination Number	24	12-33

Stomatal Studies

For stomatal measurements, the 1st pair of fully expanded leaves were used. A strip of lower epidermis from the middle portion of the leaf was peeled off and mounted in glycerol and stained in safranin. The number of stomata in 30 randomly selected microscopic field areas from six leaves was counted per

plant to obtain stomatal and epidermal cell frequency. Leaf area per stomata was calculated based upon the stomatal frequency per unit area. Stomatal index (SI) was calculated according to the formula of Salisbury (1927)

$$SI = S / E + S \times 100$$

Where S is the number of stomata per unit leaf area and E is the number of epidermal cell per unit leaf area.

Leaf Venation Pattern

Fully expanded leaves from the terminal part of the branch were collected from ten representative plants. Leaves were immersed in 80% ethanol form 48 - 72 hrs. with several changes of the solvent in order to remove chlorophyll pigments. The leaf samples were then washed and treated with 3 – 5 % NaOH for 24 – 36 hrs. The digested leaf tissue was carefully brushed apart to obtain the leaf skeleton. These are further hardened by treating with saturated chloral hydrate solution for several days, washed, dehydrated and preserved. Major venation pattern was studied and absolute vein islet number and absolute vein – termination number were calculated by Gupta (1961) and terminology of Hickey (1973) is followed for the description of leaf architecture.

Results

Leaf characters : Leaf of *Tephrosia purpurea* (L) Pers shows following characters :-

Leaf : compound, imparipinnate , stipules narrowly triangular

Rachis size : 7 -15 cm including petiole ca. 1 cm

Leaflet (Fig. 1 - 6, 11)

Number : 9-17 (-21)

Shape : obovate to narrowly elliptical

Terminal leaflet size : 7-28 mm x 2 – 11 mm

Lateral leaflet size : 5 – 30 mm x 2 – 11 mm

Base : acute

Apex : obtuse

Margin : entire

Venation : distinct on both surface

Leaflet surface : Abaxial – appressed pubescent

Adaxial – glabrous

Stomata : usually anisocytic and paracytic

Microscopy

T. S. through the lamina of the leaflet shows single layer of upper epidermis covered by cuticle. Mesophyll is differentiated into two rows of palisade cells and a central and spongy parenchyma region. Vascular bundles are embedded in between. Lower epidermis single layered with stomata and covered by cuticle. Non-glandular hairs are present in the lower epidermis. The hairs are non-glandular, simple, elongated and aseptate (Fig. 3 & 4).



Fig 1: x4 leaflet showing vein islets

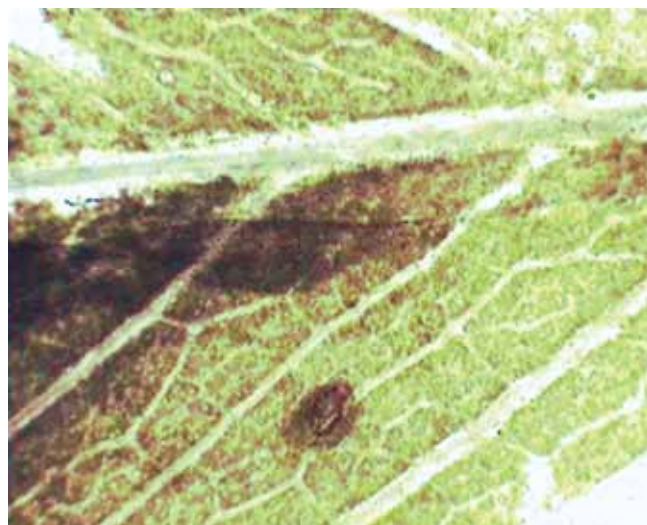


Fig 2: x4 leaflet showing mid vein and parallel veins

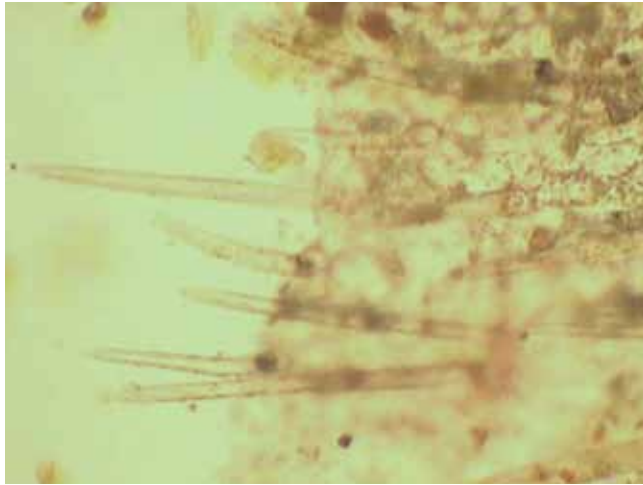


Fig. 3: x40 leaflet showing trichomes (surface view)

