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DIVERSITY OF CYPSELAR CHARACTERS IN SOME MEMBERS OF THE TRIBE INULEAE (ASTERACEAE)

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Abstract

The tribe Inuleae Cass (sensuMerxmuller*et al.* 1977) is included under the sub-family Asteroideae of the family Asteraceae consisting of 200 genera and about 2000 species. According to Anderberg (1989) the tribe Inuleae is an unnatural, paraphyletic group and he has divided Inuleae into three monophyletic tribes viz. Inuleae (s.s.), Gnaphalieae and Plucheae. It is also clear that cypselar anatomical features are of great value for delimitation of taxa in some inuloid genera of Australia by Short *et al.* (1989). Perusal of available literature regarding the exo-morphic features of cypsela in Inuleae shows that the cypselas features play a paramount role for determination of taxa. The present study has been under taken for the detailed study of cypselas in 6 genera and 7 species of the tribe Inuleae. The present endeavour is the result of work with 7 species of cypselas in the tribe Inuleae. Among the studied taxa, shape ,size, colour , presence or absence of ribs within the cypsela, number of ribs, thickness of pericarp, ,distribution of surface hairs ,carpopodium ; thickness and number of rows of corpopodial cells ; structure , colour and distribution of pappus bristles; cross-sectional area cypsela and the number of secretary ducts in each cotyledon are considered for characterization of taxa. From this study, it is obvious that detailed analysis of cypselar features is no doubt useful, taxonomic tools for isolation and characterization of taxa, along with other morphological parameters which are usually included in the floristic and other taxonomic studies.

Introduction

The tribe Inuleae Cass (sensu Merxmuller *et al.* 1977) is included under the sub-family Asteroideae of the family Asteraceae consists of 200 genera and about 2000 species. According to Anderberg (1989) the tribe Inuleae is an unnatural, paraphyletic group and he has divided Inuleae into three monophyletic tribes viz Inuleae (s.s.), Gnaphalieae and Plucheae. Present tribal composition of Inuleae is after Merxmuller *et al* (l.c.). Wiklund (1985, 1987) has studied the cypselar anatomical structure of few genera of Inuleae. It is also clear that cypselar anatomical features are of great value for delimitation of taxa in some inuloid genera of Australia by Short *et al.* (1989). Morphological cypselar features of this tribe have been briefly mentioned by Anderberg (1991, 2009), Anderberg and Eldenas (2007).

The indehiscent one seeded fruit of the family Asteraceae is commonly designated as 'achene' or 'cypsela'. The term cypsela is followed here. The part of cypsela which is attached to the receptacle by a meristematic zone, known as 'carpopodium'. In the apical part, of the cypsela, bears scales or corona like pappus. Pappus bristles are also present in some taxa. In addition to this, apical part of cypsela possess persistent stylar base in association with glandular nectary, known as 'stylopodium'.

The cypselar macro and micro characters in details are important in the following ways

I. Plays a significant role for identification of taxa when other floral features are not in hand or not available.

II. More or less constant at the genetic level of infrageneric level as these are ultimately controlled by a particular group of genes or genome.

III. These reproductive characters are less variable in varied environmental conditions.

IV. Extremely valuable and diacritical for each taxon.

V. May be significant taxonomically for solving the problem of uncertain systematic affinity.

VI. In many cases, the features fit well with the subtribal classifications which are based on phyletic and phenetic system.

Perusal of available literature (Merxmuller *et al.* 1977, Wiklund 1985, 1987; Anderberg 1991, 2009) regarding the exomorphic

features of cypsela in Inuleae have elucidated that the cypselas features play a paramount role for determination of taxa. But the available information regarding this aspect is not sufficient to correlate the characters. To fill the lacunae regarding cypselar morphology of the tribe Inuleae, the present study has been under taken which deals with the exomorphic characters of cypselas in 6 genera and 7 species of the tribe Inuleae.

