

## Node-petiole anatomy and foliar architectural patterns of two Linnaean species of *Urena* Linnaeus (Malvaceae) and their taxonomic status

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### Abstract

Foliar architectural pattern, petiolar and nodal anatomy have been examined to evaluate the taxonomic rank of two Linnaean species *Urena lobata* Linnaeus and *U. sinuata* Linnaeus. The taxonomic status of these two taxa is discussed in the present context.

**Key words:** *Urena*, Leaf architecture, Petiole-node anatomy

### INTRODUCTION

The genus *Urena* Linnaeus of Malvaceae comprises of 6 – 8 species and distributed in the tropics of old and new world. Some of its species are economically important as source of fiber and few of them are medicinally important (Mabberley 2008). Most of the species are growing as weeds along the road sides, railway tracts and in waste places.

Linnaeus (1753) had placed these two taxa at species rank at the very beginning during their first description under the genus *Urena* Linnaeus along with the third species *U. procumbens* Linnaeus. Subsequently several botanists described and added many species and infraspecific taxa. Following Linnaeus many botanist like Guerke (Fl. Brasiliensis 12, 3: 457 – 596. 1892), Masters (in Hook, f., Fl. Brit. India, 1: 329 – 330. 1874) maintained these two taxa at species rank. However, Miquel (*Pl. Jungh.* 283. 1855.) had reduced the status of *U. sinuata* and treated as a distinct variety under *U. lobata*. Hochreutiner (*Ann. Cons. Jard. Bot. Geneve* 5: 131 – 135. 1901) also retained only one species *U. lobata* and treated *U. sinuata* as a variety under it. Simultaneously, he described 14 varieties under *U. lobata* including three new. Borssum Waalkes (*Annuaire Conserv. Jard. Bot. Genève* 5: 141. 1901) had also followed the varietal status as *U. lobata* var. *sinuata* (Linnaeus) Borssum Waalkes. Guerke (*l.c.*) during the treatment of these two taxa had added 9 varieties under *U. lobata* and two under *U. sinuata*. Borssum Waalkes (*Blumea* 14(1): 142. 1966) slightly differing from his earlier opinion, had maintained only *U. lobata* at species rank and described *U. sinuata* as a subspecies under former. He had also included two varieties to each subspecies. In the recent treatment of Malvaceae of India Paul (1993) had maintained only one species *U. lobata* and treated *U. sinuata* as subspecies under the former. He had also included several varieties under both the subspecies. However, most of the taxonomic web sites (<http://www.ipni.org>;

[www.theplantlist.org](http://www.theplantlist.org)) retained these two taxa as distinct species. The taxonomy of the two taxa viz. *U. lobata* Linnaeus and *U. sinuata* Linnaeus are very much confusing and debatable and therefore, the placement of these two taxa at variable taxonomic rank from species, subspecies to varieties is frequently changed in different literatures by different authors.

It is clear that these two taxa experience more morphological (both vegetative as well as reproductive) similarities than differences. Most of the authors distinguished these two based on leaf lobation and epicalyx characters. However, the leaves are polymorphic and show much variation regarding the lobation pattern in different habitat conditions. The pubescence is also varies from site to site. In this context the foliar architectural pattern as well as petiolar and nodal anatomy can play an important role to evaluate the taxonomic status of these two closely related taxa.

## MATERIALS AND METHODS

Materials were collected from different parts of West Bengal (Darjeeling and Kalyani), Assam (Silchar) and their adjoining areas. Twigs were preserved in FAA [5 ml Formaldehyde: 5 ml Glacial acetic acid: 90 ml 70% ethanol] solution for detailed anatomical studies. All the collections were identified properly with the help of relevant literatures and also matched with the earlier collections deposited at CUH and CAL. The voucher specimens are deposited at the Herbarium of the Department of Botany, University of Kalyani.

Specimens were taken from mature portion of the plant. The anatomical studies of nodes were followed by the petiolar anatomy of the same material to achieve the continuation of vasculature mostly followed by Howard (1979). However, for the foliar architectural study Dilcher (1974) has been followed.

