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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 cypsela including shape, pappus and carpopodium 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 *Uechtritzia* Freyn. (Qaiser & Abid, unpub.). Cypsela 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 cypsela morphology for the tribe Mutisieae (s.l.). Presently, the cypsela 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 cypsela 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: Cypsela: Shape, surface, colour, size Pappus: Series, shape, number, degree of fusion, colour, size Carpopodium: Shape, position, diameter of carpopodium and diameter of foramen of carpopodium.

Observations

General cypsela 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. Carpopodium 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 carpopodium 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. Carpopodium broad circular or slightly angular disc like without any interruption, basal in position, 285-485µm in diameter. Foramen of carpopodium 152-162 µm in diameter. Cypselas of the ray floret oblong, 5.5-6.0xl.5mm, golden-light brown or light brown, conspicuously ribbed, sparsely hirsute. Pappus uniseriate, plumose, basally fused, off white, 30-35, 4-9mm long. Carpopodium broad circular or slightly angular disc like without any interruption, basal in position, 345-349 µrn in diameter. Foramen of carpopodium 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. Carpopodium slightly angular disc like ……..…… *A. latifolia*
- Pappus bristles 7-9mm long in cypsela of ray floret and 4-5mm in cypsela of disc floret. Carpopodium 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. Carpopodium 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. Cypsela morphological characters in the tribe Mutisieae (Asteraceae).

Name of taxa	Cypsela				
	Monomorphic/ Dimorphic	Shape	Surface	Colour	Size(mm)
Ainsliaea aptera	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	Disc floret: 4.0x0.5 Ray floret:6.0x1.5
Ainsliaea latifolia	Dimorphic	Disc floret: Oblong Ray floret: Oblanceolate	Disc floret: Inconspicuously ribbed, densely hirsute Ray floret: Conspicuously ribbed, sparsely hirsute	Disc floret: Golden brown Ray floret: Golden -light brown	Disc floret:4.0x1.0 Ray floret:5.5x1.5
Dicoma schimperi	Monomorphic	Turbinate	Densely villous	Dark brown	3.0x2.5
Dicoma tomentosa	Monomorphic	Obovate	Densely hirsute	Golden brown	3.0x2.5
Gerbera gossypina	Monomorphic	Oblong	Sparsely papillate	Maroonish brown	4.25x0.5

Table 1. (Cont'd.).

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

Table 1. (Cont'd.).

Name of taxa	Carpopodium			
	Shape	Position	Diameter of carpopodium (µm)	Diameter of foraman of carpopodium (µm)
Ainsliaea aptera	Disc floret: Broad circular disc without any interruption Ray floret: Broad circular disc without any interruption	Disc floret:Basal Ray floret: Basal	Disc floret: 285 Ray floret: 349	Disc floret: 152 Ray floret: 136
Ainsliaea latifolia	Disc floret: Broad slightly angular disc without any interruption Ray floret: Broad slightly angular disc without any interruption	Disc floret:Basal Ray floret: Basal	Disc floret: 485 Ray floret: 345	Disc floret: 162 Ray floret: 251
Dicoma schimperi	Undeveloped	--	--	--
Dicoma tomentosa	Undeveloped	--	--	--
Gerbera gossypina	Irregularly developed	Sub-basal	460	279

Appendix-1. List of voucher specimens.

Taxa	Collector, Number, Herbarium
Ainsliaea aptera	*Y.Nasir* 10874 (RAW); *E. & Y. Nasir* 8852 (RAW); *G.D.Samson* 15337 (KUH); *Mohindar Nath* 344 (RAW).
A. latifolia	*I.J. Robert* 11913 (RAW).
Dicoma schimperi	*M. Qaiser, G. Sarwar & Jan Alam* 886 (KUH); *Surayya* Khatoon 318 (KUH); *Coll. ignot.* s.n. (KUH)
D. tomentosa	*G.R. Sarwar, M. Qaiser & Jan Aam* 1071 (KUH); *Razia Ahmed* 14 (KUH); *Mohindar Nath* 16576 (RAW); *Nurun Nahar* s.n. (KUH).
Gerbera gossypina	*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).