The purpose of the present study is 3 fold - (i) to supplement the previous works for better understanding of taxa, (ii) to distinguish the taxa simply on the basis of cypselar structure in 7 genera belonging to the tribe Inuleae, (iii) to identify the species based on cypselar micro and macro morphological features.

Materials and Methods

Dried, mature, identified cypselas of 7 species were obtained from the following locations:

I. State Herbarium of South Australia, Botanic Gardens, North Terrace, Adelaide, South Australia 5000.

II. Dr. Peter Enz, Curator, Botanischer Garten der Universitat Zurich, Zollikerstrasse 107, CH – 8008 Zurich, Switzerland.

III. Dr. Hans V. Hansen, Curator, Botanic Garden of the University of Copenhagen, Farmimagsgade 2B, DK – 1353, Kϕbenhvnk, Denmark.

Studied materials are mentioned alphabetically in the Table 1.

Table 1 : Studied species of the tribe Inuleae.

Sl. No.	Name of the species	Source of origin	Collection No.
1.	*Chrysocephalum baxteri* (A. Cunn. ex. - DC.) A. Anderb.	State Herberium of South Australia, Botanic Gardens, North Terrace, Adelaide, South Australia 5000.	SR4804, 13.xii. 1989 South Australia : Nouthern Lofty Region. 7 km SW of Lyndoch. 3 km Sof Woodlands Road and Balmoral Road intersection.
2.	*Emilia coccenia* (Sims.) G. Don.	Dr. Peter Enz. Curator, Botanischer Gartender Universptat Zurich, Zollikerstrasse, 107, CH-8008 Zurich, Switzerland.	Nr. 261, 1991, Switzerland.
3.	*Helichrysum apiculatum* (Labill.) D. Don.	State Herberium of South Australia, Botanic Gardens, North Terrace, Adelaide, South Australia 5000.	SR. 4555, 28, i. 1987, South Australia : Southern lofty region, Horsnell Gully Conservation park.
4.	*Ixiolaena leptolepis* (DC.) Benth.	State Herberium of South Australia, Botanic Gardens, North Terrace, Adelaide, South Australia 5000.	SR 4754. 29. ix. 1989. South Australia : Lake Eyre Region 4 km South each of Wimbrinna Dam, Stuart, Creek Station.
5.	*Podolepis rugata* var.	State Herberium of South	SR 4566. 21,i. 1987,

	rugata (Labill.)	Australia, Botanic Gardens, North Terrace, Adelaide, South Australia 5000.	South Australia : Hurray Region, Karoonda to Tailem, Bang Road, 10 km forms Tailem Bend.
6.	*Streptoglossa liatroides* (Turcz.) Dunlop.	State Herberium of South Australia, Botanic Gardens, North Terrace, Adelaide, South Australia 5000.	SR 4752, 28. ix. 1989. South Australia, Late Eyre Region. 1 km south east of Strange ways, Springs Ruins
7.	*Telekia speciosa* (Schreb.) Baumg	Dr. Hans V. Hansen, Curator, Botanic Garden, of the University of Copenhagen, Farmimagsgade 2B, DK-1353 Kϕbenhavnk, Denmark.	262, GE 2440-001 I.S. 2005, Denmark.

Some fully mature cypselas of each species were selected from the mass of each sample. These were boiled for few minutes with water by adding few drops of glycerol. Then all specimens were preserved in FAA solution for study. After that 5-6 cypselas were immersed within the 1-2% NaOH solution for few days, depending upon the amount of mechanical tissue of cypselas. Different parts of cypselas were stained in 0.5% aqueous safranin solution and different parts of cypselas were studied with the help of simple and light compound microscope. Cross sections of cypselas were taken from the middle part.

Observation

1. *Emilia cocceinea* (Fig. 1A, 2A, 3A, 5A).

Cypsela homomorphic, 3.5 – 4.0 mm x 0.5 – 0.6 mm, oblong-oblanceolate, straight, light brownish, diameter more or less uniform along the length or faintly narrowed towards the apex; apex; rounded, base

rounded, ribbed; ribs 10-12. Surface with hairs on the ribs.