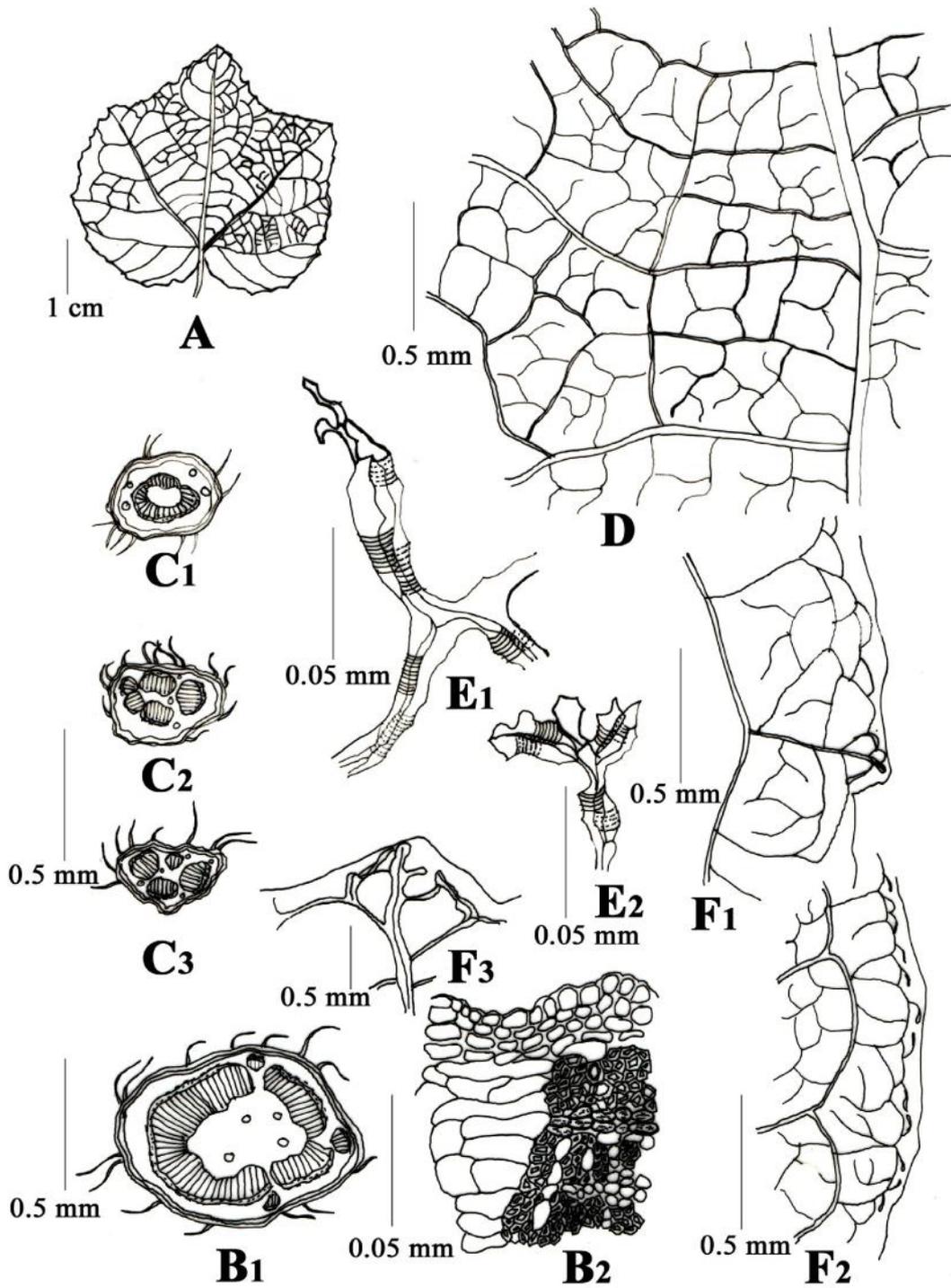
## OBSERVATION

Morphologically these two taxa are very similar. The leaves are polymorphic and much variable in respect to the lobation pattern as pointed out by earlier workers (Masters *l.c.*; Paul 1993). Anatomically they are also quite close to each other. The foliar architectural pattern of the two taxa is also shows the same result (Fig. 1 & 2). The similarities and dissimilarities in respect to the nodal, petiolar and foliar architecture are presented in Table 1.

**Table 1.** Comparative morpho-anatomical account of the two taxa of *Urena* Linnaeus

Characteras	<i>Urena lobata</i>	<i>Urena sinuata</i>
Leaves	Simple, alternate, variable in shape, size and lobation	Simple, alternate, variable in shape, size and lobation
Trichomes and indumentum	Both stellate and acicular, variable in amount of pubescence	Both stellate and acicular, variable in amount of pubescence

