Shiv Shakti International Journal of Multidisciplinary and Academic Research
ISSN: 2278-5973 (Online) | Vol. 5, No. 4, (July 2017)

Floral Micromorphology and Its Taxonomic Implications in Some Species of the Tribe Heliantheae (Asteraceae)

Dr. Bablu Roy
Department of Botany
Dinabandhu Mahavidyalaya, Bongaon, W. B.

Abstract

Floral micromorphological characters of five species of the tribe Heliantheae (Asteraceae) were analysed to evaluate their significance as taxonomic markers. Several floral microcharacters such as shape of anther appendages, types of anther bases, configuration of endothecial thickenings and anther collars; shape, size and distribution of sweeping hairs on style branches, configuration of stigmatic areas on the inner surface of stigma; size and shape of cypselas; types of pappus along with the numbers and arrangements of pappus bristles were thoroughly investigated and analysed.

Keywords: Taxonomy, floral micromorphology, Heliantheae, Asteraceae.

Introduction

The tribe Heliantheae is one of the largest and most morphologically diverse groups within the family Asteraceae, making it a significant source of taxonomic controversies across various classification systems. First established by Cassini in 1821, the tribe was defined in part using micro-synantherological characters. Later, Bentham (1873) proposed a close relationship between the tribes *Helenieae* and *Heliantheae*, a view that was largely supported—with slight modifications—by Hoffmann in 1894.

A review of existing literature on the micromorphological traits of the family Asteraceae (Robinson, 2006; Scott, 1985; Sen & Mukherjee, 2007; Mukherjee & Nordenstam, 2008) highlights the significant role these characters play in improving our understanding of taxonomic relationships, particularly within Asteraceae.

Currently, the tribe *Heliantheae* consists of 14 subtribes, 113 genera, and approximately 1,500 species (Panero, 2007). The present study focuses on five species, representing a distinct genus: *Blainvillea acmella*, *Eleutheranthera ruderalis*, *Lagascea mollis*, *Spilanthes acmella*, and *Synedrella nodiflora*.

Materials

5 species belonging to 5 genera of the tribe Helianthae (family- Asteraceae) are analyzed. The studied specimens are arranged according to alphabetical order mentioning the locality.

Sl. No.	Name of the Species	Locality
1	*Bainvilleae acmella* (Linn.) Philips.	Amaravati, Maharastra
2	*Eleutheranthera ruderalis* (Swartz) Schultz	Kalyani, W.B.
3	*Lagascea mollis* Cav.	Amaravati, Maharastra
4	*Spilanthes acmella* L.	Kalyani, W.B.
5	*Synedrilla nodiflora* (L.) Gaertn.	Bishnupur, Nadia, W.B.

Corresponding Author: Dr. Bablu Roy, bablu15.roy@gmail.com

Methodology

- Minimum five florets from different capitula of three different specimens of each taxon.
- Following methods suggested by Wetter (1983), Sundberg (1985), Karis *et.al.*(1993), with some modifications.
- Florets were placed in 2% NaOH soln. for 2-5 days.
- Stained with 50% safranin solution for 10-15 minutes. Dehydrated by a graded alcohol series and Mount.
- Florets dissected using clove oil as a softening agent.
- Light microscopical work done with binocular Metzer microscope: objectives 40X, 10X, 5X.
- The photomicrographs taken using Metzer binocular research microscope and Vision-Pro camera attachment.

Observation

***Bainvilleae acmella* (Linn.) Philips.**

Capitula heterogamous, radiate, terminal, simple, open or congested paniculiform cymes, many flowered. Involucres 2 series, 5 in each series, dimorphic, ovoid, green. Receptacles flat or slightly convex, paleate.