Carpopodium distinct, symmetric, small disc litre from the lateral view and complete ring-like from top view, white, slightly narrower than the base of the cypsela. Corpopodial cell thick-walled, rounded, not obliquely placed arranged in 6-7 layers. Diameter of carpopodium 0.24 mm.

Pappus bristles numerous, slender, white, capillary, barbellate, about 6 mm long, deciduous.

Cross – section of cypsela exhibits pentagonal with 5 conspicuous ribs and 5-7 inconspicuous ribs. Cotyledons 2. Diameter of cross section of cypsela 0.78 mm from the middle part and diameter of pericarp is 0.132 mm.

2. *Helichrysum apiculatum* (Fig. 1B, 2B, 3B, 4A, 5B).

Cypselas homomorphic, 1.0 – 1.2 mm x 0.3 – 0.5 mm, oblong, straight, brownish yellow, diameter more or less uniform along the length or faintly narrowed towards the apex, base and apex rounded. Not ribbed. Hairs present in surface.

Corpopodium symmetric, descoid from lateral view and complete ring- like from top view, white, narrower than the base of the cypsela. Carpopodial cells thin – walled, square, obliquely placed, mm arranged in 2-3 layers. Diameter of carpopodium 0.12 mm.

Pappus bristles barbellate, connate, 1-seriate, many, persistent, scabrous to subplumose, moderately thick, light yellow, basally connate, about 3.0 – 3.5 mm long. Lateral cells of the bristles gradually elongated towards the apex. At the apex, laterals cells more or less 2 times wider than the axis.

Cross section of cypsela exhibits elliptic with slightly wavy outline. Cotyledons-2, each with many secretary ducts within. Diameter of cross section of cypsela and pericarp 0.48 mm and 0.096 mm respectively from the middle part of cypsela.

3. *Chrysocephalum baxteri* (Fig. 1C, 2C, 3C, 4B, 5C).

Cypselas homomorphic, 1.1 – 1.2 mm x 0.2 – 0.3 mm, oblong, straight, blackish brown, diameter more or less uniform along the length and faintly narrowed towards the base and apex; base rounded and apex

more or less rounded. Hairs and ribs absent in the surface. Mucilage vesicles absent in surface.

Carpopodium symmetric, discoid from lateral view and completely ring-like from top view, white, slightly narrower than the base of the cypsela. Carpopodial cells thick-walled, more or less square in outline, large, obliquely placed, arranged in 3 layers. Diameter of carp podium 0.12 mm.

Pappus bristles 1-seriate, 9-11 number, persistent, scabrous, barbellate, moderately-thick, base thick, shiny white, but top portion of pappus light yellow; basally connate, about 3-3.5 mm long. Laterals cells of the bristles gradually elongated towards the apex. At the apex, lateral cells more or less 3 times wider than the axis.

Cross-section of cypsela exhibits more or less rounded with slightly wavy outline. Cotyledons – 2, with round shaped cells. Diameter of cross – section of cypsela and pericarp 0.3 mm and 0.036 mm respectively from the middle part of cypsela.

4. *Ixiolaena leptolepis* (Fig. 1D, 2D, 3D, 4C, 5D).

Cypsela homomorphic, 2.5 – 3 mm x 0.3 – 0.4 mm, oblanceolate brownish yellow, diameter more towards the apex and gradually narrowed towards the base. More or less hexagonal apex and base star shaped. Ribs distinct, 5-6 in number. Twin hairs present at the ribs, rib surface deep brown. Surface with mucilage vesicles having round apex. Vascular trace found after clearing the cypselar wall.

Carp podium symmetric, small, discoid from the lateral view and completely ring-like from the top view, white, same as the base of cypsela. Carpopodial cells thick-walled, tetrangular cells, obliquely placed narrower than the base of the cypsela; cells small diameter about 0.156 mm, arranged in 3-4 layers. Diameter of carpodium 0.156 mm.

