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Foliar architectural and micro-morphological investigations on *Pothos scandens* Linnaeus (Araceae) – an interesting climbing epiphyte from Kamrup District of Assam

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Abstract

Both qualitative and quantitative foliar architectural and micro-morphological characteristics were studied on *Pothos scandens* Linnaeus (Araceae) collected from different locations of Kamrup District of Assam. Only paracytic type of stomata has been found and foliar architecture is simple curvi-pinnate type. The present paper is an attempt to evaluate foliar micromorphological characters as well as architectural characters as a tool to delimit the taxa under the genus *Pothos* Linnaeus.

Key words: Araceae, *Pothos scandens*, foliar micro-morphology, foliar architecture, Kamrup, Assam

INTRODUCTION

The family Araceae was established by A. L. De Jussieu in 1789. The word 'Arum' is derived from the ancient Greek word 'Aron' **(**Mayo *et al.* 1997) indicating all Eurasian plants having usually arrow-shaped leaves and a showy spathe partially enclosing a spadix. This major monocot family has been divided into nine sub-families, together with 106 genera and 3,200 species (Croat 1979, 1990, 1994; Mabberley 2008). Mayo *et al.* (1997) recorded 105 genera and approximately 3,300 species.

The genus *Pothos* Linnaeus belongs to the tribe Potheae of Araceae. The name *'Pothos'* is of Greek origin, which represents a Greek mythological character. Etymologically it is a modified spelling of Sinhalese vernacular name "*Potha*" which is indigenous to Indian Ocean and western Pacific Ocean areas (Mayo *et al.* 1997).

Pothos scandens Linnaeus (Araceae) is a shrubby root-climber and generally loose its contact with soil when become mature and is distributed throughout the Indo-Malayan region and China. The lower branches are intended for rooting and the upper ones are free and hanging. Leaves distichous with broad truncate petiole, articulated at the joint of petiole and lamina, leaf lamina ovate to elliptic or lanceolate, ± 2 – 9 x 2 – 11 cm. Inflorescence solitary. Spathe ovate to concave, ± 0.5 x 0.2 cm. Spadix stipitate, globose, ±1 x 0.7 cm. Flowers bisexual, tepals 6, free, ± 0.2 cm in diameter; stamens 6. Ovary trilocular, placentation axile. Fruits ±1.5 x 1.3 cm. Flowering and fruiting: May to December.

Taxonomic importance of foliar epidermal characters in Araceae has been emphasized by many authors including Dalitzsch (1886), Engler (1920), Solereder and Meyer (1928),

Birdsey (1955), Webber (1960), Pant and Kidwai (1966), Bunting (1968), Grear (1973), Tomlinson (1974), Grau (1983), Grayum (1984), Shaw (1993), Mayo *et. al*. (1997), LAWG (1999) and Keating (2003). But, no appreciable work has been done so far on the epidermal morphology and foliar architecture of *Pothos scandens* and hence, the present study was designed to evaluate the foliar architecture and micro-morphological features as an aid to identification and species delimition in the genus *Pothos* Linnaeus of Araceae.

MATERIAL AND METHODS

The flowering twigs were collected as voucher specimens from various localities of Kamrup District of Assam and processed into mounted herbarium-sheets (Fosberg & Sachet 1965) and confirmed the identity of specimens by matching at GUBH, ASSAM and CAL and consulting with relevant literature (Mayo *et al*. 1997; Boyce & Hay 2001; Li Hang & Boyce 2010). The nomenclatural status was verified online at www.plantlist.org, version 1.1. Specimens will be deposited at GUBH after the conclusion of the present project.

To study the foliar micro-morphological characters, slides were prepared with the peelings of both adaxial and abaxial epidermises from tip, middle and basal portions of mature leaves either mechanically or by controlled maceration using 10 % aqueous solution of nitric acid following the technique of Boulos and

Beakbane (1971). Then peels were stained with 1% aqueous safranin and mounted in glycerine-jelly which was later on sealed with DPX. From the prepared slides, microphotographs were taken at different magnifications using light microscope. The nature and distribution pattern of stomata, epidermal cells, guard cells, subsidiary cells, stomatal index and stomatal frequency were worked out for both surfaces. For description, terminologies followed as suggested by Hickey (1973), Stace (1984) and LAWG (1999).