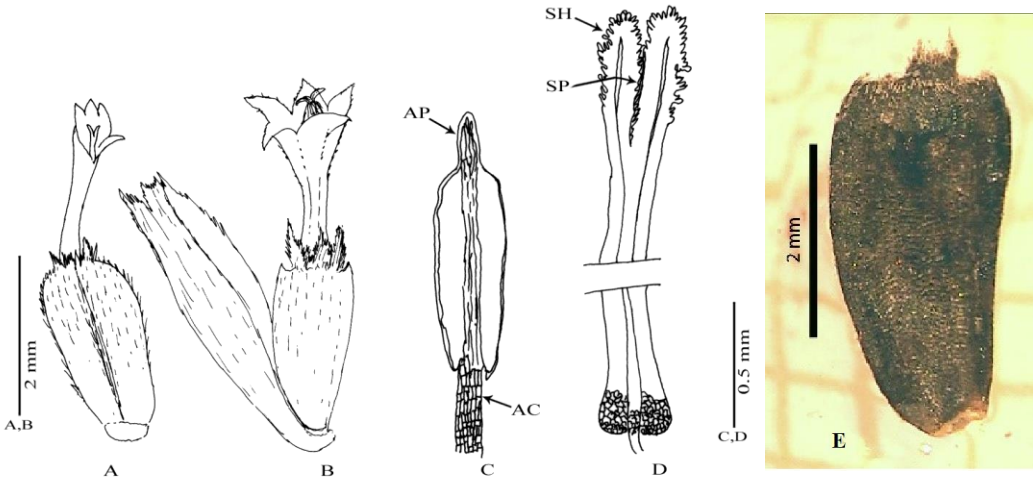
Ray florets, pistillate 3.5 -4mm long; cypsela 1.5x0.5mm, hairs few, near the apices. Corolla white, apices bilobed, true ray 2.5-3.0 mm, trichomes on corolla tube in tuft, unicellular, tubular; style 1.1-1.3mm long, bifurcated. Style arms radially oriented in relation to capitulum.

Disc florets many, bisexual, paleate, 2.3-2.5 mm, palea lanceolate, 1.1mmx0.5mm, acute. Corolla actinomorphic, tubular-campanulate, white or pale yellow, 1.5mm, lobes 4, trichomes on corolla lobes multicellular conical or unicellular, clavate.

Stamens 4, syngenecious, 1 mm long, inserted near the base of the corolla tube; filament glabrous, 0.5mm; anther 0.5mm, calcarate, ecaudate, tails unequal; anther collar balusterform, 0.3-0.32x0.09-0.1mm, with 4-5 vertical and 8-9 horizontal rows of thick walled cells; anther base obtuse, anther appendage, rounded, 0.06x0.05 mm.; endothecial cells strictly polarized.

Style thin, 1.1-1.3 mm long, linear; bifurcated; bifurcation upto 0.4mm, stigmatic surface in broad parallel; sweeping hairs distributed up to the bifurcation, more or less similar in size, minute, conical. Style arms radially oriented in relation to capitulum. Style base bulbiform.

Cypsela 2.5 x 1 mm, with basal carpodium and apical cup shaped stylopodium; hairs few, near the apices. Pappus minute hairy, aristate-corona, 2 toothed, teeth 0.2-0.3mm.



Diag.1 *Blainvillea acmella*: A- Ray floret, B- Disc floret, C-- Anther with collar and appendage, D- Style and stigma, E-Micrograph of Cypsela

***Eleutheranthera ruderalis* (Swartz) Schultz**

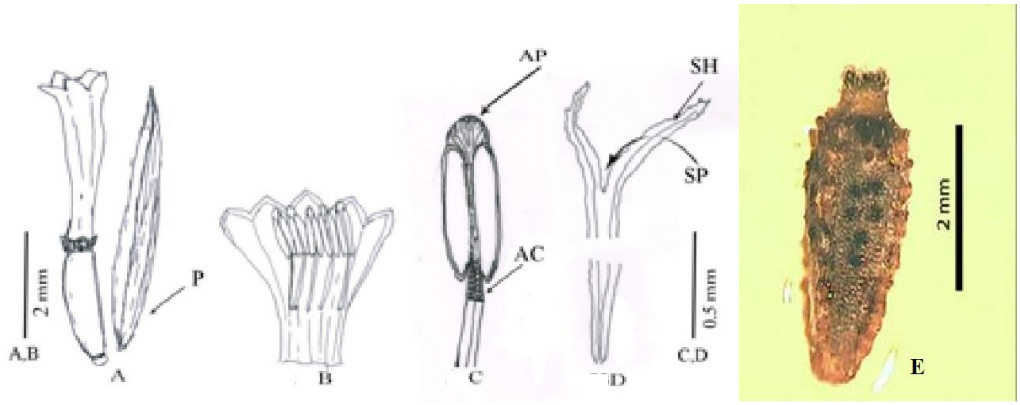
Capitula homogamous, discoid, solitary axillary, many flowered. Involucres in one series, 5-6, campanulate or oblanceolate, green. Receptacles flat or slightly convex, paleate.

