Volume : 3 | Issue : 10 | October 2014 • ISSN No 2277 - 8179

Research Paper

A Poisonous Forest Tree "Vishtendu" (*Diospyros Montana* Roxb.) : Taxonomic Evaluation

Botany

KEYWORDS : GLANDULAR HAIR, STOMATA, TOXIC AND MEDICINAL PROPERTIES.

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ABSTRACT

Poisonous plants have many chemical constitutents. Diospyros montana is a naturally occurring tree of deciduous forest. It is poisonous used in various purposes i.e. weapons, in controlling pests and medicines on the basis its constituent properties. Poisonous plants occur in great variety (higher plants and lower groups) in tropical regions. Studies of Diospyros montana are done for their taxonomy, toxic and medicinal properties and epidermal studies. Four types of trichomes i.e. Unicelled flagellate glandular hair, Unicelled branched flagellate glandular hair, Unicelled Conical glandular hair, Uniseriate flagellate glandular hair and two types of stomata i.e. anomocytic and actinocytic are present on different plant parts of Diospyros montana. The study indicates the taxonomic importance of the different parameters of epidermal studies.

I. Introduction

Bistendu is a native tree to the tropics. It has been used in treatment for fever, dysuria and used as fish poison. The present paper deals with microscopic examinations of epidermal cells, stomata and trichomes with the aim of providing useful taxonomic data that would give further insight into proper classification and identification of the plant.

Choubey and Khare (2007) have described the poisonous plants and Smith (2004) and Long (2005) have published the work on the poisonous plants. King and Robinson (1969) have used trichome character alongwith several other epidermal features in determining generic circumscriptions in the Compositae. The morphological characters of trichomes have been studied by Faust and Jones (1973), Inamdar and Gangadhara (1975), Sahu (1982, 83, 84, 85) and Tiwari (1982). Ahmad *et al.*, (2009) studied that trichomes were mostly macrohair and microhair in eight species of Verbenaceae. Francey (1936) recognized total eight categories and 34 structural stomatal types based on the number, position and size of the subsidiaries. Patel *et al.* (1971) have noticed anisocytic, anomocytic, diacytic, paracytic stomata and stomata with a single subsidiary cell in some Polemoniales. According to Camargo *et al.*(2011) in 35 rainforest tree species of Central Amazonia, the most common stomatal type found was anomocytic(37%), followed by paracytic (26%) and anisocytic (11%).

The present work deals with toxic, medicinal, trichomes & stomatal studies for diagnostic utility.

II. Materials and methods

Diospyros montana plant parts are collected from local surroundings and nearby forests for the studies of poisonous, toxic or medicinal properties. The peeling plant parts are prepared for the microscopic studies. Epidermal structures are done by the methods of Bobous and Beakbane (1971), Salisbury (1927) and Kokate (1994), Faust and Jones (1973). Descriptions of foliar epidermal features of trichomes, stomata and epidermal cell follow the terminology of Prat (1932) and Metcalfe (1950, 1960), Ramayya (1962) and Payne (1978) and Cutler *et al.*, (2008) and the formula are following:

(1) **Stomatal index% (SI) =**

$$\frac{\text{Stomata density x 100}}{\text{Stomata density + epidermal cell}}$$

(2) **Stomatal density =**

$$\frac{\text{Stomata frequency}}{\text{10 x area of grid square micron}}$$

(3) **Stomatal frequency** = number of stomata per unit area

(4) **Trichome index% (TI) =**

$$\frac{\text{Trichome density x100}}{\text{Trichome density + epidermal cell density)}}$$

(5) **Trichome density =**

$$\frac{\text{Trichome frequency}}{\text{10Xarea of grid square}}$$

(6) **Trichome frequency** = number of trichome per unit area

Trichomes are epidermal outgrowths or appendages on plants. Trichomes are differentiated mainly in two parts,

1. Proximal foot that is lying in the epidermis.
2. Distal part body that is lying above the foot.

III. Observation

Geographically, *Diospyros montana* is widely distributed in almost all countries in the tropics and temperate regions.

3.1. *Diospyros montana*

Volume : 3 | Issue : 10 | October 2014 • ISSN No 2277 - 8179

3.1.2. Morphology
It is a poisonous, perennial tree with with spiny trunk and spiny older branches and leaves are elliptic lanceshaped, simple, alternate, distichous; flowers unisexual, dioecious or polygamous. Male flowers are in axillary cymes or umbels, stamens 4 to numerous, often paired and forming 2 whorls; ovary rudimentary. Female flowers are usually solitary, greenish, axillary. It is staminodes 1-16 or absent; stigma often 2-cleft. Fruit is a berry.

