Studies on Micromorphology and Its Taxonomic Implications in Some Species of the Teibe Astereae (Asteraceae)

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Abstract

Micromorphological characters of six species of the tribe Astereae(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, Micromorphology, Astereae, Asteraceae.

Introduction

The family Asteraceae is nested high in the Angiosperm phylogeny in Asterales. The family contains largest number of described, accepted species of 24000 under 1600-1700 genera. The family comprises of 12 subfamilies and 43 tribes (Funk et al., 2009). In Compositae, several micromorphological features have been used for characterization of taxa as additional source of information together with other morphological features. Perusal of available literature regarding the micromorphological characters of Compositae (Robinson, 2006; Scott ,1985; Paria & Chinya,2002; Sen & Mukherjee, 2007; Mukherjee & Nordenstam, 2008) revealed that the micromorphplogical characters have immense value for better understanding of taxa specially for the family Asteraceae.

Tribe Astereae, is the second largest tribe of the family Asteraceae. It was first recognized by Cassini (1819). The tribe is primarily characterized by anther (tailless anther; ecaudate and ecalcarate anther base) and style characters (deltate to triangular or lanceolate style appendages).

According to Nesom and Robinson (2007) there are about 205 genera and approximately 3,080 species within the tribe. The present study of this tribe is restricted to 6 species under 4 genera: *Conyza canademis, Erigeron annus, E. karvimskianus, Grangea maderaspatana, Myriactis javanica* and *M. nepalensis.*

Materials

6 species belonging to 4 genera of the tribe Astereae (family- Asteraceae) are analyzed. The studied specimens are arranged according to alphabetical order mentioning the locality.

Sl. No.	Name of the Species	Locality
1	*Conyza canadensis* (L.) Cronquist	Nainital, Uttarakhand
2	*Erigeron annuus* (L.)Pers	Darjeeling, W.B.
3	*Erigeron karvinskianus* Cass	Darjeeling, W.B.
4	*Grangea maderaspatana* (L.) Poir.	Darjeeling, W.B.
5	*Myriactis javanica* (BC.) DC.	Darjeeling, W.B.
6	*Myriactis nepalensis* Less.	Shillong, Meghalaya

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Methods

Fresh plant materials were used for the study of micromorphological character of six species of the tribe Astereae. For each species at least five capitulum were collected from different plants to study the range of variations within the taxon. The capitulum were fixed in FAA solution. At least ten florets from different capitula were taken randomly and washed in water. Then the florets were kept in 2% NaOH solution for 5-7 days for soften and clearing the tissue. Then the florets were washed in water and dissected under stereo dissecting binocular microscope and stamen, style and pappus were separated out carefully and stained with 0.5% aqueous safranin. After proper staining, dissected parts were mounted in 70% phenol glycerine solution and sealed with wax for semi-permanent preservation. Stamens, styles and pappus were studied with the aid of compound microscope. Anther and styler features were drawn by the prism type of camera lucida. Measurements were facilitated by stage and ocular micrometre.

Observation

***Conyza canadensis* (Thumb.) Less.**

Capitula heterogamous, disciform, borne in paniculate cymes, many flowered. Involucre small campanulate; phyllaries many, subequal, campanulate, arrange in 2-3 rows, green. Receptacles flat or slightly convex, epaleate.

Ray florets many, arranged in many rows, similar, pistillate, 4.5-4.7 mm long. Corolla tubular, 2-3 toothed, 2.5-3 mm, white in colour, trichomes on corolla lobe tubular, acute; style 4-4.2 mm long, bifurcated.

Disc florets bisexual, 4.5-4.9 mm. Corolla tubular-campanulate, 3.5mm, lobes 5, trichomes on corolla lobes unicellular clavate and multicellular tubular, acute.

Stamens 5, syngenecious, 1.5-1.7mm long; filament glabrous, 0.8-0.9mm, attached near the top of the corolla tube; anther 0.8-0.9x0.2 mm, ecalcarate; anther collar cylindrical, 0.3mmx0.05mm, anther base rounded; anther appendage small, triangular, acute 0.15x0.07 mm.

Style thin, 4-4.2mm long, linear, acutely bifurcate; bifurcation upto0.7-0.8 mm.; style base obconical; style apex acute; stigmatic surface in separate lines; sweeping hairs distributed above the bifurcation of the style arms, short, similar, obtuse.