Characteras	<i>Urena lobata</i>	<i>Urena sinuata</i>
Node	Trilacunar,3-traced; median one larger than the laterals	Trilacunar,3-traced; median one larger than the laterals
	Epidermis 1-cell-layered thick, covered by thin and even cuticle	Epidermis 1-cell-layered thick, covered by thin and even cuticle
	Cortex of 3-4 layered parenchymatous cells	Cortex of 3-4 layered parenchymatous cells
	Vascular bundles : outside covered by sclerenchymatous patches, pith parenchymatous.	Vascular bundles : outside covered by sclerenchymatous patches, pith parenchymatous.
	Druses of crystals present	Druses of crystals present
Petiole in t.s (cellular)	Resemblances with the nodal configuration. Distal region is characterized by the presence of hypodermis.	Resemblances with the nodal configuration. Distal region is characterized by the presence of hypodermis.
Petiole in t.s (no. of vascular bundles in proximal : middle : distal)	4 : 5 : 1	6-7 : 5-6 : 3
Venation (major)	Mixed craspedodromous	Mixed craspedodromous
Veins at lamina base	3 – 9	3 – 7
Venation (minor)	Primary vein (1 <sup>0</sup> ) 1, straight, moderately thickened, terminated at the apex of midlobe.	Primary vein (1 <sup>0</sup> ) 1, straight, moderately thickened, terminated at the apex of midlobe.
	Secondary veins (2 <sup>o</sup> ) two types: a) basal pair opposite, terminated at the apices of lateral lobe; b) upper pair 4-6; moderately thickened, angle of divergence variable, acute narrow to moderate(45 – 65°); intersecondary veins absent	Secondary veins (2 <sup>o</sup> ) two types: a) basal pair opposite, terminated at the apices of lateral lobe; b) upper pair 4-6; moderately thickened, angle of divergence variable, acute narrow to moderate(45 – 65°); intersecondary veins absent