Disc florets many, bisexual, paleate, 4.3-4.5 mm, palea lanceolate, 2mmx1 mm, acute, hairy. Corolla actinomorphic, tubular-campanulate, yellow, 2.5mm, lobes 5-6, trichomes on corolla lobes multicellular conical or unicellular, clavate.

Stamens 5-6, syngenecious, 2-2.2mm long, inserted near the base of the corolla tube; filament glabrous, 0.8-1.0mm; anther 1-1.2mm, calcarate, ecaudate, tails equal; anther collar balusterform, 0.4-0.42x0.2 -0.21mm, with 10-12vertical and 20-25 horizontal rows of thick walled cells; anther base sagittate, anther appendage dome shaped, 0.2x0.1 mm.; endothecial cells strictly polarized.

Style thin, 3-3.3 mm long, linear; obtusely bifurcated; bifurcation upto0.8-1.0mm, stigmatic surface in broad parallel; sweeping hairs distributed up to the bifurcation on the style arms, minute, conical, unequal.Style arms radially oriented in relation to capitulum. Style base bulbiform.

Cypsela 2.2-2.5x 0.8-1.0 mm, with basal carpodium and apical cup shaped stylopodium; hairs few, near the apices. Pappus small lacerate, crown with hairs.



Diag. 2 *Eleutheranthera ruderalis*: A- Single floret, B-Dissected disc corolla showing anther attachment, C- Anther with collar and appendage, D- Style and stigma, E-Micrograph of Cypsela.

***Lagascea mollis* Cav.**

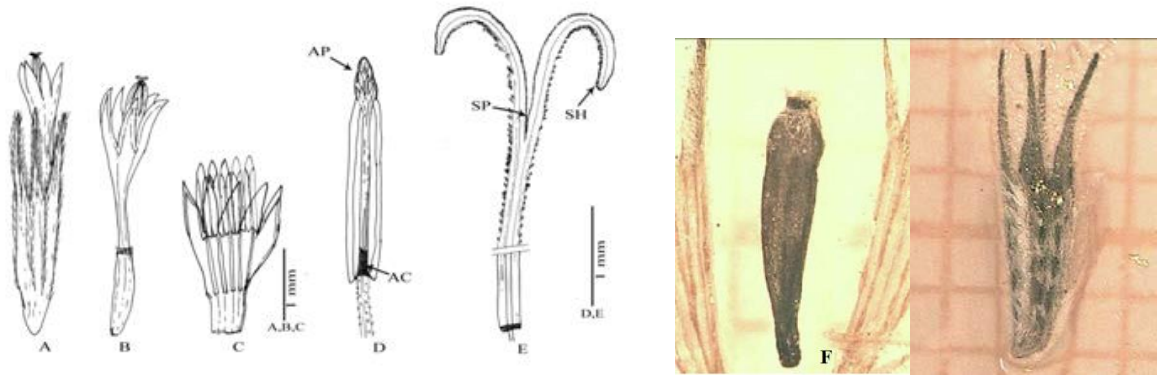
Capitula homogamous, few flowered (1 or 2), discoid, aggregated into tight glomurule like clusters and subtended by leafy bracts producing a compound capitulum. Involucres in one series, cylindrical, fused, subequal, hairy.

Disc 1 or 2, bisexual, epaleate, 6-7 mm. Corolla actinomorphic, tubular-campanulate, white, 2.5mm, lobes 5-6, trichomes on corolla lobes multicellular conical and apical acicular, unicellular, clavate.