Cypsela homomorphic, 0.8-1.0x0.25-0.3mm, hairs twin types; Stylopodium small, unenlarged, free, ecoronate, ebordered. Carpopodium symmetric, complete, circular. Pappus homomorphic, many, bristillate, subequal, 3.2-3.5 mm long.

***Erigeron annuus* (L.) Pers**.

Capitula heterogamous, radiate, borne in solitary axillary or few to several subcorymbs, many flowered. Involucres many, subequal, campanulate, arrange in 2-3 rows, green.

Ray florets many, arranged in two rows, similar, pistillate, 9-10 mm long; cypsela 1mmx0.2mm, hairy. Corolla true ray, 2-3 toothed, 8-9 mm, white, violet, pink or purple in colour, trichomes on corolla lobe absent; style 2-2.5 mm long, bifurcated.

Disc florets bisexual, 3.5-4.2 mm. Corolla tubular, lobes 5, trichomes on corolla lobes unicellular, clavate.

Stamens 5, syngenecious, 2 mm long; filament glabrous,1mm;anther 1.0x0.2 mm, ecalcarate; anther collar cylindrical, 0.4mmx0.7mm; anther appendage small, triangular, acute, 0.15x0.07 mm.; endothecial cells strictly polarized.

Style thin, 2.8- 3.0 mm long, linear, acutely bifurcate; bifurcation upto 0.6-0.8 mm.; stigmatic surface in separate lines; sweeping hairs distributed on the top of the style arms, short, more or less similar in size, clavate or subclavate.

Cypsela homomorphic 1.0x0.4 mm, straight or slightly curved; twin hairs are tubular and narrow acute. Stylopodium ecoronate, ebordered. Carpopodium present, symmetric, complete, circular, ring like. Pappus heteromorphic bristillate, outer ones long, subequal, 2.2-2.8mm, inner ones small, 0.2-0.3mm.

***Erigeron karvanskianus* Cass**.
Capitula heterogamous, radiate, borne in solitary axillary or few to several subcorymbs, many flowered. Involucres many, subequal, campanulate, arrange in 2-3 rows, green.
Ray florets many, arranged in two rows, similar, pistillate, 9-10 mm long; Corolla true ray, 2-3 toothed, 8-9 mm, white, violet, pink or purple in colour, style 2-2.5 mm long, bifurcated.
Disc florets bisexual, 3.5-4.2 mm. Corolla tubular, lobes 5, trichomes on corolla lobes unicellular, clavate. Stamens 5, syngenecious, 2 mm long; filament glabrous,1mm; anther 1.0x0.2 mm, ecalcarate; anther collar cylindrical, 0.4mmx0.7mm; anther appendage small, triangular, acute, 0.15x0.07 mm.; endothecial cells strictly polarized.
Style thin, 2.8- 3.0 mm long, linear, acutely bifurcate; bifurcation upto 0.6-0.8 mm.; stigmatic surface in separate lines; sweeping hairs distributed on the top of the style arms , short, more or less similar in size, clavate or subclavate.
Cypsela homomorphic 1.0x0.4 mm, straight or slightly curved; twin-hairs are tubular and narrow acute. Stylopodium present, small, unenlarged, free, ecoronate, ebordered. Carpopodium symmetric, complete, circular. Pappus heteromorphic, bristillate, outer ones long, subequal, 2.2-2.8mm, inner ones small, 0.2-0.3mm.

***Grangea maderaspatana* (L.) Poir.**
Capitula heterogamous, disciform, solitary terminal or axillary, yellow, many flowered. Involucres many, subequal, campanulate, arrange in 2-3 rows, green.
Ray florets many, arranged in many rows, similar, pistillate, 2.2-2.5mm long; Corolla tubular, bilabiate, 1 mm, yellow in colour, trichomes on corolla lobe glandular; style 1.2-1.3 mm long, bifurcated; style base cylindrical.
Disc florets bisexual, 2.2-2.3mm. Corolla tubular, lobes 5, trichomes on corolla lobes multicellular, glandular.
Stamens 5, syngenecious, 0.7mm long; filament glabrous,0.3mm; anther 0.4x0.2 mm, ecalcarate; anther collar cylindrical, 0.2mmx0.0.05mm; anther appendage small, triangular, 0.08x0.05 mm.
Style thin, 1.1- 1.3mm long, linear, acutely bifurcate; bifurcation upto 0.2mm.; stigmatic surface in separate lines; sweeping hairs distributed above the bifurcation of the style arms, short, more or less similar in size, obtuse. Style base cylindrical. Style arms tangentially oriented in relation to capitulum.
Cypsela homomorphic,1.5-2x0.4 mm, cream coloured, dorsiventrally flattened, oblong, base truncate, glandular hairy. Pappus setose-paleaceous with fimbriate margin.