Pappus bristles, 1-seriate, 9-10 in numbers, fine capillary, barbellate, shiny white, but at the base light yellow and slightly thick, persistent, 3.0 – 3.2 mm long, connate at the base in a ring. Lateral cells of the bristle with pointed tip at the apex and base; obtuse tips at the middle portion.

Cross-section of cypsela exhibits more or less circular with wavy out line. Cotyledons – 2. Diameter of cross section of cypsela

and pericarp 0.36 mm and 0.06 mm respectively from the middle part of cypsela.

5. *Podolepis rugata* var *rugata* (Fig. 1E, 2E, 3E, 4D, 5E).

Cypsela homomorphic, 2.0 – 2.1 mm x 1.0 – 1.2 mm, ellipsoid, light brown, diameter less uniform along the length but faintly narrowed towards the base and apex, breath maximum in the middle part of cypsela, apical portion slightly tetrangular to pentagular, basal portion rounded; ribbed; ribs weakly developed; twin hairs present in the ribs in maximum number and less in other parts. Gelly like mucilaginous substances present through the outer surface of cypsela after wetting with water.

Carpopodium symmetric, small, disc like from the lateral view and completely ring like from the top view, larger than the base of the cypsela, white. Carpopodial cells thick-walled, basal row of tetrangular cells smaller than the outer rows, not obliquely placed, arranged in 4- layers. Diameter of carpopodium 0.288 mm.

Pappus bristles, capillary, barbellate, free, 1-seriate, numerous, shiny white, persistent, 1.2 – 1.3 mm long, more or less scabrous, connate at the base in a ring. Lateral barbs of bristles with pointed tip at the apical part and with obtuse tip at the basal part of bristle.

Cross-section of cypsela exhibits more or less elliptic with 6-9 weekly developed ribs. Cotyledons-2, and each with small rounded secretary ducts. Diameter of cross section of cypsela and pericarp 0.72 mm and 0.084 mm respectively from the middle part of cypsela. Gelly like mucilaginous substances present on the outer surface.

6. *Streptoglossa liatroides* (Fig. 1F, 2F, 3F, 4E, 5F).

Cypsela homomorphic, (4-5) mm x (1-1.5) mm, oblong, straight, blackish brown, diameter not uniform along the length, slightly narrower towards the base, distinctly ribbed; ribs 9-10. Apical and basal portion rounded. Surface posses many shiny twin hairs with pointed apex and basal glands.

Carpopodium symmetric, small disc-like from lateral view and complete ring-like from top view, white, narrower than the base of the cypsela. Carpopodial cells thick-walled, polygonal, large, not obliquely

placed, arranged in 15-16 layers. Diameter of carpodium 0.48 mm.

Pappus rather stiff, barbellate, bristles in one row, each bristle with patent teeth. Bristles numerous, light brown, persistant, about 6-7 mm long, not connate at base in a ring. Lateral cells of the bristles with pointed tips. Lateral barbs of the bristles more longer towards the apical part of bristle.

Cross-section of cypsela more or less rounded with wavy outline. Hairs present on the surface, cotyledon – 2, Diameter of cross section of cypsela and pericarp 0.6 mm and 0.096 mm respectively from the middle part of cypsela.

7. *Telekia speciosa* (Fig. 1G, 2G, 3G, 5G).

Cypsela homomorphic, (3.5 – 4) m x (0.8 – 0.9) mm, oblong to slightly club shaped, bent, light brown, faintly narrowed towards basal part, distinctly, ribbed; ribs 10-14 variable in size and shape; apical and basal part truncate. Surface pubescent-near ribs.

Carpopodium more or less, symmetric, disc-like from lateral view, complete ring-like from top view, light brown in colour, same as diameter of the base of the cypsela. Carpopodial cells thick-walled, rounded, small not obliquely placed, arranged in 3-4 rows. Diameter of carpopodium 0.36 mm.

Pappus absent.

Cross-section of cypsela ovate with wavy out-line, more or less rounded; ducts present. Cotyledon-2. Diameter of cross section of cypsela pericarp 0.858 mm and 0.195 mm respectively from the middle part of cypsela.