Stamens 5, syngenecious, 4-4.2mm long, inserted near the base of the corolla tube; filament warty, 1.8-2.0mm; anther 2-2.1mm, calcarate, ecaudate, tails equal; anther collar balusterform, 0.4-0.42x0.2 - 0.21mm, with 10-12vertical and 20-25 horizontal rows of thick walled cells; anther base sagittate, anther appendage conical, 0.2x0.1 mm.; endothecial cells strictly polarized.

Style thin, 5.5-5.8 mm long, linear; obtusely bifurcated; bifurcation upto1.5-2.0mm, stigmatic surface in broad parallel; sweeping hairs distributed below the bifurcation on the style arms, narrow obtuse, conical, unequal.Style arms radially oriented in relation to capitulum. Style base bulbiform.

Cypsela 3.5x 1.0 mm, with basal carpodium and apical cup shaped stylopodium; hairs few, near the apices. Pappus small lacerate, crown with hairs.



Diag.3. *Lagascea mollis:* A- Florets with involucre B- Florets, C-Dissected disc corolla showing anther, D- Anther with collar and appendage, E- Style and stıgma, F-Micrograph of Cypsela.

***Spilanthes acmella* L.**

Capitula heterogamous, radiate, terminal, simple, open or congested paniculiform cymes, many flowered. Involucres 2 series, 5 in each series, dimorphic, ovoid, green. Receptacles flat or slightly convex, paleate.

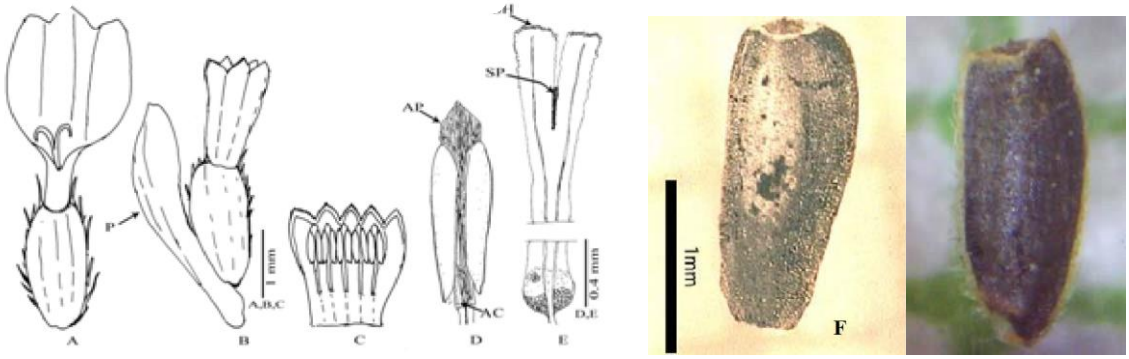
Ray florets, pistillate 3.5 -4mm long; cypsela 1.5x0.5mm, hairs few, near the apices. Corolla white, apices bilobed, true ray 2.5-3.0 mm, trichomes on corolla tube in tuft, unicellular, tubular; style 1.1-1.3mm long, bifurcated. Style arms radially oriented in relation to capitulum. Pappusaristate-corona, 2 toothed.

Disc florets many, bisexual, paleate, 2.3-2.5 mm, palea lanceolate, 1.1mmx0.5mm, acute. Corolla actinomorphic, tubular-campanulate, white or pale yellow, 1.5mm, lobes 4, trichomeson corolla lobesmulticellular conical or unicellular, clavate.

Stamens 4, syngenecious, 1 mm long, inserted near the base of the corolla tube; filament glabrous, 0.5mm; anther 0.5mm, calcarate, ecaudate, tails unequal; anther collar balusterform, 0.3-0.32x0.09-0.1mm, with 4-5 vertical and 8-9 horizontal rows of thick walled cells; anther base obtuse, anther appendage rounded, 0.06x0.05 mm.; endothecial cells strictly polarized.