***Myriactis nepalensis* Less.**
Capitula heterogamous, disciform, borne in a small panicle, many flowered. Involucres many, subequal, hemispheric, green. Receptacles broad, convex, epaleate.
Ray florets many, arranged in many rows, similar, pistillate, 1.5-1.6mm long;. Corolla tubular, 4-toothed, 1 mm, white in colour, trichomes on corolla lobe glandular;
Disc florets bisexual, 1.5-1.8mm. Corolla tubular, lobes 4, trichomes on corolla tube multicellular, glandular and on lobes unicellular, tubular, clavate.
Stamens 4, epipetalous, 0.7mm long; filament glabrous,0.5mm; anther 0.2x0.15 mm, ecalcarate; anther collar cylindrical, 0.1mmx0.0.05mm; anther appendage small, triangular, 0.05x0.03 mm.; endothecial cells strictly polarized.
Style thin, 1.1- 1.3mm long, linear, acutely bifurcate; bifurcation up to 0.5mm.; stigmatic surface in separate lines; sweeping hairs distributed above the bifurcation of the style arms, short, more or less similar in size, obtuse. Style base cylindrical. Style arms tangentially oriented in relation to capitulum.
Cypsela homomorphic, oblong-ovate, 1.0x0.4 mm, short stalked, dorsiventrally compressed.

***Eupatorium erithropappum* B.L Rob.**

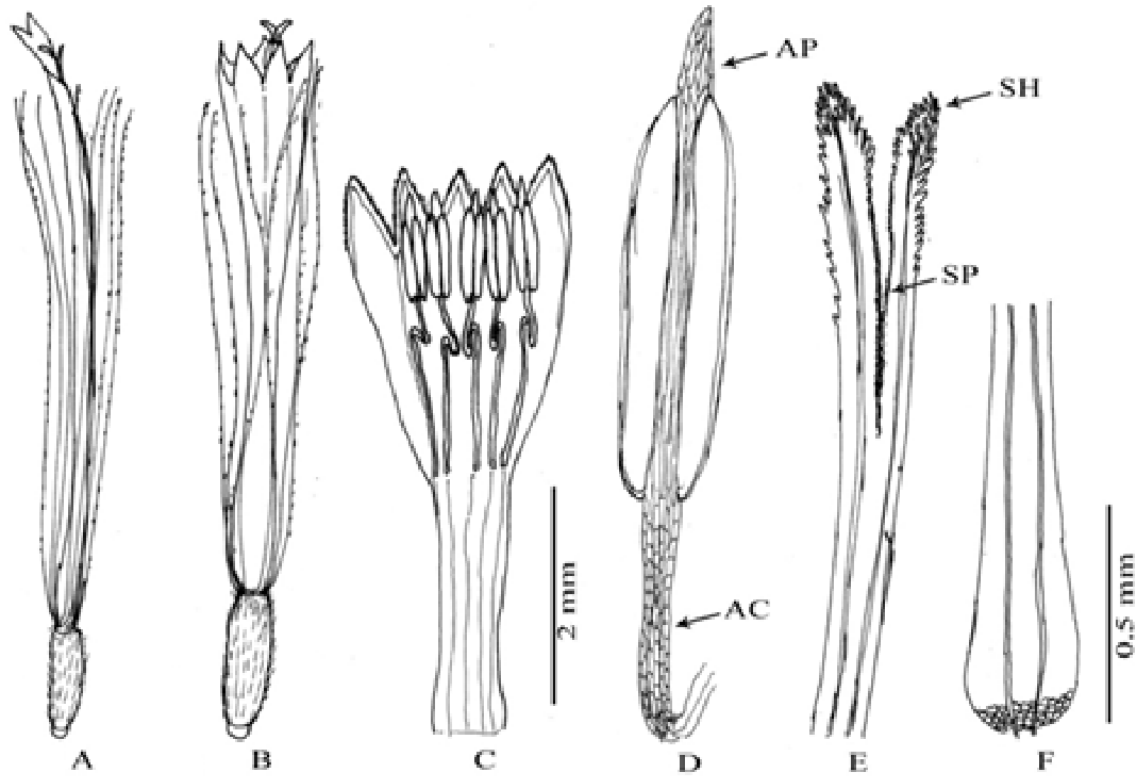
Capitula homogamous, discoid, many flowered. Involucres many, subequal, campanulate, arrange in 2-3 rows, green. Receptacles flat or slightly convex, epaleate.

