Research Article *ISSN: 2277-8713*
Bidyut kr. Jana, IJPRBS, 2012; Volume 1(5): 463-484 *IJPRBS*

CYPSELAR MORPHOLOGY OF SOME SPECIES OF THE FAMILY COMPOSITAE AND THEIR TAXONOMIC SIGNIFICANCE

***BIDYUT KR. JANA, SOBHAN KR. MUKHERJEE**

Department of Botany, University of Kalyam, Kalyani, West Bengal.

Accepted Date:

16/10/2012

Publish Date:

27/10/2012

Keywords

Cypselar morphology

Asteraceae

Corresponding Author

Mr. Bidyut Kr. Jana

Department of Botany,

University of Kalyam,

Kalyani, West Bengal.

Abstract

Asteraceae or Compositae are regarded as one of the most advanced families of the dicotyledons. It is characterized by some characters, one of them is fruit. Fruit is developed from inferior, bicarpellary, one seeded structure, which is technically termed as achene or cypsela. In mature cypsela fruit wall or pericarp is either addpressed with seed wall or secondarily separated from seed wall. In mature cypsela, seed wall may or may not be associated with endosperm and endosperm layer exists in mature cypsela either one or two layers. The paper deals with cypselar morphology of 27 species from 11 genera of the family Asteraceae. Morphological features of the size, shape, colour of cypselas, apical part, surface hair, location of vascular trace, presence or absence of phytomelanin layer, structure of carpopodium and their cellular arrangements, pappus structure, stylopodia etc. are taxonomically significant. Exomorphic characters of cypselas serve as reliable taxonomic marker in systematic study.

INTRODUCTION

The indehiscent one seeded fruit of the Asteraceae is commonly designated as 'achene' or 'cypsela. The term cypsela is followed here which is attached to the receptacle by a meristematic zone, known as carpopodum. The seeds of Asteraceae are key instrument for the success of the family. It is evident from the literature that the seed features have not been paid its due attention. The characteristics of the seeds have been little used in taxonomic study for the classification of most seeds. The orientation, colour, shapes, size, thickness and measurements which make up the morphometrics differ considerably from taxa-taxa, so that rather few of the accumulated data bear directly on the problem of tribal and genetic relationship. Many cereal grains and the cypsela of the Asteraceae, beside the testa proper, have additional coats derived from reduced calyx. Sometimes those layers and the seed coat proper are so intimately associated that it becomes difficult to distinguish the individual layers. Brief cypselar external features have usually been included by different floristic workers during their preparation of floristic accounts. The information on the seed morphology of Asteraceae is not forthcoming, the only classical work[1] gave the seed morphology of 35 genera. Corner[2] described in general terms the seed anatomy and morphology of about 37 genera. A study of morphological and micromorphological has been done in seven species of the tribe anthemideae[3]. The objective of the present study is for better understanding of the different taxa, on the basis of morphological features.

MATERIALS & METHODS

The present work is based on the seeds of 27 species from 11 genera were obtained from different herbaria and 2 by the first author, which are given in Table-1. For softening the cypselas, some randomly selected cypselas were boiled in water and soaked in 2-8% NaOH solution for 3-7 days, depending upon the thickness of the pericarp and nature of distribution of mechanical tissues within the pericarp. Cypselas were stained with 0.1% aqueous Safranin solution and dissected under stereo dissecting binocular microscope and were mounted in Phenol Glycerin solution.

Comparative study of cypselas were done in both stereo dissecting binocular and compound microscope. Measurements were done with the ocular micrometer.

RESULTS AND DISCUSSION

Acanthospermum hispidum **(Figure 1 A)**

Cypsela homomorphic, 7 mm x 3 mm with awns, 5 mm x 3 mm without awns, yellowish brown, obovate, straight, upper part truncate, basal part tapered. Ellipsoidal in cross sectional configuration. Surface rough; remain covered with spine like outgrowth. Some of this outgrowth remains bifurcate at the terminal region. Ribs not observed clearly. Surface hair absent. At the upper portion of cypsela, stylopodium present, unenlarged, partially immersed in the nectar. Corona absent. Carpopodium not clearly observed. pappus represented by 2 awns, yellow brown, approximately 2 mm x 3 mm.

