

TAXONOMIC SIGNIFICANCE OF CYPSELA MORPHOLOGY FOR THE TRIBE MUTISIEAE (S.L.) (ASTERACEAE) FROM PAKISTAN

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Abstract

Cypselas of 5 species distributed in 3 genera of the tribe Mutisieae (s.l.) were examined from Pakistan to assess their taxonomic significance. Micromorphological characters of cypselas including shape, pappus and carpodium have been proved very rewarding to evaluate the taxonomic decisions both at the generic and specific levels.

Introduction

Tribe Mutisieae (s.l.) is represented in Pakistan by 9 species distributed in 6 genera viz., *Ainsliaea* DC., *Leibnitzia* Cass., *Pertya* Sch. Bip., *Dicoma* Cass., and *Uechtrizia* Freyn. (Qaiser & Abid, unpub.). Cypselas morphological features for the various tribes of the family Asteraceae including Anthemideae, Gnaphalieae, Inuleae, Senecioneae and Plucheeae have been proved very rewarding for the systematic evaluation (Abid & Qaiser, 2002; 2007; 2008a,b; 2009; Abid & Ali, 2010). But still there is no detail report available on cypselas morphology for the tribe Mutisieae (s.l.). Presently, the cypselas morphology is carried out to provide the strength to the taxonomic decisions for the tribe Mutisieae (s.l.) from Pakistan.

Materials and Methods

Five species of the tribe Mutisieae (s.l.) assembled in 3 genera viz., *Ainsliaea*, *Gerbera* and *Dicoma* were studied for cypselas characters from herbarium specimens (Appendix 1) under stereomicroscope (Nikon XN Model), compound microscope (Nikon Type 102) and scanning electron microscope (JSM-6380A). For scanning electron microscopy (SEM) mature cypselas were directly mounted on metallic stub using double adhesive tape and coated with gold for a period of 6 minutes in sputtering chamber and observed under SEM.

The following characters were studied: Cypselas: Shape, surface, colour, size Pappus: Series, shape, number, degree of fusion, colour, size Carpodium: Shape, position, diameter of carpodium and diameter of foramen of carpodium.

Observations

General cypselas characters of the tribe Mutisieae (s.l.)

Cypselas monomorphic or dimorphic, oblong, oblanceolate, turbinate or obovate, 3-6 x 0.5-2.5mm, golden brown, light brown or maroonish brown, inconspicuously or conspicuously ribbed, densely or sparsely hirsute or villous or sparsely papillate. Pappus uniseriate or biseriate, bristly or scaly, bristles barbellate or plumose, basally fused, 30-70, 4-10mm long, off-white, if biseriate than scales 10, subulate with toothed edges, 5-

5.5mm long, off-white. Carpodium undeveloped or irregularly developed or broad circular or slightly angular disc like without any interruption, basal or sub-basal in position, 285-485 μm in diameter. Foramen of carpodium 136-279 μm in diameter (Table 1; Figs. 1 A-L; 2 A-I).

Key to the genera

- 1 + Cypsela of ray and disc florets similar (monomorphic) 2
 - Cypsela of ray and disc florets different (dimorphic) *Ainsliaea*
- 2 + Cypsela obovate or turbinate, densely villous or hirsute *Dicoma*
 - Cypsela oblong, sparsely papillate *Gerbera*

Ainsliaea DC.

It is represented by two species viz., *A. aptera* DC., and *A. latifolia* (D.Don) Sch. Bip.

Cypselas dimorphic, cypselas of the disc floret oblanceolate, 4.0x0.5-1.0 mm, golden brown, inconspicuously ribbed, densely hirsute. Pappus uniseriate, plumose, basally fused, off-white, 30-35, 7-9mm long. Carpodium broad circular or slightly angular disc like without any interruption, basal in position, 285-485 μm in diameter. Foramen of carpodium 152-162 μm in diameter. Cypselas of the ray floret oblong, 5.5-6.0x1.5mm, golden-light brown or light brown, conspicuously ribbed, sparsely hirsute. Pappus uniseriate, plumose, basally fused, off white, 30-35, 4-9mm long. Carpodium broad circular or slightly angular disc like without any interruption, basal in position, 345-349 μm in diameter. Foramen of carpodium 136-251 μm in diameter. (Table 1; Fig. 1A-L).