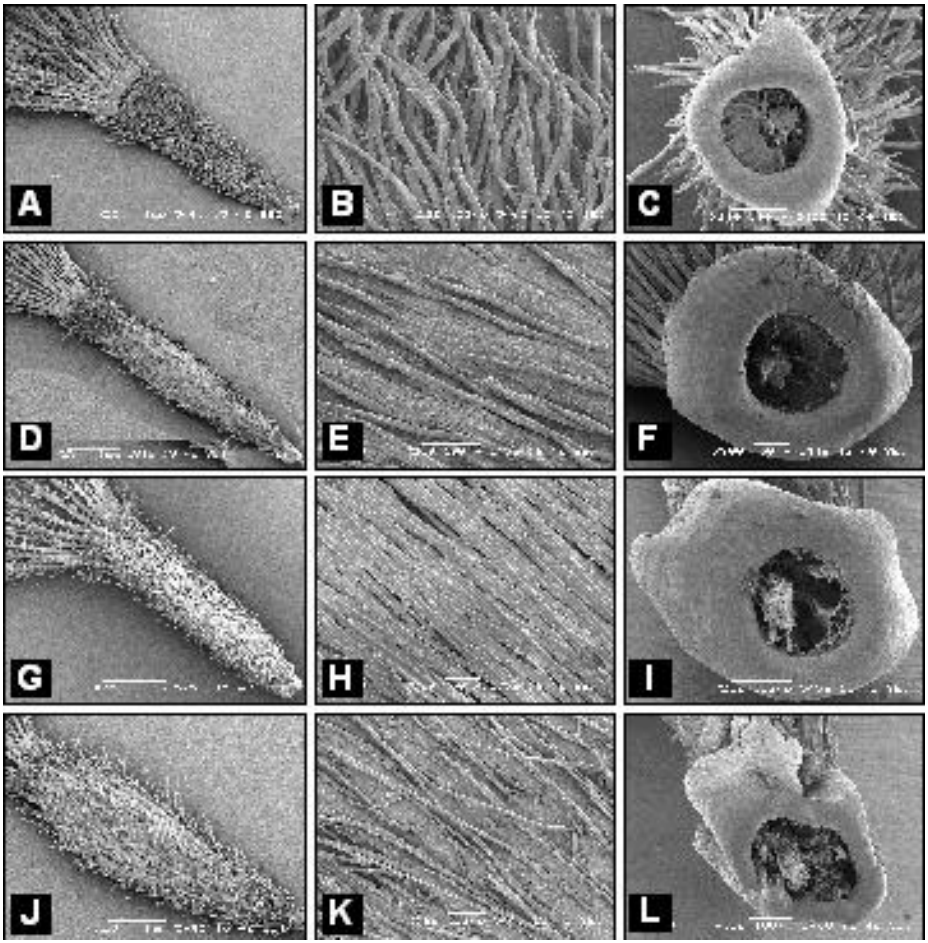

Fig. l. Scanning Electron Micrographs. *Ainsliaea aptera:* A, cypsela of the disc floret; B, surface; C, carpopodium; D, cypsela of the ray floret; E, surface; F, carpopodium. *A. latifolia*: G, cypsela of the disc floret; H, surface; I, carpopodium; J, cypsela of the ray floret; K, surface; L, carpopodium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

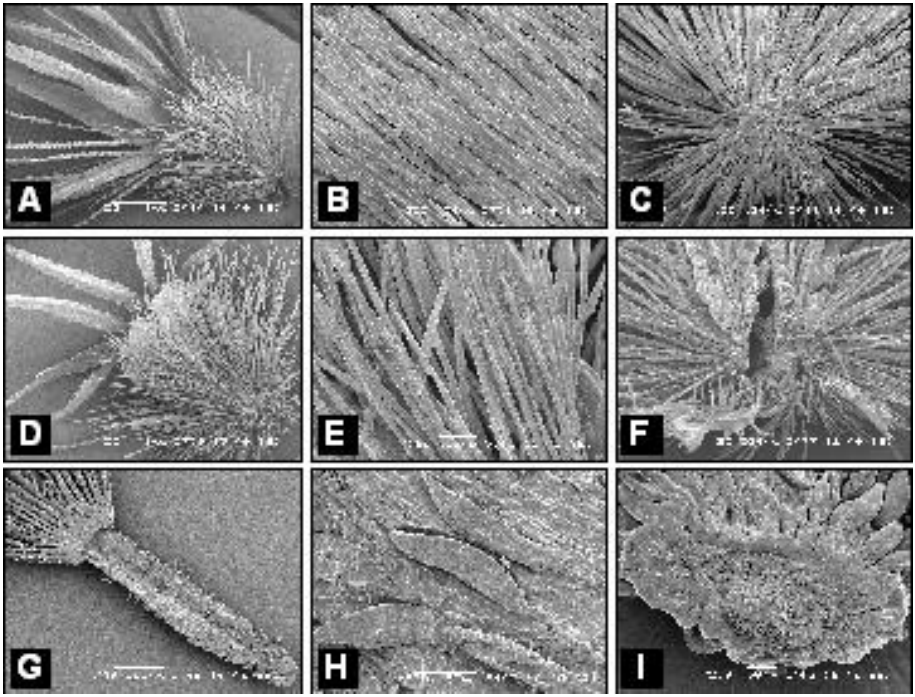

Fig. 2. Scanning Electron Micrographs. *Dicoma schimperi*: A, cypsela; B, surface; C, carpopodium. *D. tomentosa*: D, cypsela; E, surface, F, carpopodium. *Gerbera gossypina*: G, cypsela; H, surface I, carpopodium (Scale bar: A, D, =1mm; B, H, I =50µm; C, E, F=100µm).

***Gerbera* L.**

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

Cypeslas monomorphic, oblong, 4.25x0.5mm, maroonish brown, sparsely papillate. Pappus biseriate, barbellate, basally fused, off-white. 60-70 in number, 10mm long. Carpopodium irregularly developed, sub-basal in position. 460µm in diameter. Foramen of Carpopodium 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 cypsela 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 carpopodium, as broad and slightly angular disc like carpopodium is found in *A. latifolia* and a broad circular disc like carpopodium is present in *A. aptera*. Similarly, carpopodium 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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