Bidens frondosa **(Figure 1 B)**

Cypsela homomorphic, 6 mm x 1.5 mm with pappus, 5 mmx 1.5 mm without pappus, light brown, spotted, narrowly oblong, straight, upper portion truncate, whereas basal portion tapered, without beaked, margin entire. Ellipsoidal in cross sectional configuration. Surface glabrous; containing 3 ribs; inconspicuous or weekly arranged, alternating with furrow, furrows wider than ribs. The distance between 2 ribs near about 0.08 mm. Phytomelanin deposition observed in the cypselar wall layer. At the upper portion of cypsela, stylopodium present; enlarged, partially immersed in the nectary, cylindric. Corona absent. At the basal region of cypsela; carpopodium present, symmetric, diameter same as the base of cypsela, 4 lobbed ring like. Carpopodial cells are thick-walled, made up of radially elongated cells, not pitted, and uniseriately arranged. At the upper portion of cypsela; pappus present, homomorphic, represented by 2 equally arranged, retrorsely barbed awns, brown in colour, persistent.

Centaurea aspera **(Figure 1 C)**

Cypsela homomorphic, 4 mm x 1 mm with pappus, 3 mm x 1 mm without pappus, white brown, stripped, obovate, slightly curved, upper portion truncate whereas basal portion slightly tapered, spheroidal in cross sectional configuration. Surface

pubescent, ribs absent. Surface hairs ascending in orientation with the surface, made up of body cells and basal cells. At the upper portion of cypsela stylopodium present, inconspicuously arranged, fully immersed in the nectar. At the basal region of cypsela carpopodium present, diameter of carpopodium same as the base of the cypsela; cells outline visible, distinguishable from the other cells of cypsela, symmetric, ring like. Carpopodial cells thin-walled, not-pitted, horizontally arranged in 1 row. At the upper portion of cypsela pappus present, ecoronate, homomorphic, yellowish in colour, unequally arranged, represented by 85-90 barbellate-setose type of pappus bristles, arranged in (4-5) rings, persistent.

C. saobiosa **(Figure 1 D)**

Cypsela homomorphic, 3 mm x 1 mm with pappus, 2 mm x 1 mm without pappus, yellow brown, stripped, obovate, upper portion truncate whereas basal region slightly tapered. Ellipsoidal in cross section. Surface sparsely pubescent. Surface hair made up of body and basal cell, ascending in orientation with the surface. At the upper portion of cypsela, stylopodium present, inconspicuously arranged, fully immersed in the nectar. At the basal region of cypsela, carpopodium present; diameter of it same as the base of the cypsela, cells outline visible, distinguishable from other cells of the cypsela. Carpopodial cells thin-walled, more or less rectangular, not pitted, uniseriately arranged. At the upper portion of cypsela pappus present, ecoronate, homomorphic, arranged in 2-3 circle, light yellow in colour, unequally arranged, barbellate-setose, 35-45 in number, persistent.

C. stoebe **(Figure 1 E)**

Cypsela homomorphic, 4 mm x 1 mm with pappus, 3 mm x 1 mm without pappus, yellow brown, oblanceolate, straight, upper portion truncate, whereas basal portion slightly tapered, striated with entire margin, ellipsoidal in cross section. Surface rough and glabrous, containing 2 lateral lobes. On the surface ribs absent. Surface hairs absent. At the upper portion of cypsela, stylopodium present, fully immersed in the nectary. At the basal region of cypsela, carpopodium present, diameter same as the base of the cypsela, asymmetric, biconvex. Carpopodial cells distinguishable

from other cells of the cypsela, thin-walled, not pitted, more or less hexagonal, arranged in 2-3 layers. At the upper surface of cypsela, pappus present, homomorphic, light yellow, unequal, 40 -65 in numbers, barbellate- setose type, arranged in 2-3 circles, persistent.

Crepis alpina **(Figure 1 F)**

Cypsela homomorphic, 18 mm x 1 mm with beak, 8mm x 1mm without beak, yellow brown in colour, linear, slightly curved, upper part truncate ,whereas basal part tapered, cylindrical. Surface pubescent; surface hair apprised-ascending in orientation with the surface, containing body cells and basal cells. Surface hair twin type. On the surface, 17 ribs present, alternating with furrows; furrows wider than ribs. The distance between 2 ribs 0.12 mm. With in the ribs vascular supply clearly observed. Morphologically, phytomelanin layer not observed. At the upper surface of cypsela, pappus present, made up of 16-22 barbellate pappus bristle, white in colour, unequal in arrangement, approximately 4mm-5 mm in length. Within the pappus crystal formation not observed. At the upper part of cypsela, stylopodium present, inconspicuous. At the basal region of cypsela, carpopodium present, arranged in irregular ring, asymmetric; diameter of carpopodium narrow than the base; carpopodial cells thick-walled, arranged in 3-4 rows.