Key to the species of *Ainsliaea*

- 1 + Pappus bristles 8-9mm long in both cypselas of ray and disc florets. Carpodium slightly angular disc like *A. latifolia*
 - Pappus bristles 7-9mm long in cypsela of ray floret and 4-5mm in cypsela of disc floret. Carpodium broad circular disc like *A. aptera*

Dicoma Cass.

It is represented by 2 species viz., *D. schimperi* (DC.) Baill. ex Hoffman and *D. tomentosa* Cass.

Cypselas monomorphic, turbinate or obovate, 3x2.5mm, brown or golden brown, densely villous or hirsute. Pappus bristly or scaly, uniseriate or biseriate, bristles barbellate, basally fused, offwhite. 40-50. 5mm long, scales subulate with toothed edges, basally fused, off white 10 in number, 5-5.5mm long. Carpodium undeveloped. (Table 1; Fig. 2A-F).

Key to the species of *Dicoma*

- 1 + Cypsela obovate, densely hirsute. Pappus biseriate, outer ones bristly and inner ones scaly *D. tomentosa*
 - Cypsela turbinate, densely villous. Pappus uniseriate, scaly *D. schimperi*

Table 1. Cypselas morphological characters in the tribe Mutisieae (Asteraceae).

Name of taxa	Cypselas			
	Monomorphic/ Dimorphic	Shape	Surface	Colour
<i>Ainsliaea aptera</i>	Dimorphic	Disc floret: Oblanceolate Ray floret: Oblong	Disc floret: Inconspicuously ribbed, densely hirsute Ray floret: Conspicuously ribbed, sparsely hirsute	Disc floret: Golden brown Ray floret: Light brown
<i>Ainsliaea latifolia</i>	Dimorphic	Disc floret: Oblanceolate Ray floret: Oblanceolate Turbinate	Disc floret: Inconspicuously ribbed, densely hirsute Ray floret: Conspicuously ribbed, sparsely hirsute Densely villous	Disc floret: Golden brown Ray floret: Golden -light brown Dark brown
<i>Dicoma schimperii</i>	Monomorphic	Obovate	Densely hirsute	3.0x2.5
<i>Dicoma tomentosa</i>	Monomorphic	Oblong	Sparsely papillate	3.0x2.5
<i>Gerbera gossypina</i>	Monomorphic	Oblong	Sparsely papillate	4.25x0.5

Table 1. (Cont'd.).

Name of taxa	Pappus					
	Bristles			Scales		
	Structure	Length (mm)	Number	Colour	Structure	Length (mm)
<i>Ainsliaea aptera</i>	Disc floret: plumose, uniseriate, basally fused	Disc floret: 8-9	Disc floret: 35	Disc floret: Off white	--	--
<i>Ainsliaea latifolia</i>	Ray floret: plumose, uniseriate, basally fused	Ray floret: 8-9	Ray floret: 35	Ray floret: Off white	--	--
<i>Dicoma schimperii</i>	Disc floret: plumose, uniseriate, basally fused	Disc floret: 7-9	Disc floret: 30	Disc floret: Off white	--	--
	Ray floret: plumose, uniseriate, basally fused	Ray floret: 4-5	Ray floret: 30	Ray floret: Off white	subulate with a midrib, edges toothed, uniseriate, united at the base forming a star like crown on the cypselas	5-5.5
<i>Dicoma tomentosa</i>	Bristles barbellate, fused at the base	5	40-50	off white	subulate with a midrib, edges toothed	5
<i>Gerbera gossypina</i>	Bristles barbellate, basally fused	10	60-70	Off white	--	--

Table 1. (Cont'd.).