Florets all similar, hermaphrodite. Corolla regular, tubular, white or pale-purple in colour, lobes-5, connate; trichomes on corolla lobe unicellular clavate.

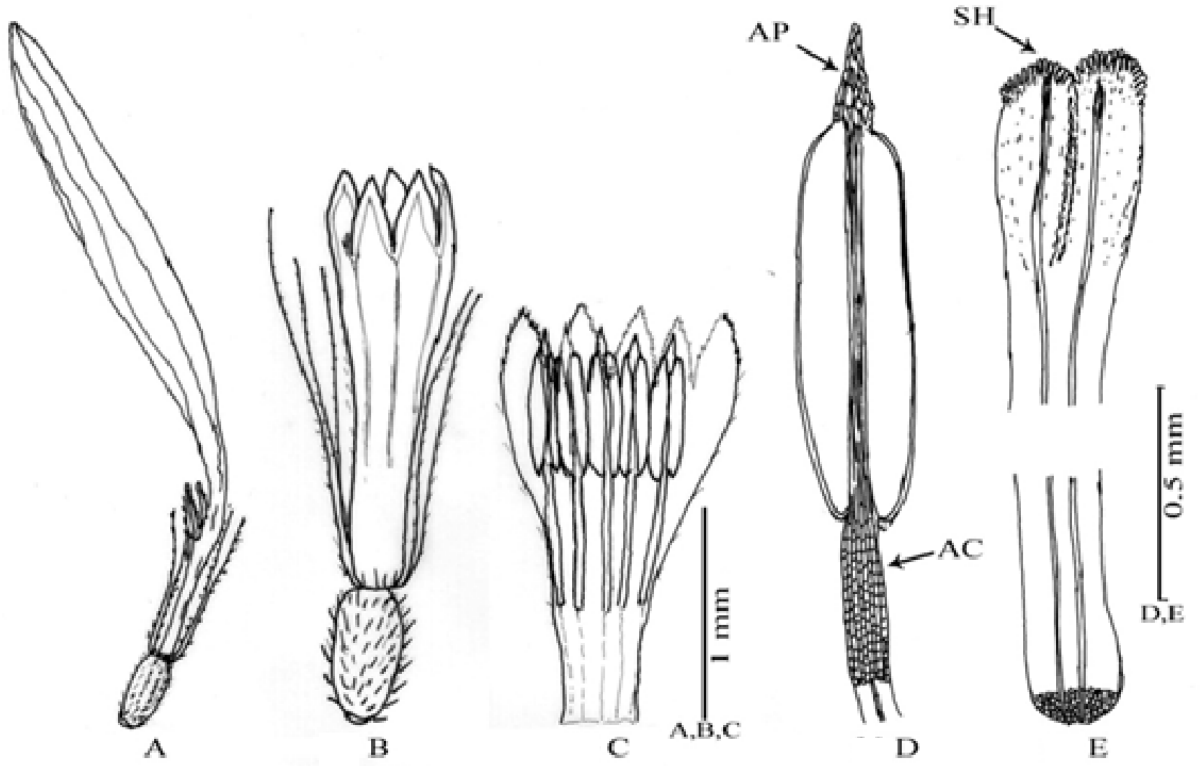
Stamens 5, 1.5-1.7 mm; filament glabrous, 0.4-0.5mm; collar cylindrical; anther 1.0-1.2mmx0.15-0.17 mm, ecalcarate; endothecial cells strictly polarized. Dome shaped apical appendage, 0.3x0.2 mm to 0.3xo.3 mm.

Style 5.0- 5.2 mm, linear, acutely bifurcate; bifurcation upto 1.8-2.2 mm. stigmatic surface along the inner margins; style appendages beyond the stigmatic areas, long; sweeping hairs distributed up to the bifurcation, more or less similar in size, clavate or subclavate. Style arms tangentially oriented.