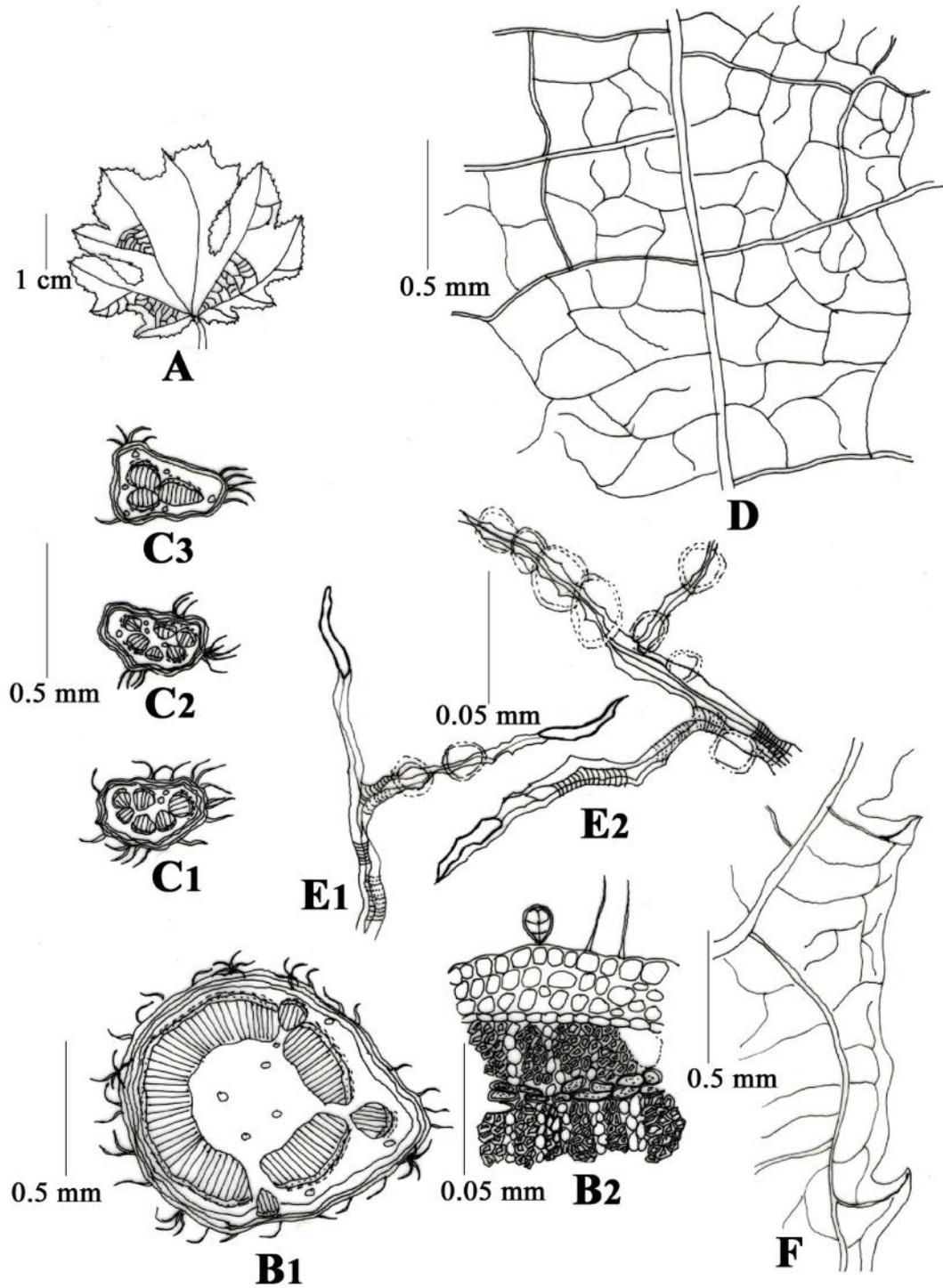


**Fig. 1.** *Urena lobata* subsp. *lobata* : A. Leaf; B. T. S. of node: B1. Diagrammatic; B2. Cellular; C. T.S. of petiole: C1. Proximal; C2. Middle; C3. Distal; D. Venation; E1&E2. Vein ending; F1,F2&F3. Marginal venation.

Characteras	<i>Urena lobata</i>	<i>Urena sinuata</i>
	Tertiary veins with both interangular and joining: a) Joining veins predominantly opposite, rarely alternate b) Angle of origin AR,AO and RR,RO at the admedial and exmedial side respectively c) Relationship of the joining veins to the midrib oblique, decreases gradually	Tertiary veins with both interangular and joining: a) Joining veins predominantly opposite, rarely alternate b) Angle of origin AR,AO and RR,RO at the admedial and exmedial side respectively c) Relationship of the joining veins to the midrib oblique, decreases gradually
	Venation massive, up to 7°	Venation massive, up to 7°
	Areole formation by 4°, 5° and 6° veins	Areole formation by 4°, 5° and 6° veins
	Marginal venation incomplete with both loops and free vein endings	Marginal venation incomplete with both loops and free vein endings
	Free vein endings with the aggregation of smaller and broaden tracheids, branched	Free vein endings with the aggregation of smaller and broaden tracheids, branched
	Free vein ending mostly simple, slightly curved, rarely once or twice branched, consisting of spirally thickened tracheids	In addition to spirally thickened tracheids, there is the presence of vermiform and diffused sclereids along the veins.
Leaf serration	Malvoid type	Malvoid type

### DISCUSSION

Two Linnaean species viz. *Urena lobata* Linnaeus and *Urena sinuata* Linnaeus are morphologically very similar and many of the diagnostic characters used by the author are polymorphic in nature. This variability in different habitat condition leads to publish many infraspecific taxa under both the species (Guerke *l.c.*; Masters 1874; Tang *et al* 2007) and results the increase of the number of synonyms. However, many of them also seriously encountered such variability and disagree with the specific status of the taxa and ultimately



**Fig. 2.** *Urena lobata* subsp. *sinuata* : A. Leaf; B. T. S. of node: B1. Diagrammatic; B2. Cellular; C. T.S. of petiole: C1. Proximal; C2. Middle; C3. Distal; D. Venation; E1&E2. Vein ending; F. Marginal venation.

placed them in infraspecific rank either as variety of subspecies (Hochreutiner *l.c.*; Borssum Waalkes *l.c.*; Paul 1993). In this context the present anatomical study may play important role which can be helpful to evaluate the proper taxonomic position of these two taxa. A trilacunar 3-traced nodal pattern is typical in both the cases. The cellular configuration of node, internode and petiole are very much similar. Both the taxa show mixed craspedodromous type of major venation pattern. Most of the other foliar architectural features are exactly same in the two taxa. Trichome types, druses or crystals show similar types of distribution. The only difference in respect to the anatomical features is the number of vascular bundles in the proximal, middle and distal regions of the petioles. The free vein endings are also with some differences as the free vein endings of *U. lobata* are mostly simple, slightly curved, rarely once or twice branched, consisting of spirally thickened tracheids, whereas in *U. sinuata* in addition to spirally thickened tracheids, there is presence of vermiform and diffused sclereids along the veins. These features can be used as the diagnostic characters for both the taxa (Table - 1). The foliar anatomical features including the venation pattern are often been used for the delimitation of taxa and thus here can be used towards the opinion of taxonomic status of *U. sinuata*.

Both the taxa can be distinguished from one another based on very few characters. Therefore, present study suggests the subspecies rank is more suitable rather than the species status. It also justified the taxonomic treatment of Hochreutiner (*l.c.*); Borssum Waalkes (*l.c.*) and Paul (1993). Present observation also suggests careful investigation of different aspects of plant systematics for better evaluation of taxonomic status of these two taxa.

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