3.1.3. Trichome characters
Unicelled flagellate glandular hair - Foot: compound, body: conical, entire, rounded tip, content: translucent, walls thin, smooth and straight. **Plate 4.1. Fig. 1 & 8** - On stem, pedicel, leaf.

Unicelled branched flagellate glandular hair - Foot: compound, body: flagellate, entire, rounded tip, content: translucent, walls thin, smooth and straight. **Plate 4.1. Fig. 2** - On leaf.

Unicelled conical glandular hair – Foot: compound, body: flagellate, entire, rounded tip, content: translucent, walls thin, smooth and straight. **Plate 4.1. Fig. 3, 4 & 7** - On stem, calyx, corolla, androecium, pedicel, gynoecium, fruitwall.

Uniseriate flagellate glandular hair – Foot: compound, body: flagellate, entire, rounded tip, content: translucent, walls thin, smooth and straight. **Plate 4.1. Fig. 5 & 6** - On stem, pedical, androecium, gynoecium, fruitwall.

3.1.4. Stomatal studies
Anomocytic stomata – The guard cells are surrounded by irregular subsidiary cells. In these stomata the subsidiary cells are exactly similar to that of other epidermal cells.
Plate 4.1. Fig.11 & 12- in calyx, corolla, pedicel.

Actinocytic stomata (S1) – The guard cells are surrounded by a circle of radiating subsidiary cells.
Plate 4.1. Fig. 9 & 10 – in stem, leaf, corolla.

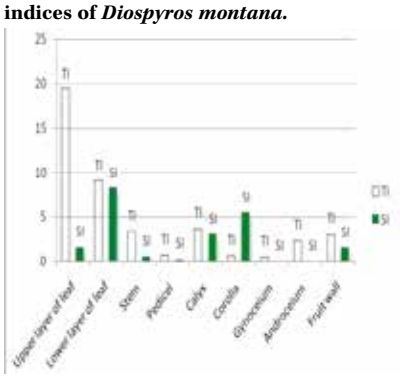
3.1.5. Toxic constituents
Diospyrin, amegakinone, bitramentacenone, betulinic acid.

3.1.6. Medicinal and toxic properties
The plant is useful in treatment of fever, dysuria, gravel, neuralgia, pleurisy, pneumonia, menorrhagia and flooding, and poisonous spider-bite. Its alcoholic extract inhibits carcinoma in mice.

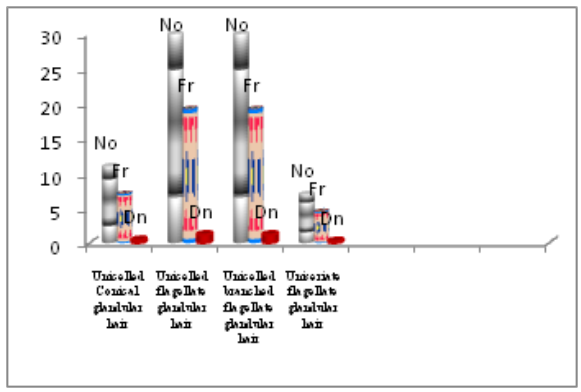
Fruits are applied to boils appear on hands with much pain. The plant is used as fish poison.

IV. Graphs and Tables
The macro morphological characters are assessed on different parts of studied plants.

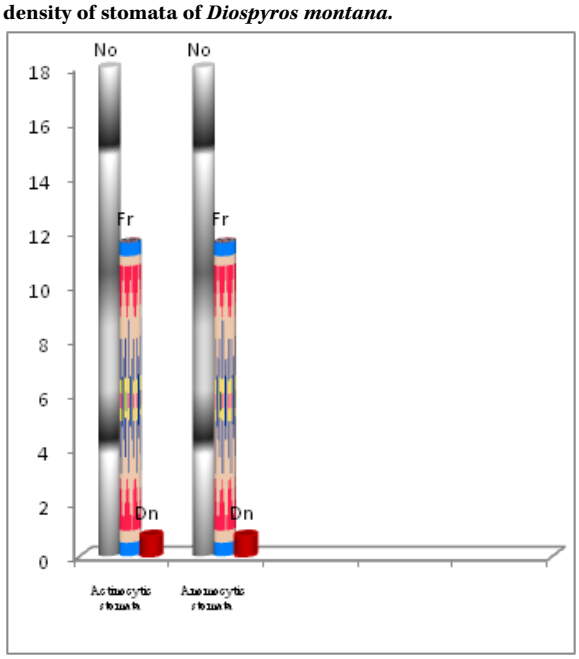
Graph 4.1. Comparative analysis of trichome and stomatal indices of *Diospyros montana.*