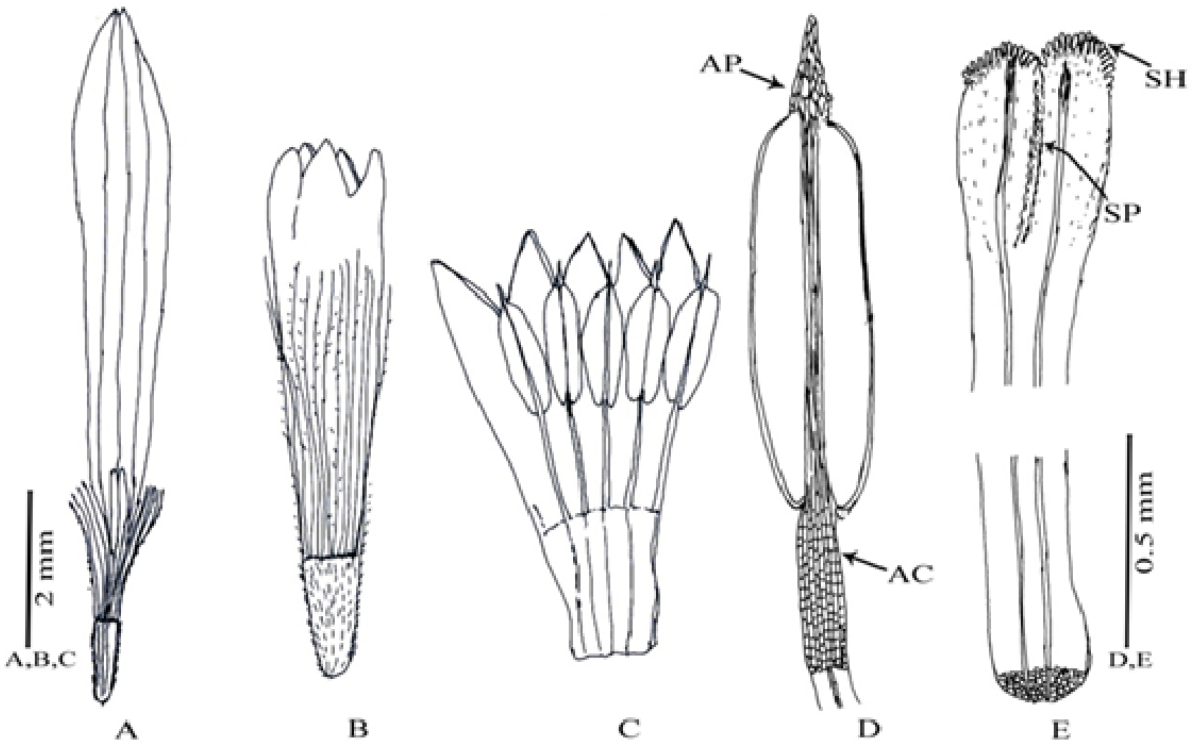
Cypsela 3-3.5mmx0.4 mm; cypsela 4-5 ridged, hairs are distributed along the ridges, tubular and narrow acute. Pappus many, awn like scales, subequal, 5-6mm long.