Crepis aspera **(Figure 1G)**

Cypsela homomorphic 5mm x1 mm, whitish brown, lanceolate, one side straight, another side curved, beak absent, upper part tapered, basal part truncate, dorsiventrally flattened. Surface pubescent; containing spine like structure. Surface hair twin type, exhibit great diversity, made up of body cells and basal cells, ascending-inclined in orientation with the surface. Surface cells thick-walled, irregular in shape. Ribs and furrow not clearly observed on the surface. Phytomelanin layer not observed on the surface. At the upper surface of cypsela pappus absent, stylopodium not clearly observed. At the basal region of cypsela, carpopodium present, diameter of carpopodium equal to the base, asymmetric; carpopodial cells thick- walled, arranged 3-4 rows.

Crepis dioscoridis **(Figure 1 H)**

Cypsela heteromorphic. Disk cypsela 4mm x 1mm, dark brown, oblanceolate, slightly

curved apical portion truncate, basal part slightly tapered, cylindrical. Ray cypsela 5mm x 1mm, light yellow in colour, oblanceolate, slightly curved, upper part rounded, basal part tapered, dorsoventrally compressed. In disk cypsela surface pubescent; surface hair apprised-ascending in orientation with the surface. Surface containing 11 ribs alternating with furrow; furrows wider than ribs. The distance between 2 ribs o.12mm-0.23 mm. In ray cypsela, surface glabrous, containing 6 ribs alternating with furrows. In both the cypsela apical beak absent. Morphologically, phytomelanin layer not observed. In disk cypsela, at the upper part of cypsela stylopodium present, in ray cypsela, this structure not prominently observed. In both the cypsela pappus absent. At the basal region of cypsela, carpopodium present, arranged in irregular ring, asymmetric; diameter of carpopodium narrow than the base; carpopodial cells thick- walled, arranged in a single row.

Crepis foetida **(Figure 1 I)**

Cypsela homomorphic, 13mm x 0.1 mm with beak, 5mm x 0.1mm without beak, yellow brown in colour, linear, straight, upper part truncate where as basal part slightly tapered, cylindrical. Surface pubescent; surface hair twin type, oppressed –ascending in orientation with the surface, made up of body cell and basal cell. At the upper part of cypsela, stylopodium present, cylindrical. Pappus absent. On the surface 13 ribs present, containing vascular supply, alternating with furrow; furrows wider than ribs. The distance between 2 ribs 0.1mm-0.2 mm. Phytomelanin layer not observed. At the basal region of cypsela, carpopodium present, arranged in irregular ring, asymmetric; diameter of carpopodium narrow than the base. Carpopodial cells with thick- walled, arranged in single row.

Crepis neglecta **(Figure 2 J)**

Cypsela homomorphic, 3mm x 0.5mm without beaked, yellow brown in colour, lanceolate, curved, cylindrical, upper part truncate whereas basal part tapered. Surface pubescent; surface hair twin type, Appressed- ascending in orientation with the surface, made up of body cells and basal cells. On the surface, 12 ribs present, alternating with furrows; furrows wider than ribs. The distance between 2 ribs 0.17 mm - 0.2 mm. Morphologically phytomelanin layer not observed. At the

upper portion of cypsela, stylopodium present, cylindrical. At the basal region of cypsela, carpopodium present, symmetric, diameter of carpopodium narrow than the base, pentangular; carpopodial cells thick - walled, arranged in 2-3 rows. Pappus absent.

Crepis palaestina **(Figure 2 K)**

Cypsela homomorphic, 8mmx1mm with beak, 5mmx1mm without beak, yellow brown in colour, lanceolate, cylindrical, straight in direction, upper part tapered whereas lower part truncate. Surface pubescent; surface hairs twin type, ascending to inclined in orientation with the surface. Glandular type of surface hairs absent. On the surface, 13-15 ribs present, alternating with furrow; furrows wider then ribs. The distance between 2 ribs 0.1mm-0.2mm.Morphologically, phytomelanin layer not observed. At the upper portion of cypsela, cylindrical stylopodium present. At the basal region of cypsela, carpopodium present, arranged in irregular ring, asymmetric; diameter of carpopodium equal to the base; carpopodial cells thick - walled, arranged in one row. At the upper part of cypsela, a prominent beak present, approximately 2-3 mm long. Pappus absent.