Name of taxa	Carpopodium		
	Shape	Position	Diameter of foramen of carpopodium (µm)
<i>Ainsliaea aptera</i>	Disc floret: Broad circular disc without any interruption	Disc floret: Basal	Disc floret: 285
<i>Ainsliaea latifolia</i>	Ray floret: Broad circular disc without any interruption	Ray floret: Basal	Ray floret: 349
<i>Dicoma schimperii</i>	Disc floret: Broad slightly angular disc without any interruption	Disc floret: Basal	Disc floret: 485
<i>Dicoma tomentosa</i>	Ray floret: Broad slightly angular disc without any interruption	Ray floret: Basal	Ray floret: 345
<i>Gerbera gossypina</i>	Undeveloped	--	--
	Undeveloped	--	--
	Irregularly developed	Sub-basal	460
			279

Appendix-1. List of voucher specimens.

Taxa	Collector, Number, Herbarium
<i>Ainsliaea aptera</i>	Y.Nasir 10874 (RAW); E. & Y. Nasir 8852 (RAW); G.D.Samson 15337 (KUH); Mohindar Nath 344 (RAW).
<i>A. latifolia</i>	I.J. Robert 11913 (RAW).
<i>Dicoma schimperi</i>	M. Qaiser, G. Sarwar & Jan Alam 886 (KUH); Surayya Khatoon 318 (KUH); Coll. ignot. s.n. (KUH)
<i>D. tomentosa</i>	G.R. Sarwar, M. Qaiser & Jan Aam 1071 (KUH); Razia Ahmed 14 (KUH); Mohindar Nath 16576 (RAW); Nurun Nahar s.n. (KUH).
<i>Gerbera gossypina</i>	Inayat 19682 (KUH); Sultan-ul-Abedin & M. Qaiser 5695 (RAW); S.I. Ali 677 (KUH); Saood Omer, S. Nazimuddin & A. Wahid 1100 (KUH); Y. Nasir s.n. (RAW).