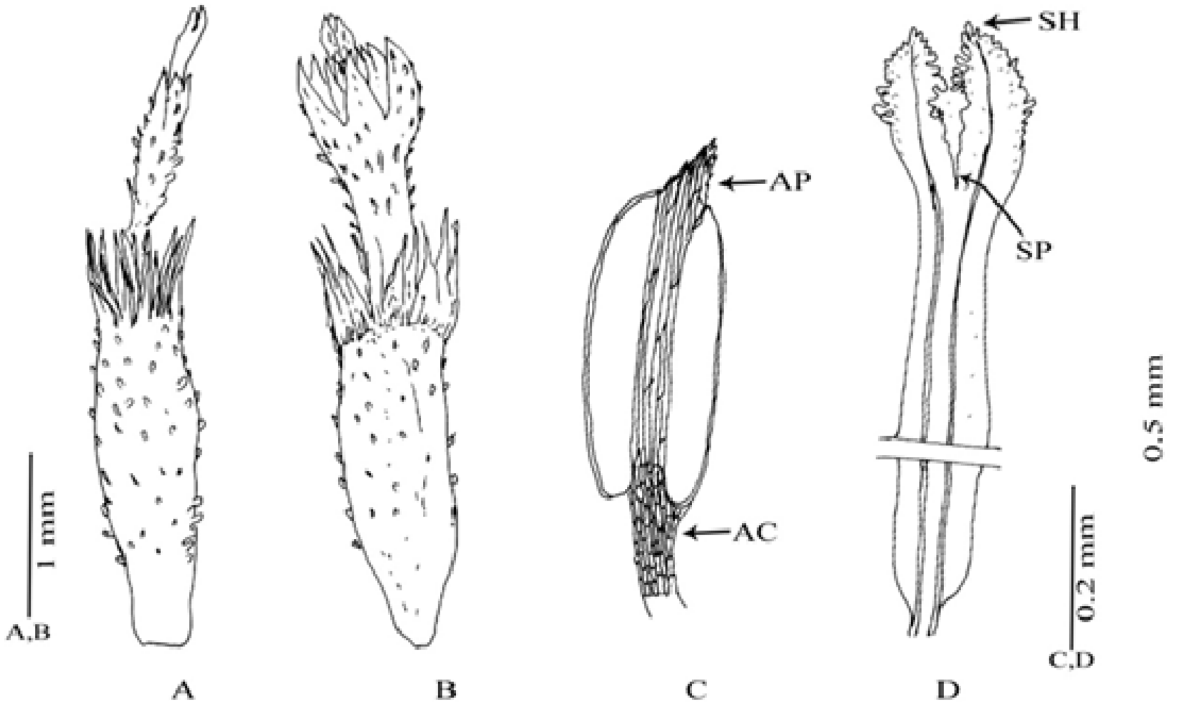
Diag. 1–*Conyza canadensis:* A- Ray floret, B- Disc floret, C-Dissected disc corolla showing anther attachment, D- Anther with collar and appendage, E- Style and stigma.



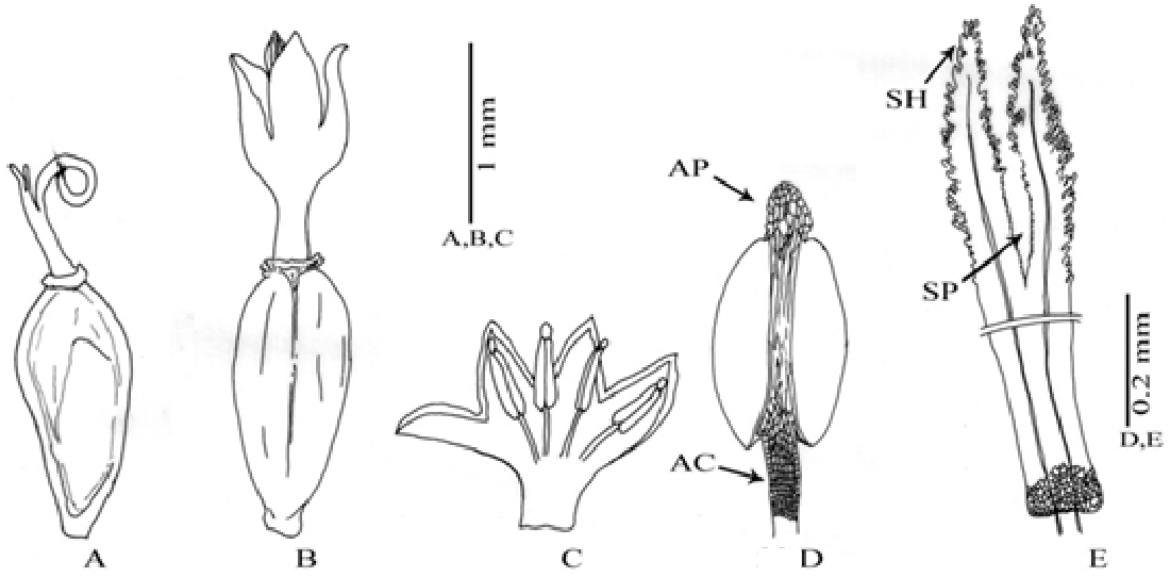
Diag. of *Vigeron annua* A- Ray floret B- Disc floret, C-Dissected disc corolla showing anther attachment, D- Anther with collar and appendage, E- Style and stigma.