ARTIFICIAL KEY to the studied species

A. Cypsela more or less circular without having any ribs and furrows, barb hairs longer and slender towards apical part of pappus bristles.

B. Carpopodial cell thick-walled, barb hairs conspicuously longer towards extreme ends of pappus bristles; cypsela surface without having twin hairs. ……
Chrysocephalum baxteri

BB. Carpopodial cell thin-walled; barb hairs slightly longer towards the apical portion of pappus bristles; cypsela surface possess twin hairs…….
Helichrysum apiculatum

AA. Cypsela pentagular to circular with distinct ribs and furrows, barb hairs not as above

C. Pappus bristles absent, pericarp thin in transection…….. *Telekia speciosa*

CC. Pappus bristles present, persistant or deciduous, pericarp moderately thin to thick in transection.

D. Cypsela villous; pappus bristles stiff, with patent teeth, carpopodial cells arranged in 10-12 rows…….. *Streptoglossa liatroides*

DD. Cypsela not as above, pappus bristles not stiff, carpopodial cells arranged in 4-7 rows.

E. Cypsela ellipsoid in cross section; pappus bristles barbellate, capillary, barbellate, free……. *Podolepis rugata* var *rugata*

EE. Cypsela pentagular to hexangular in cross section; pappus bristle capillary to stiff barbellate, free to connate.

F. Pappus bristles deciduous; carpopodial cells 4-6 cells wide; cypsela ovate-oblong, pentagular…….. *Emilia coccinea*

FF. Pappus bristles persistant; carpopodial cells 1-4 cells wide, cypsela oblanceolate, hexangular…….. *Ixiolaena leptolepis*

Discussion

The present endeavour is the result of work with 7 species of cypselas in the tribe Inuleae. The taxonomists have usually neglected comparative cypselar morphology. The lack of authentic cypselar morphological data has hindered the identification of isolated fruits or cypselas, particularly when floral stages are not available.

Among the studied taxa, shape of the cypsela varies from oblong lanceolate – oblanceolate, but the shape is specially significant in *Podolepis rugata* var. *rugata*. Cypsela may be straight and sometimes curved in *Ixiolaena leptolepsis, Telekia speciosa* and *Emilia coccinea*.

Size of the cypselas among the studied taxa is also significant. Cypselas are largest in *Streptoglossa liatroides* and smallest in *Helichrysum apiculatum*.

Colour of cypsela is often with different shades. Colour may be brown, light brown, blackish brown, brownish yellow with blackish brown ribs. The colour of cypselas may be variable depending on the stage of maturity. So, this character is not significantly reliable for taxonomic studies.

Presence or absence of ribs within the cypsela is the main characters for identification of species. Ribs are present in *Emilia* coccinea (9-12), *Ixiolaena leptolepis, Podolepis rugata* var. *rugata* (7-8), *Telekia speciosa* (12-15), *Streptoglossa liatroides* (9-10) and ribs are absent in *Helichrysum apiculatum* and *Chrysocephalum. baxteri*. Number of ribs is also basically fixed for a particular species and has significant role of isolation, although it may vary in different cypselas within a species.

Thickness of pericarp is maximum in *Emilia coccinea* (0.132 mm) and minimum in *Chrysocephalum baxteri* (0.036 mm). Distribution of surface hairs is variable among the studies species, sometimes more conspicuous near the ribs as in *Emilia, Streptoglossa*, where as in others these are distributed throughout the surface as in *Podolepis*.

Carpopodium is a meristematic zone at the base of cypselar base which is attached with the receptacle. Basic ring-like structure is more prevalent and constant in every species. Carpopodial cells are thick-walled, usually separated from other pericarpic cells. Thickness and number of rows of corpopodial cells plays an important role for characterization of taxa. Thickness varies from 1-2 rows in *Ixiolaena*, 2-3 rows in *Helichrysum,* more than 12 rows as in *Streptoglossa*. Carpopodial cells are usually thick-walled, seldom thin walled (*Telekia speciosa*). Diameter of carpopodium is often same as the base of cypsela, seldom wider than the base (*Podolepis rugata* var. *rugata*) or narrower than the base of cypsela (*Streptoglossa liqtroides*). So, characters of carpopodium are taxonomically valuable.