Style thin, 1.1-1.3 mm long, linear; bifurcated; bifurcation upto0.4mm, stigmatic surface in broad parallel; sweeping hairs distributed up to the bifurcation on the style arms, more or less similar in size, minute, conical. Style arms radially oriented in relation to capitulum. Style base bulbiform.

Cypsela 1.2x0.5 mm, with basal carpodium and apical cup shaped stylopodium; hairs few, near the apices. Pappus minute hairy, aristate-corona, 2 toothed, teeth 0.2-0.3mm.



Diag.4 *Spilanthes acmella*: A- Ray floret, B-Disc florets, C- Corolla with anther attachment, D-Anther with collar and appendage, E- Style and stigma, F-Micrograph of Cypsela.

***Synedrilla nodiflora* (L.) Gaertn**

Capitula heterogamous, radiate, borne singly in leaf axil, many flowered. Involucres 2 series, 5 in each series, homomorphic, ovoid, green. Receptacles small, slightly convex, paleate.

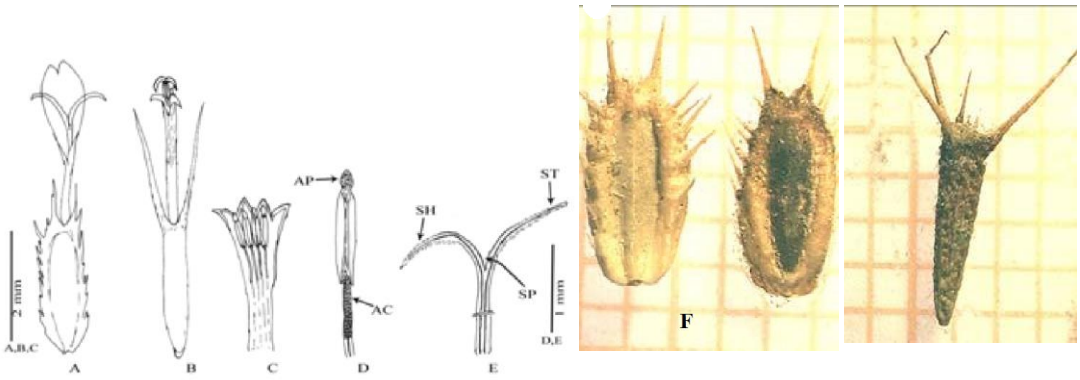
Ray florets, pistillate 7.5 -8mm long; cypsela 2.5-3x1-1.3mm, hairs few. Corolla yellow, apices bilobbed or trilobbed, true ray 2.5-3.0 mm, trichomes on corolla lobe absent; style 3.3-3.5mm long, bifurcated. Style arms radially oriented in relation to capitulum. Pappusaristate-corona, 2 toothed.

Disc florets many, bisexual, paleate, 7.3-8.0 mm, palea lanceolate, 3.1mmx1.5mm, acute. Corolla actinomorphic, tubular-campanulate, yellow or pale yellow, 1.5mm, lobes 4-5, trichomes on corolla lobes unicellular, clavate.

Stamens 4-5, syngenecious, 2 mm long, inserted near the middle of the corolla tube; filament glabrous, 1mm; anther 1mm, calcarate, ecaudate, tails unequal; anther collar cylindrical, 0.4-0.5x0.09-0.1mm, with 6-8 vertical and 20-25 horizontal rows of thick walled cells; anther base sagittate, anther appendage, dome shaped, 0.03x0.02 mm.; endothecial cells strictly polarized.

Style thin, 3.8-4.2 mm long, linear; bifurcated; bifurcation upto1.5-2mm, stigmatic surface in broad parallel; sweeping hairs distributed up to the bifurcation on the style arms, minute, conical,acute, unequal. Style arms radially oriented in relation to capitulum. Style base cylindrical.

Cypsela 2.5x3.0 mm, forms paired spines, multicellular cylindrical; carpopodium absent. Stylopodium small clavated column in a concave echinate crown, unenlarged. Pappus2-3, stiff, acute awns, 2.5-3mm.



Diag.5 *Synedrilla nodiflora*: A-Ray florets., B- Disc florets, C- Corolla with anther attachment D- Anther with collar and appendage, E- Style and stigma, F-Micrograph of Cypsela.