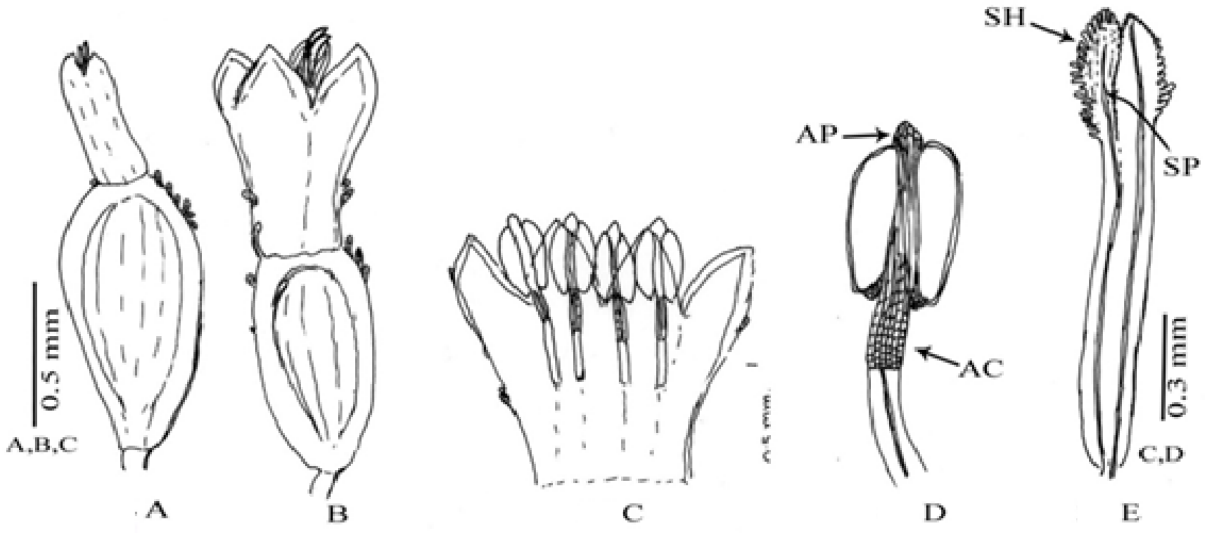
Diag *Erigeron karvan anus:* A- Ray flor B- Disc floret, C ssected dis rolla showing anther attachment, D- Anther with collar and appendage, E- Style and stigma.



Diag. 4–G *ea maderaspata* - Ray floret, B- floret, C- Anther with collar and appendage, D- Style and stigma.



Diag. 5–*Myreactis javanica:* A- Ray floret, B- Disc floret, C-Dissected disc corolla showing anther attachment, D- Anther with collar and appendage, E- Style and stigma.



Diag. 6- *Myreactis nepalensis-:* A- Ray floret, Disc floret, C-Dissected disc corolla showing anther attach D- Anther with collar and appendage, E- Style and stigma.

Discussion and Results

On the basis of present study, the tribe Astereae possess the following diagnostic features- capitula heterogamous, discoid (*Conyza, Grangea, Myriactis*) or radiate (*Erigeron*), many flowered. Involucral bracts in 3-5 rows, usually gradate, narrow lanceolate, apices acute or rounded. Receptacle usually glabrous (*Conyza, Myriactis)*, sometimes fimbriate or with pales (*Erigeron*), flat or slightly convex. Ray florets usually ligulate and pistillate; inner disc florets actinomorphic, bisexual, tubular. Stamens 5, syngenecious, but free epipetalous in *Myriactis;* anther base ecalcarate, sagittate or obtuse *(Erigeron, Conyza*); filament surface glabrous; 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; 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. The cypselas are homomorphic (*Conyza, Erigeron*), usually narrow oblong, sometimes narrow oblanceolate to ovate; usually compressed anterior-posteriorly with two distinct lateral ribs. Cypsela surface is densely or sparsely covered by short or long acroscopic twin hairs and sometimes by sessile, few celled glandular trichomes.

Stylopodium is absent or ill-developed in majority of the species, however a well-developed, tubular stylopodium has been noted in *Conyza canadensis.* Carpopodium is invariably symmetric, complete circular ring like among the studied species. Pappus bristles are usually biseriate, sometimes uniseriate *(Erigeron),* usually scabrous, seldom more or less capillaceous *(Erigeron).*

Conclusion

Therefore, on the basis of micromorphological characters of stamens, styles and cypsela, different taxa of Asteraceae can be easily distinguished. These features may provide new dimension in the field of taxonomic studies in Asteraceae.

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