Apical part of cypsela usually bears pappus bristles of different forms (capillary bristles or scabrous bristles) or pappus may be absent (*Telekia speciosa*). Pappus bristles

may be free (*Podolepis rugata* var. *rugata*) or united basally and form a ring like structure (*H. apiculatum, Chrysocephalum baxteria, Ixiolaena leptolepsis, Streptoglossa liatroides*) and is distributed in one row. Colour of pappus bristles varies is variable from white to cream yellow, to yellow. Nature of pappus barbs is important for isolation of species. Pappus is usually persistent but deciduous pappus has been noted only in *Emilia coccinea*. Number of pappus bristles from species to species or even within the same species. Therefore, majority of pappus features can be used for certain taxa.

Cross-section of cypsela usually has 2 cotyledons with variable number of secretary ducts.

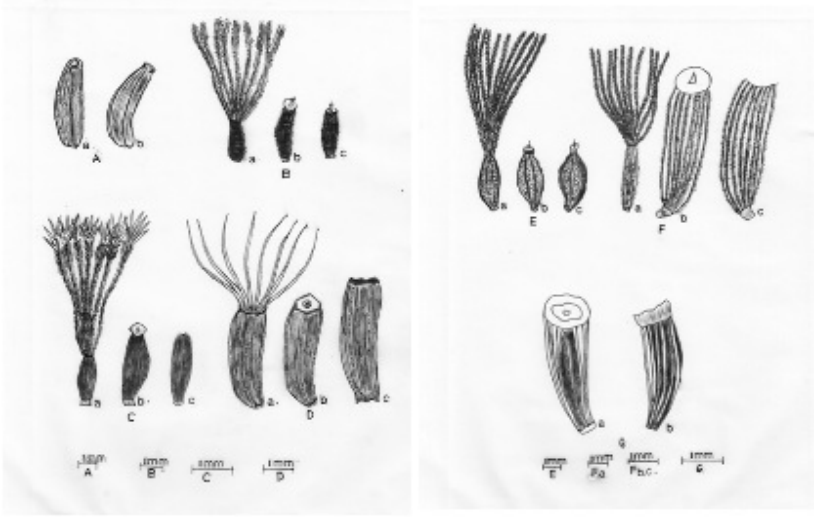
Summary

From this study, it is obvious that detailed analysis of cypselar features is no doubt useful, taxonomic tools for isolation and characterization of taxa, along with other morphological features which are usually included in the floristic and other taxonomic studies.