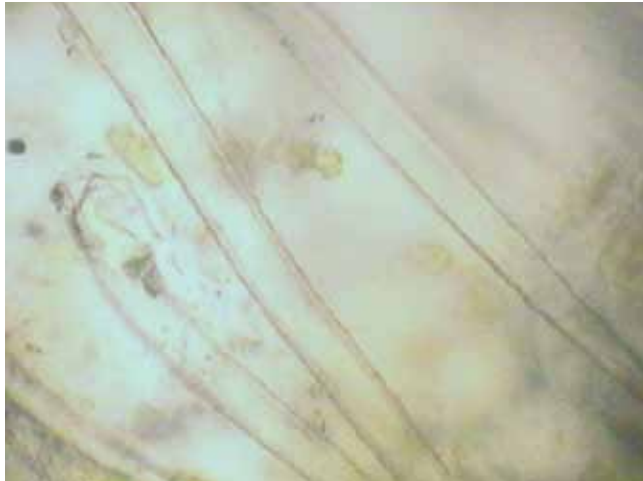


Fig. 4: x100 leaflet trichomes (enlarged view)



Fig. 5: x100 leaflet showing stomata (surface view)

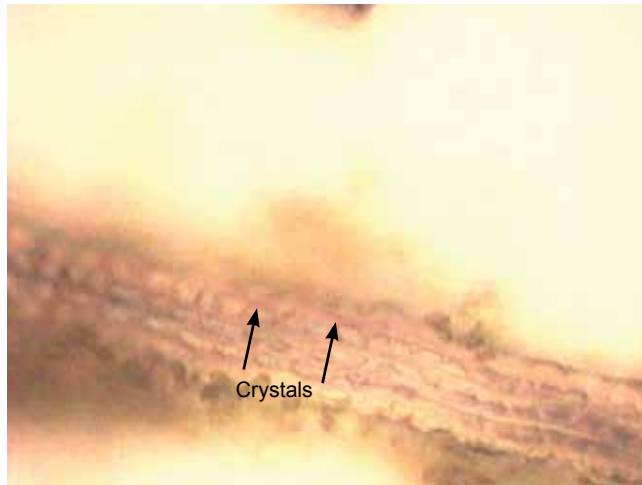


Fig. 6: x40 Leaflet showing veins crystals (surface view)

Leaflet architecture of *Tephrosia purpurea* Pers.

A T.S. through midrib region shows that the palisade is discontinuous over the meristele region and the vascular tissue exhibits an arc of xylem with phloem beneath. This group of bundle is protected with above and below by an arc of lignified fibers which is somewhat ovate in shape above and crescent shape below. The upper ridge of the midrib is composed of a group of collenchymatous cells (Fig. 7, 8).



Fig. 7: x10 T.S. of leaflet showing Vascular bundle



Fig. 8: x40 T.S. leaflet showing V.B.(enlarged view)