To study foliar architecture, fresh and mature leaves were cleared following the technique suggested by Bersiar & Bocquet (1960) with slight modification. According to this technique, small pieces of leaves (about 2.5 cm long) were taken from the midrib region, at the apex, middle and basal portion and treated with aqueous NaOH (5 %) for overnight in an oven at 32^{o}C and then soaked in aqueous solution of HNO_3 in various concentration (30 %, 50 %, 70 %, 90 % and 100 %). The materials were then washed repeatedly with distilled water and dehydrated through the ethanol grade and kept there to remove chlorophyll. After preparing permanent slides from the treated materials microphotographs were taken. Venation pattern is described using the terminology suggested by Hickey (1973), Dilcher (1974), Melville (1976), LAWG (1999) and Keating (2003).

Stomatal Index (SI): The Stomatal Index was calculated using the following formula (Salisbury 1927):

$$SI = \frac{S}{S+E} \times 100$$

Where,

S = Number of stomata per unit area of leaf

E = Number of epidermal cells in the same unit area of leaf

Stomatal Frequency (SF): The Stomatal frequency was calculated using the formula as suggested by Salisbury (1927).

$$SF = \frac{S}{A}$$

Where,

N = Number of stomata per field
A = Area of the field

Guard Cell Area (GCA): The Guard Cell Area were calculated using the formula of Franco (1939).

$$GCA = L \times B \times K$$

Where,

L = Length of the Guard Cell
B = Breadth of the Guard Cell
K = Franco's Constant (K = 0.78524)

RESULTS AND DISCUSSION

Foliar micro-morphological characteristics

Epidermis single layered on both the surfaces. Adaxial epidermal cells pentagonal and hexagonal and on abaxial surface cells are pentagonal, hexagonal and heptagonal. Cell walls in both surfaces prominent and straight. The size of epidermal cells on adaxial surface 36.6 x 23 µm; on abaxial surface 22.6 x 18.6 µm. Ratio of length and breadth is 1.59 on adaxial surface and on abaxial surface is 1.22 (Tables 1 & 2).

Table 1. Qualitative foliar epidermal characters of *Pothos scandens* Linnaeus [*Abbreviations used***:** An = Anisocytic; P = Paracytic; BrP = Brachyparacytic; ABrP = Amphibrachyparacytic; Pt = Paratetracytic; BrPt-2 = Brachyparatetracytic-2; Ph = Parahexacytic; BrPh = Brachyparahexacytic; + = Present; – = Absent]

Surface	Epidermal cells		Types of Stomata						
	Cell shape	Cell wall	An	P	BrP	ABrP	Pt	BrPt-2	Ph
Adaxial	Pentagonal and hexagonal	Prominent and straight	-	+	-	-	-	-	-
Abaxial	Pentagonal, hexagonal and heptagonal	Prominent and straight	-	+	-	-	-	-	-

Table 2. Quantitaive foliar micro-morphological characters of *Pothos scandens* Linnaeus [*Abbreviations used*: ST = Stomata; EC = Epidermal Cell; SI = Stomatal Index; SF = Stomatal Frequency; SS = Stomatal Size; SA = Stomatal Aperture; GCA = Guard Cell Area]

Surface	ST/ µm²	EC/ µm²	SI/ µm²	SF/ µm²	SS (µm)		EC (µm)		SA (µm)		L/B Ratio		
					L	B	L	B	L	B	ST	EC	SA
Adaxial	3.33	404.33	0.82	1.06	6	3.6	36.6	23	3	1.3	1.67	1.59	2.31
Abaxial	33	389.67	7.81	10.51	17.6	9.6	22.6	18.6	10	1.6	1.83	1.22	6.25

Based on the occurrence of stomata on leaf surface, *Pothos scandens* has been recognised as amphistomatic. Number of stomata on abaxial surface is more than the adaxial surface. Only paracytic type and contiguous stomata (attached pole to pole) have been observed on both the surfaces. The size of stomata on adaxial surface is 6 x 3.6 µm and on