Table 2 : Comparative macro-micro morphological features of cypselas

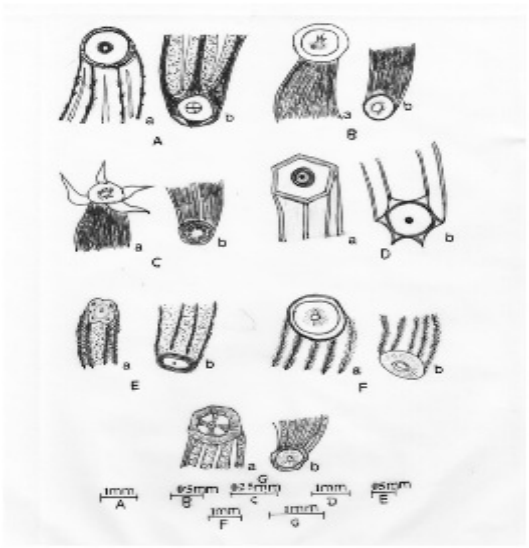
Name of the species	Shape of the cypsela	Shape of Apical portion of cypsela	Shape of Basal portion of cypsela	Size of the cypsela	Colour of the cypsela	Ribs on the Cypselar surface	Hairs on the cypselar surface	Carpopodium	Shape of the cross-section	Diameter of pericarp	Diameter of cross-section of cypsela	Pappus
1. *Chryso-cephalum baxteri*	Oblong	More or less round	Round	1.1 – 1.2 mm x 0.2 – 0.3 mm (excluding pappus)	Blackish brown	Absent	Absent	Carpopodium, slightly narrowed than the base of the cypsela. Carpopodial cells thick walled, more or less square in outline, large, arranged in 3-layeres; cells obliquely placed. Diameter of carpopodium 0.12 mm,	More or less rounded.	0.036 mm	0.3 mm	**Pappus bristles connate 9-11 or numerous, light yellow, 3-3.5 mm, long, persistant**
2. *Emilia coccinea*	Oblong-oblanceolate	Round	Round	3.5 – 4.0 mm x 0.5 – 0.6 mm (excluding pappus)	Light brown	Ribs 10-12 in numbers	Hairs present on the ribs	Carpopodium, slightly narrowed than the base of the cypsela. Carpopodial cell thick-walled, rounded arranged in 6-7 layers cells not obliquely placed. Diameter of carpopodium 0.24 mm	Pentagonal with 5-conspicuous ribs and 5-7 inconspicuous ribs.	0.132 mm	0.78 mm	**Pappus bristles numerous, white, capillary barbellate, about 6 mm long, deciduous.**
3. *Helichrysum apiculatum*	Oblong	Round	Round	1.0 – 1.2 x 0.3 – 0.5 mm (excluding pappus)	Brownish yellow	Absent	Twin hairs present throughout the cypselar surface	Carpopodium, slightly narrowed than the base of the cypsela. Carpopodial cells thin-walled, cells square, arranged in 2-3 layers, cells not obliquely placed. Diameter of carpopodium 0.12 mm.	Elliptic with wavy out line.	0.096 mm	0.48 mm	**Pappus bristles connate numerous, light, yellow, barbellate connate, about 3.0-3.5 mm long, persistant**
4. *Ixiolaena leptolepis*	Oblanceolate	Hexagonal	Star shape	2.5 – 3 mm x 0.3 – 0.4 mm (excluding pappus)	Brownish yellow	Ribs distinct 5-6 in numbers	Twin hairs present at the ribs	Carpopodium, same as the base of the cypsela. Carpopodial cells thick-walled, tetrangular, cells small	More or less circular with wavy out-line.	0.06 mm	0.36 mm	**Pappus bristles connate with elongated twin hairs, 9-10 in numbers, white but at the base light yellow and slightly thick,**