Graph 4.2. Comparative analysis of number, frequency and density of trichomes of *Diospyros montana.*



Graph 4.3. Comparative analysis of number, frequency and density of stomata of *Diospyros montana.*



Graph 4.4. Comparative analysis of number, frequency and density of epidermal cells of *Diospyros montana.*

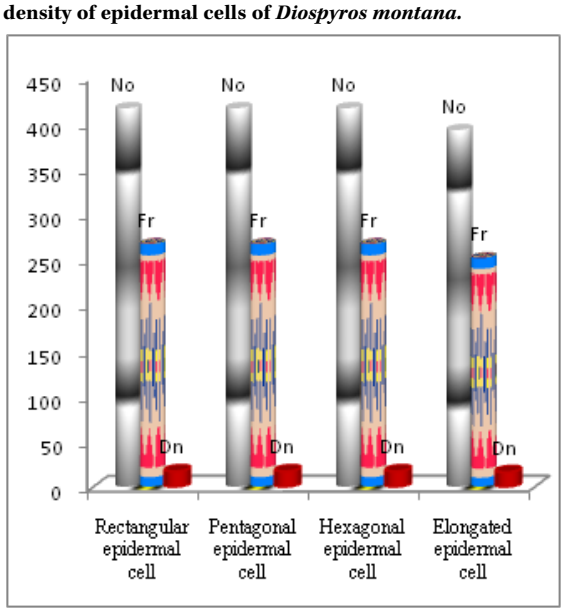


Plate 4.1.

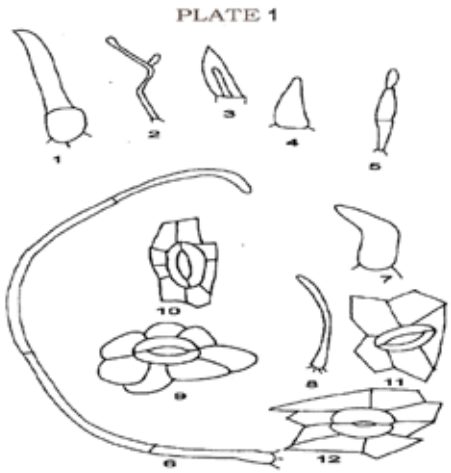


Plate no. – 4.1- Trichome types of *Diospyros montana*

Fig. 1& 8 - Unicelled flagellate glandular hair

Fig. 1; Size - 40X 35µ, in stem, pedicel

Fig. 8; Size - 10X 125µ, in leaf

Fig. 2 - Unicelled branched flagellate glandular hair

Size - 40X 31.25µ, in leaf

Fig. 3, 4 & 7 -Unicelled conical glandular hair

Fig. 3 - Size - 40X 21.25µ, in calyx, corolla, androecium, pedicel, Gynoecium

Fig. 4 - Size - 40X 16.25µ, in androecium, fruitwall

Fig. 7 - Size - 40X 25µ, in stem

Fig. 5 & 6 - Uniseriate flagellate glandular hair

Fig. 5 - Size - 40X 28.75µ, in pedicel, androecium, gynoecium,

Fruitwall

Fig. 6 - Size - 10X 725, in stem

Plate no –4.1- Stomata types of *Diospyros montana*

Fig. 9 & 10 - Actinocytic stomata

Fig. 9 - in leaf, corolla; Size - 40X

Stomata l=13.75µ, b=7.50µ;

Stomata with subsidiary cell l=33.75µ, b=25µ

Fig 10 - in stem; Size - 40X

Stomata l=13.75µ, b=8.75µ;

Stomata with subsidiary cell l=27.50µ, b=15µ

Fig. 11 & 12 - Anomocytic stomata

Fig. 11 in leaf; Size - 40X

Stomata l=12.50µ, b=7.50µ;

Stomata with subsidiary cell l=20µ, b=36.25µ

Fig. 12 - in calyx, pedicel, fruitwall ; Size - 40X

Stomata l=15µ, b=11.25µ;

Stomata with subsidiary cell l=31.25µ, b=18.75µ

V. Results and discussion

As a small deciduous tree, bistendu is with spiny trunk and spiny older branches. In *Diospyros montana* betulin, diospyrin, mamegakinone, bitramentacenone, oleanolic acids, lupeol are contained. Their crushed leaves are used as fish poison. Medicinally the plant is used in fever, dysuria, neuralgia, pneumonia. Bark extract is antinflammatory, antipyretic and analgesic.