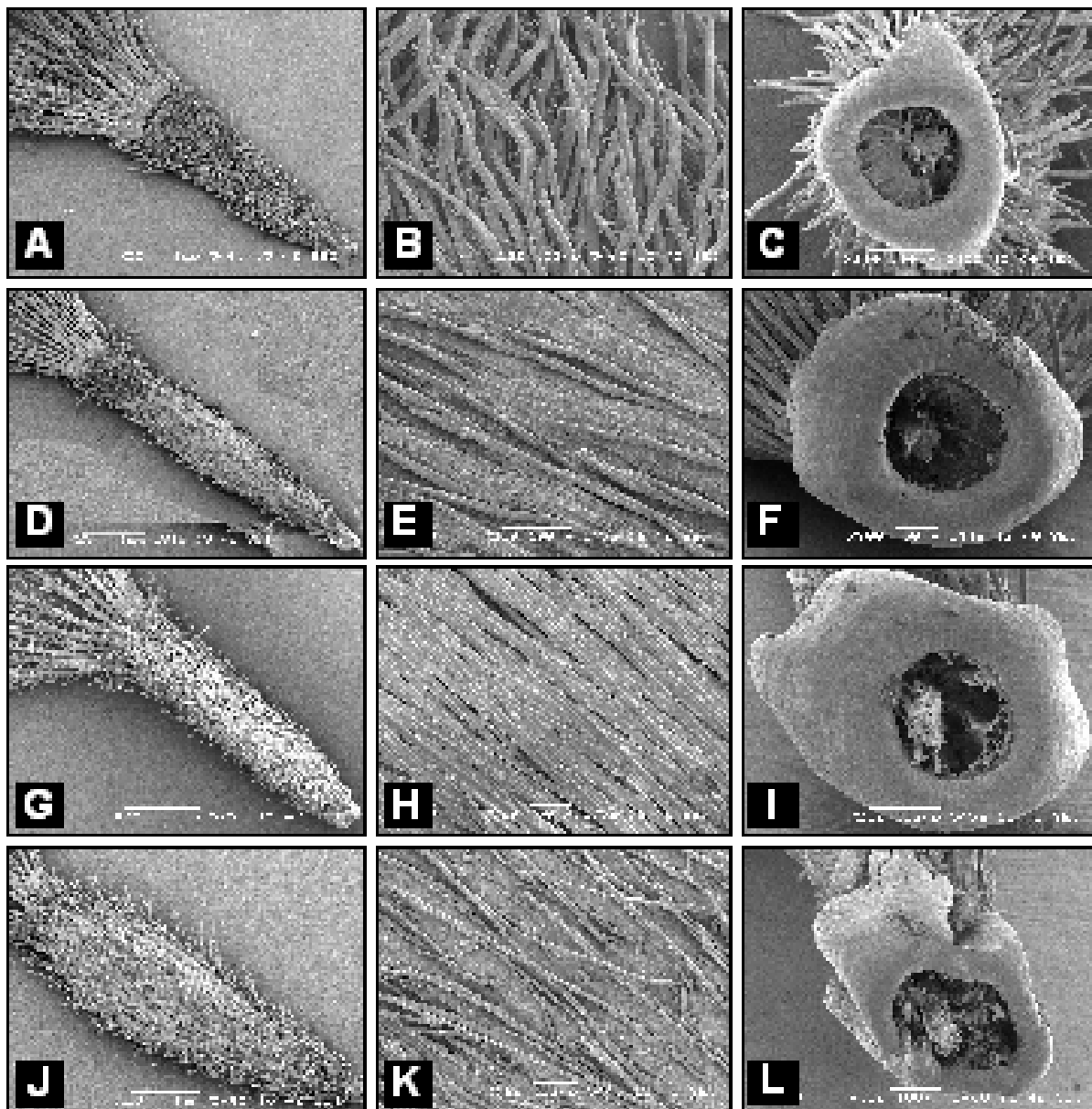


Fig. 1. Scanning Electron Micrographs. *Ainsliaea aptera*: A, cypselas of the disc floret; B, surface; C, carpopodium; D, cypselas of the ray floret; E, surface; F, carpopodium. *A. latifolia*: G, cypselas of the disc floret; H, surface; I, carpopodium; J, cypselas of the ray floret; K, surface; L, carpopodium (Scale bar: A,D,G,J=1mm; B,C,E,F,I,K=100µm; H,L=50µm).