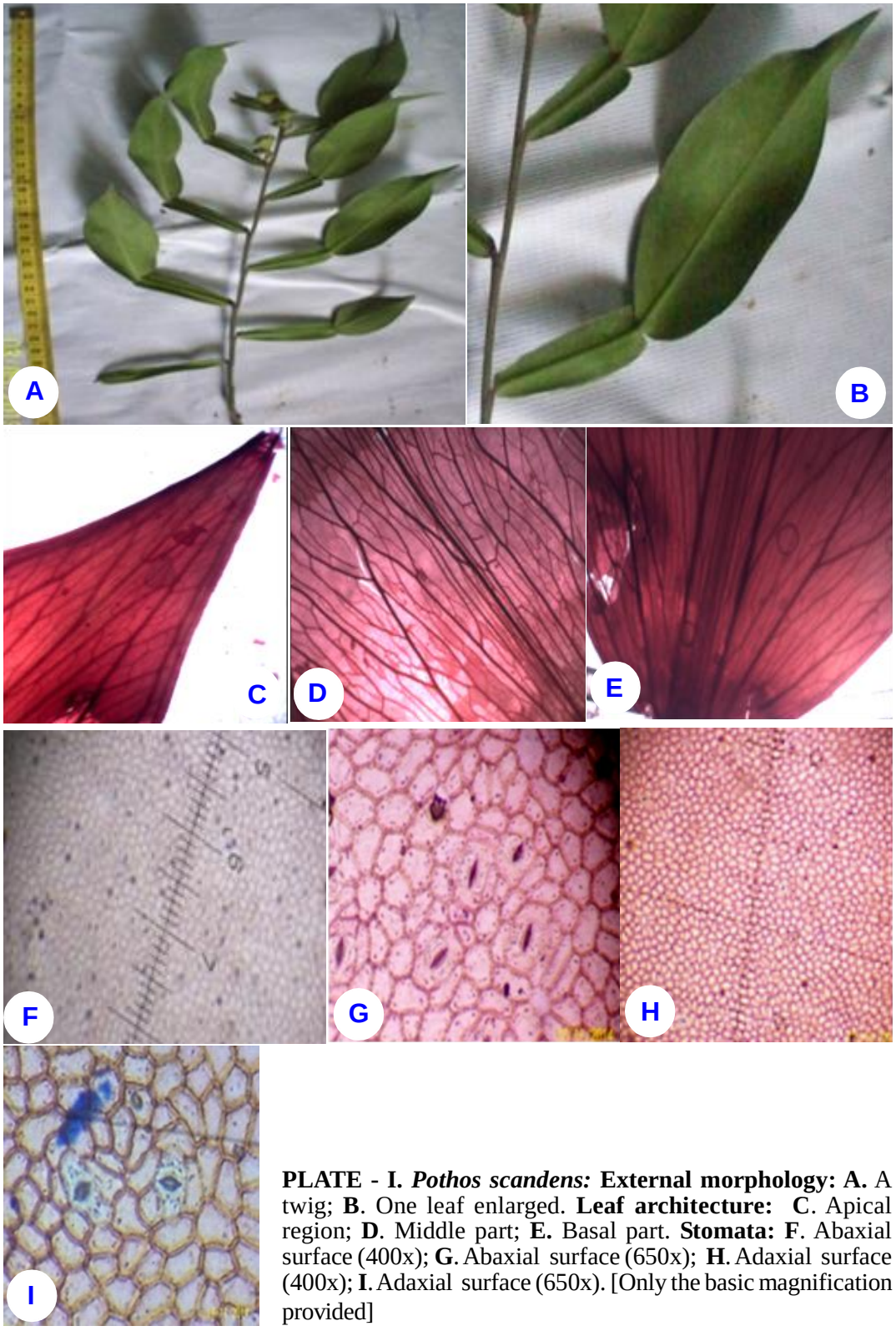

PLATE - I. *Pothos scandens:* External morphology: A. A twig; **B**. One leaf enlarged. **Leaf architecture: C**. Apical region; **D**. Middle part; **E.** Basal part. **Stomata: F**. Abaxial surface (400x); **G**. Abaxial surface (650x); **H**. Adaxial surface (400x); **I**. Adaxial surface (650x). [Only the basic magnification provided]

abaxial surface 17.6 x 9.6 µm. Ratio of length and breadth for stomata on adaxial surface is 1.67 and on abaxial surface is 1.83. Size of stomatal aperture on adaxial surface is 3 x 1.3 µm and on abaxial surface 10 x 1.6 µm and ratio of length and breadth for stomatal aperture on adaxial and on abaxial surfaces are 2.31 and 6.25 respectively. Guard cell area on adaxial and abaxial surface are 16.97 and 132.67 respectively.

Foliar architectural characteristics

The venation is simple curvi-pinnate type with moderate sized single primary (1^o) vein, branched, straight where 3 – 6 secondary veins are arranged alternately on either sides of primary vein forming smooth arches. Secondary veins (2^o) are weak, supra basal acrodromous type, vein spacing irregular and vein angle acute with weak intersecondaries. Tertiary veins (3^o) mixed opposite or alternate percurrent with straight, convex and sinuous vein course producing acute angle and inconsistent. Quarternary veins (4^o) well developed, opposite percurrent and dichotomising type. Quinaries (5^o) are highest order veins, dichotomising. Areolation well developed formed by joining 2^{nd}, 3^{rd}, 4^{th} and 5^{th} order veins, random, 4-sided and 5 or more sided, variable in shape and size. Freely ending ultimate veins of leaves simple, linear type.

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