Total four types of glandular hairs i.e. unicelled flagellate, Unicelled conical, Unicelled branched flagellate, and uniseriate flagellate and two types stomata i. e. actinocytic and anomocytic and four types of epidermal cells i. e. rectangular, pentagonal, hexagonal, elongated are noted on this species but stomata are absent on gynoecium and androecium. Organographic distribution of trichomes is given in Table 4.1.

The highest frequency and density of trichome, stomata and epidermal cells are 19.23 and 1.23 on upper layer of leaf (of trichomes), 11.54 and 0.74 on lower leaf (of Stomata) and 266.67 and 17.09 (epidermal cell) (Table 4.1). The highest trichome index is 19.35 on upper layer of leaf while the highest stomatal index is 8.26 on lower layer of leaf (Graph 4.1). Multicellular trichomes and anomocytic stomata were reported on leaf of *Diospyros montana* by Kumar *et al.,* (2011).

VI. Conclusion

Economically *Diospyros montana* of Ebenaceae family to useful as medicinal plant. As well as they also show toxic properties. They can be identified by Unicelled flagellate glandular hair, Unicelled branched flagellate glandular hair, Unicelled Conical glandular hair, Uniseriate flagellate glandular hair and anomocytic and actinocytic stomata, rectangular, pentagonal, hexagonal, elongated epidermal cells along with other data parameters in the taxonomy.

Table 4.1. Quantitative and analysis of trichomes, stomata and epidermis of Diospyros montana .

Plant parts	Trichome				Stomata				Epidermis				Trichome index.	Stomata index
	Type	Number	Frequency	Density	Type	Number	Frequency	Density	Type	Number	Frequency	Density		
Upper layer of leaf	Unicelled flagellate glandular hair, Unicelled branched flagellate glandular hair	30	19.23	1.23	Actinocytic,, Anomocytic	2	1.28	0.08	Rectangular, Pentagonal, Hexagonal, Elongated	125	80.13	5.14	19.35	1.57

Lower layer of leaf	Unicelled flagellate glandular hair, Unicelled branched flagellate glandular hair	20	12.82	0.82	Actinocytic , Anomocytic	18	11.54	0.74	Rectangular ,Pentagonal, Hexagonal, Elongated	200	128.21	8.22	9.09	8.26
Stem	Unicelled conical glandular hair., Unicelled flagellate glandular hair, Uniseriate flagellate glandular hair	7	4.49	0.29	Actinocytic	1	0.64	0.04	Rectangular, Pentagonal, Hexagonal	200	128.21	8.22	3.38	0.5
Pedicel	Unicelled conical glandular hair, Unicelled flagellate glandular hair, Uniseriate flagellate glandular hair	3	1.92	0.12	Anomocytic	1	0.64	0.04	Rectangular, Pentagonal, Hexagonal	416	266.67	17.09	0.72	0.24
Calyx	Unicelled conical glandular hair	11	7.05	0.45	Anomocytic	9	5.77	0.37	Rectangular, Pentagonal, Hexagonal	289	185.26	11.88	3.67	3.02
Corolla	Unicelled conical glandular hair	1	0.64	0.04	Actinocytic	9	5.77	0.37	Rectangular, Pentagonal, Hexagonal	156	100	6.41	0.64	5.45
Gynoecium	Unicelled conical glandular hair, Uniseriate flagellate glandular hair	2	1.28	0.08			0	0	Elongated	392	251.28	16.11	0.51	0
Androecium	Unicelled conical glandular hair, Uniseriate flagellate glandular hair	2	1.28	0.08			0	0	Rectangular, Elongated	84	53.85	3.45	2.33	0
Fruit wall	Unicelled conical glandular hair, Uniseriate flagellate glandular hair	2	1.28	0.08	Anomocytic	1	0.64	0.04	Rectangular, Elongated	64	41.03	2.63	3.03	1.54

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