Results and Discussion

On the basis of present study, the tribe Heliantheae possess the following diagnostic features- capitula heterogamous, or homogamous, heterogamous capitula mostly radiate or homogamous capitula radiate (*Lagascea*), many flowered, rarely few flowered (1 or 2 flowered in *Lagascea*). Involucral bracts in 1-7 series, usually gradate, narrow lanceolate, apices acute or rounded. Receptacle usually paleate, sometimes fimbriate, flat to slightly convex, conic or sometime columnar. Ray florets usually ligulate and pistillate or neuter; inner disc florets actinomorphic, bisexual tubular, throats urceolate or campanute. Trichomes on corolla lobe present in most of the species. Stamens 5, syngenecious, but monadelphous in *xanthium;* filaments inserted near the base of corolla tube; anther base ecalcarate, sagittate or obtuse; filament surface glabrous, warty in *Lagascea* or hairy in *Tithoni*a; anther collar cylindrical; anther appendages acute, obtuse or rounded; anther endothecial cells are strictly polarized. Style bifurcated, style branch relatively short; stigmatic areas confined to two separate lines on style arms or stigmatic surface fused; above the stigmatic zones sterile style appendages are absent. Sweeping hairs distributed upto the bifurcation; style arms spreading radially; style base cylindrical or slightly bulbous with sclerified cells; nectary present at the base of the style, usually glabrous.

Cypselas are homo or heteromorphic, blackish, straight or curved; mostly non-ribbed, less often ribbed; mostly pubescent, less often glabrous. Stylopodium is usually minute elevated column or small ring (*Blainvilleae*). Carpopodium is usually symmetric, ring-like or absent. Pappus is mostly awned, sometimes coronate, less often scaly of absent.

Conclusion

Heliantheae is one of the most diverse and heterogeneous tribes within the family Asteraceae. As such, micromorphological characteristics of stamens, styles, and pappus can serve as valuable tools for distinguishing between different taxa within the tribe. These features offer promising avenues for advancing taxonomic studies in the Asteraceae family.

References

Bentham, G. 1873. Compositae. In Bentham, G. and Hooker, J.D.(eds.), *Genera Plantarum*, vol. **2(1**):163-533. London L. Reeve and Co.

Cassini, H. 1821. Heliantheae. In Cuvier, G. *Dictyonnarie des Science Naturelles*, ed. 2 vol. **20** :354-385 Le Normant, Paris.

Funk, V.A., Susanna, A., stuessy, T.F. & Bayer, R.J. 2009.Systematics, Evolution and Biogeography of Compositae. IAPT, Vienna.

Hoffmann, O. 1890-1894. Compositae. In: Engler, A. And Prantle, K. (eds.), *Dienatürlichen Pflanzenfamilien*, Engelmann, Leipzig **4(5)**:87 – 387.

Karis, P. character evolution. Pl. Syst. Evol. **186**: 69-93.. O. 1993. Morphological Phylogenetics of the Asteraceae-Asteroideae, with notes on

Mukherjee, S.K. & Nordenstam, B. 2008. Diversity of pappus structures in some tribes of the Asteraceae Phytotaxonomy **8** : 32-46.

Panero, J. L. And Funk, V.A. 2007. New Infrafamilial taxa in Asteraceae. *Phytologia* **89**: 356 – 360.

Robinson, H. 2006. An introduction to micro-characters of the asteraceae. The International Compositae Alliance, Barcelona, p.5.

Scott, R.W. 1985. Micro characters as generic markers in Eupatorieae. Taxon **34**: 26-30.

Sen, S. and Mukherjee, S. K. 2007. Styler features of some common taxa in Asteraceae. *J. Econ. Taxon. Bot.* **31**: 478 – 486.

Sundberg, S. 1985. Micromorphological characters as generic markers in the Asteraceae. Taxon **34(1)**: 31-3

Wetter, M.A. 1983. Micromorphological characters and generic delimitation of some new world Senecioneae (Asteraceae). *Brittonia* **35**:1-22. 7.