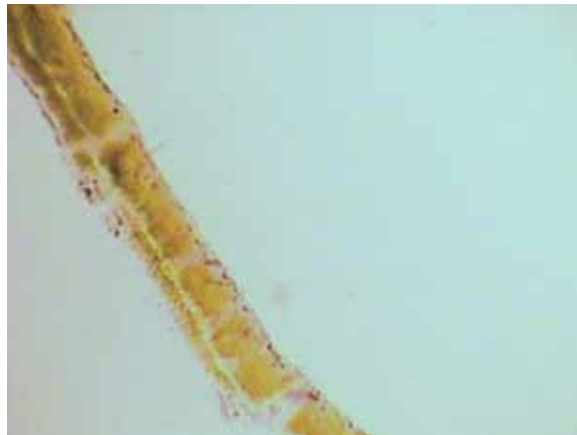


Fig. 9: x10 T. S. lamina

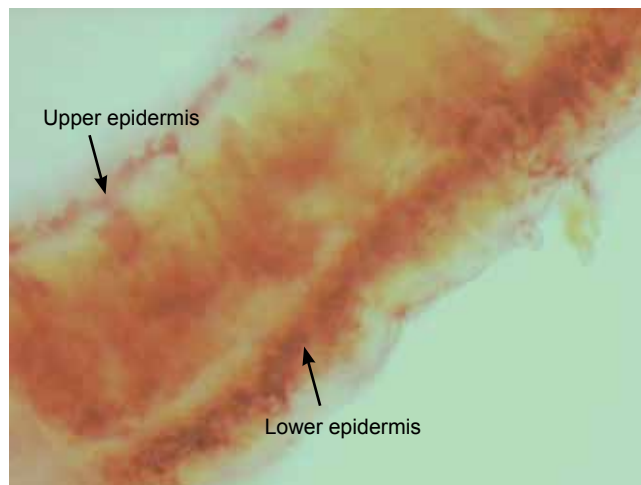


Fig.10: x40 T.S. lamina (enlarged view)

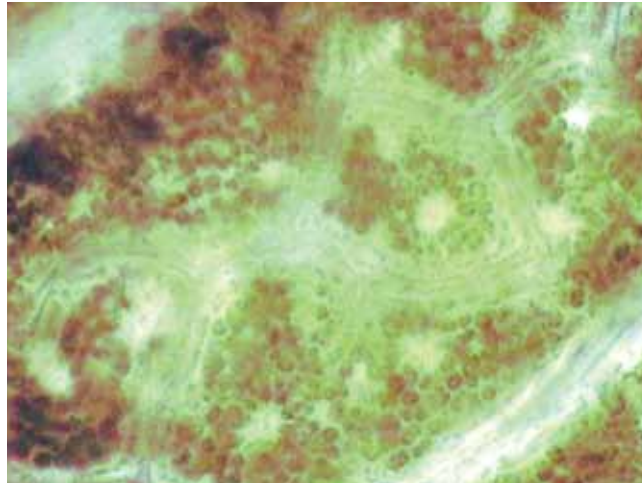


Fig.11: x40 Upper surface of leaflet without trichomes

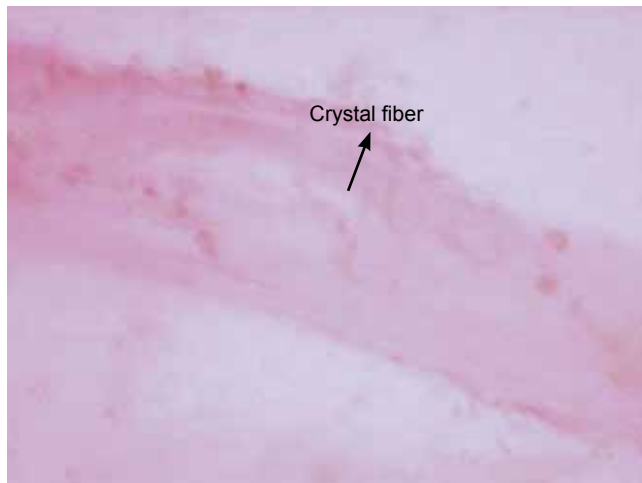


Fig. 12: x40 Crystal fibers

Leaflet architecture of *Tephrosia purpurea* Pers.

Conclusion

In nature, there is remarkable diversity of leaf morphology among different species of a plant. 24 species of *Tephrosia* were recorded in India. Leaf architecture study of *Tephrosia purpurea* (Linn) Pers. shows many distinctive features that act as an important tool in identifying the plant specie and differentiating the species from its adulterants.

Tephrosia purpurea (Linn) Pers. has compound, imparipinnate leaf, leaflets four to ten pairs, obovate to narrowly elliptical, almost glabrous above and pubescent beneath with anisocytic and paracytic type of stomata on both the surfaces.

Stomatal index is a significant tool in identifying the species of a plant as it is not affected by the factors like the age of the plant, size of the leaf, environmental condition etc. It is relatively constant for a species. Study of stomatal index shows a range of 11 -24 (adaxial surface) and 6-16(abaxial surface) in *Tephrosia purpurea* (Linn) Pers leaf.

Similarly ,Vein islet, that is used to distinguish between drugs of closely related specie does not alter with the age of a plant and is independent of the size of the leaf. It is also constant for a given species. Study shows that *Tephrosia purpurea* (Linn) Pers leaf have vein-islet number within the range of 14-29.

Besides these characters, *Tephrosia purpurea* (Linn)Pers leaf shows non glandular, simple, elongated and aseptate trichomes, crystal sheath surrounding the large vascular bundle which are capped by fibre strands on both adaxial and abaxial side and presence of collenchyma cells on the upper ridge of the midrib.

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