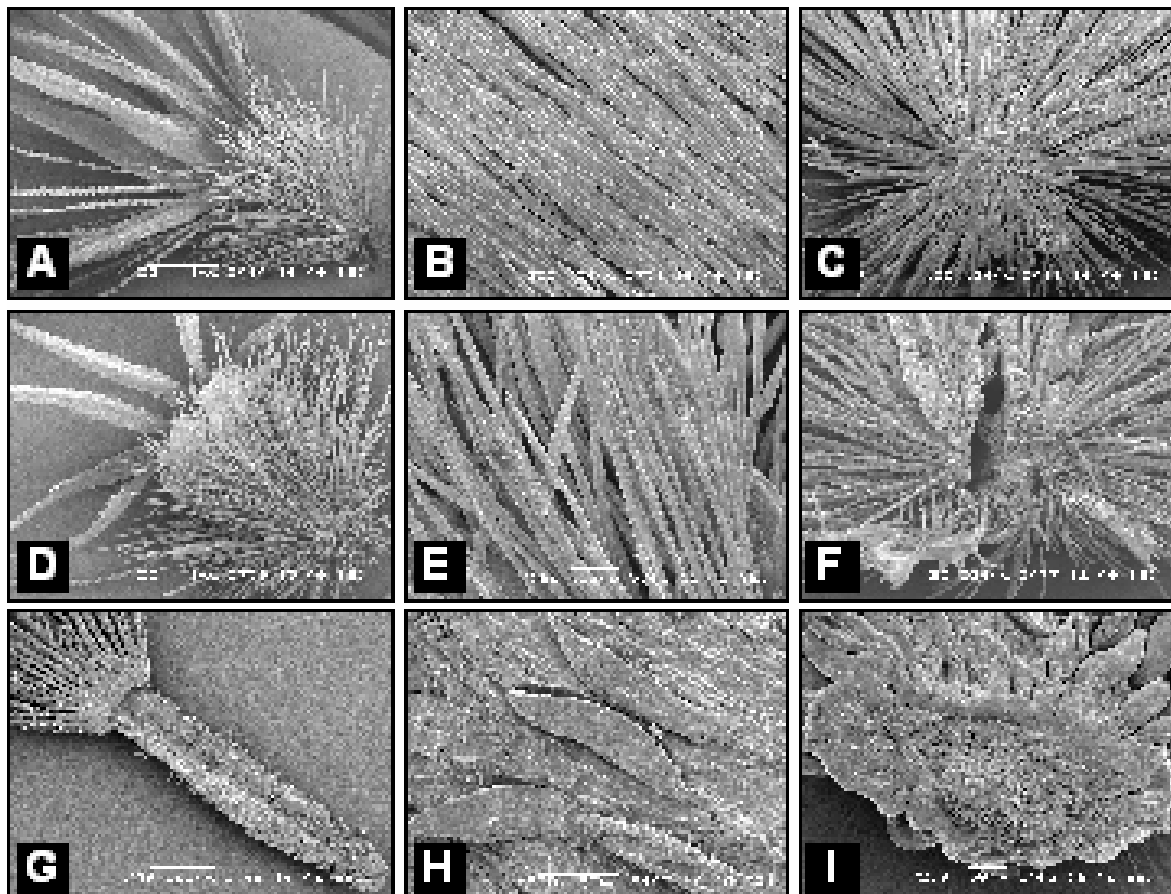


Fig. 2. Scanning Electron Micrographs. *Dicoma schimperi*: A, cypselas; B, surface; C, carpodium. *D. tomentosa*: D, cypselas; E, surface, F, carpodium. *Gerbera gossypina*: G, cypselas; H, surface I, carpodium (Scale bar: A, D, =1mm; B, H, I =50µm; C, E, F=100µm).

Gerbera L.

It is represented by single species viz., *G. gossypina* (Royle) Beauv.

Cypselas monomorphic, oblong, 4.25x0.5mm, maroonish brown, sparsely papillate. Pappus biseriate, barbellate, basally fused, off-white. 60-70 in number, 10mm long. Carpodium irregularly developed, sub-basal in position. 460µm in diameter. Foramen of Carpodium 279µm in diameter (Table 1; Fig. 2G-I).

Results and Discussion

The tribe Mutisieae is characterized by bilabiate corolla with an expanded limb. However, the genus *Dicoma* Cass., is characterized due to non-mutisioid corolla distinctly divided into a narrow tube and wide limb, due to this it was called as *Dicoma* group (Bremer, 1994). This is also supported by the molecular data and this *Dicoma* group was placed into a separate tribe Dicomeae (Panero & Funk, 2002; 2008). Similarly, the genus *Dicoma* also possesses exclusive cypselas features and remains distinct from rest of the genera by having obovate or turbinate cypselas with densely villous or hirsute hairs. Besides this, Grau (1980) also reported highly characteristic testa in *Dicoma* among other Mutisieae. On the other hand, *Ainsliaea* is the only genus where dimorphic cypselas i.e., different cypselas in both ray and disc florets are observed. While, the genus *Gerbera* is characterized by having oblong cypselas with papillate surface (Qaiser & Abid, unpub.).

The importance of cypsela morphology is also evident at specific level, such as the species of *Ainsliaea* are distinguished on the basis of carpodium, as broad and slightly angular disc like carpodium is found in *A. latifolia* and a broad circular disc like carpodium is present in *A. aptera*. Similarly, carpodium features have always been found useful for the taxonomic delimitation of the various taxa of the family Compositae (Haque & Godward, 1984; Abid & Qaiser, 2009; Abid & Ali, 2010). The two species of *Dicoma* can also be distinguished from each other by having obovate cypselas with biseriate and dimorphic pappus in *D. tomentosa* while, *D. schimperi* is characterized by having turbinate cypselas with uniseriate scaly pappus.

Therefore, cypsela micromorphology provides an additional information to delimit the various taxa of the tribe Mutisieae (s.l.) from Pakistan.

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