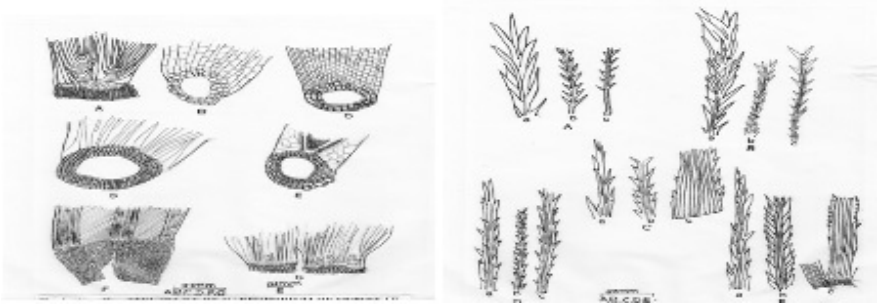
								arranged in 3-4 layeres, obliquely placed. Diameter of carpopodium 0.156 mm				**3.0 – 3.2 mm long, persistant**
5. *Podolepis rugata* var. *rugata*	Ellipsoid	Slightly tetrangular to pentangular	Round	2.0 – 2.1 mm x 1.0 – 1.2 mm (excluding pappus)	Light brown	Ribs weekly developed.	Twin hairs present on the ribs in maximum number and less in other parts.	Carpopodium, slightly larger than the base of the cypsela. Carpopodial cells thick-walled, tetrangular cells of basal row smaller than the outer row, arranged in 4-5 layeres, not obliquely placed. Diameter of carpopodium 0.288 mm.	More or less elliptic.	0.084 mm	0.72 mm	**Pappus bristles capillary, free, numerous, shiny white, 1.2 – 1.3 mm long, persistent.**
6. *Streptoglossa liatroides*	Oblong	Round	Round	4-5 mm x 1-1.5 mm (excluding pappus	Blackish brown	Ribs distinct, 9-10 in number	Many shiny twin-hairs with pointed apex and basal glands	Carpopodium, slightly narrower than the base of the cypsela. Carpopodial cells thick-walled, polygonal cells arranged in 15-16 layers, obliquely placed. Diameter of carpopodium 0.3 mm,	More or less rounded with wavy out line.	0.096 mm	0.6 mm	**Pappus bristles with patent teeth, not connate numerous, light brown, 6-7 mm long, persistent.**
7. *Telekia speciosa*	**Club.shaped and bent**	**Truncate**	**Truncate**	**3.5-4 mm x 0.8 – 0.9 mm**	**Light brown**	**Ribs distinct, 10-14 in number**	**Hairs present on the ribs.**	**Carpopodium, same as the base of the cypsela. Carpopadial cells thick-walled, rounded small cells arranged in 3-4 layers, cells not obliquely placed. Diameter of carpopodium 0.03 mm**	**Ovate with wavy outline.**	**0.084 mm**	**0.66 mm**	**Absent**



Figs. 1. A – G. MORPHOLOGYY OF CYPSELAS

A. *Emilia coccinea* (a. adaxial side, b. abaxial side; B. *Helichrysum apiculatum* (a. adaxial side with pappus, b. adaxial side b. abaxial side) ; C. *Chrysocephalum baxteri* (a. adaxial side with pappus, b. adaxial side b. abaxial side) ; D. *Ixiolaena leptolepis* (a. adaxial side with pappus, b. adaxial side b. abaxial side); E. *Podolepis rugata* var *rugata*(a. adaxial side with pappus, b. adaxial side b. abaxial side); F. *Streptoglossa liatroides* (a. adaxial side with pappus, b. adaxial side b. abaxial side) ; G. *Telekia speciosa* (a. adaxial side b. abaxial side)





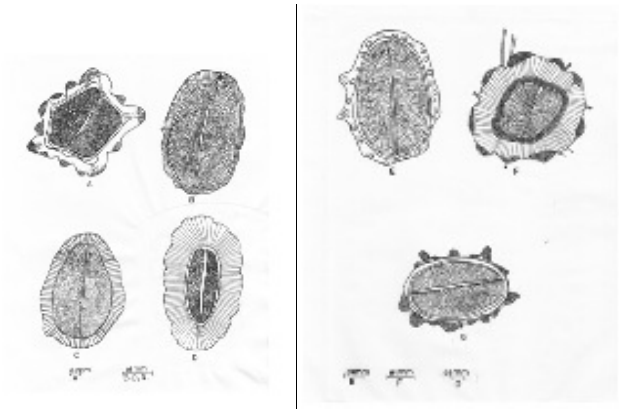
Figs. 2. A – G. STRUCTURE OF CARPOPODIA OF CYPSELAS

A. ***Emilia coccinea;*** **B.** ***Helichrysum apiculatum ;***

C. ***Chrysocephalum baxteri ;*** **D.** ***Ixiolaena leptolepis*** **;**

E. ***Podolepis rugata ;*** **F.** ***Streptoglossa liatroides;***

G. ***Telekia speciosa***



Figs. 5. A – G. CROSS SECTIONS OF CYPSELAS

A. ***Emilia coccinea ;*** **B.** ***Helichrysum apiculatum ;***

C. ***Chrysocephalum baxteri ;*** **D.** ***Ixiolaena leptolepis*** **;**

E. ***Podolepis rugata ;*** **F.** ***Streptoglossa liatroides ;***

G. ***Telekia speciosa***

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