Crepis pulchra **(Figure 2 L)**

Cypsela homomorphic, 5mm x 5mm, yellow in colour, lanceolate, slightly curved, truncate at both apex and base, cylindric. Surface glabrous, rough in tecture, containing 7 ribs, alternating with furrows; furrow wider then ribs. The distance between 2 ribs 0.15mm 0.2mm. Morphologically, phytomelanin layer not observed. At the apical region of cypsela, beak absent. At the upper part of cypsela, stylopodium present, cylindrical. At the basal region of cypsela, carpopodium present, arranged in irregular ring, symmetric, hexagonal, diameter of carpopodium equal to the base; Carpopodial cells thick walled, arranged in single row. At the upper part of cypsela pappus present, made up of barbellate pappus bristles, whitish in colour, 18-22 in number, unequally arranged. Lateral cell of pappus bristles as wider as rachis. Within the pappus bristles crystal formation not observed.

Hieracium racemosum **(Figure 2 M)**

Cypsela heteromorphic. Ray cypsela 3mm x 1mm and oblong whereas disk cypsela 3mmx o.5 mm and narrow oblong. Ray cypsela black in colour where as disk

cypsela brown in colour. Both the cypselas straight in direction. In ray cypsela upper part truncate, basal part tapered. In case of disk cypsela both the ends truncate. Surface glabrous type in both the cypselas. On the surface 10 ribbs present in ray cypsela alternating with furrow, furrow wider then ribbs. The distance between 2 ribbs 0.1 mm. In case of disk cypsela 11 ribs present on the surface. In both the cases pappus made up of barbellate bristles in a single circle. In ray cypsela, pappus with 17 bristles where as in disk cypsela pappus with 21 bristles. At the basal region carpopodium present, asymmetric, carpopodial cells thick walled, arranged in 2 layers only.

Leontodon crispus **(Figure 2 N)**

Cypsela homomorphic .blackish brown, 16mmx 1mm .linear, straight, upper part truncate where as lower part tapered. Surface rough and hairy. Surface hairs ascending in orientation with the surface. Surface containing 15 ribbs, alternating with furrows. Furrows wider than ribs. The distance between 2 ribbs .05-.1 mm. At the upper part of cypsela containing pappus, arranged in a single ring containing 23 plumose type of bristles, white in colour, and unequal in length. Each pappus bristles 8-11 mm long. Carpopodium present, basal in position, pentangular, thick walled, carpopodial cells arranged in single row.

Leontodon muelleri **(Figure 2 O)**

Cypsela homomorphic, 6 mm x o.5mm, brownish, linear, slightly curved, upper part truncate, basal part tapered. Surface pubescent type. Surface hairs apprised in orientation with the surface of cypela. On the surface 5 ribs present, alternating with furrows. Furrows wider then ribs. The distance between 2 ribbs 1.5 mm. At the upper part of cypsela, pappus present, made up of 9-10 unequally arranged barbellate pappus bristles, light yellow in colour, arranged in single circle. At the basal region of cypsela, carpopodium present, symmetric, carpopodial cells thick walled, uniseriately arranged.

Melampodium perfoliatum **(Figure 2 P)**

Cypsela heteromorphic. Disk cypsela 3.4 mm x 2.5 mm, whereas ray cypsela 5 mm x 3 mm. Disk cypselas blackish, obovate, upper part rounded, basal part truncate, whereas ray cypselas yellow-brown, ovate, curved, upper part truncate, basal part rounded. Ellipsoidal in cross sectional

configuration. Surface rough and glabrous containing 10 ribs alternating with furrow; furrows wider than ribs. The distance between 2 ribs 0.1 mm. Surface hairs absent. At the upper part of cypsela, stylopodium present, inconspecious, corona absent. At the basal region of cypsela, carpopodium present, narrower than the base, irregular ring like. Carpopodial cells thick-walled, rounded, not pitted, arranged in 4-6 rows, distinguishable from other cells of the cypsela. At the upper portion of cypsela, pappus absent.

Solidago Canadensis **(Figure 2 Q)**

Cypsela homomorphic, 2 mm x 0.5 mm with pappus, 1 mm x 0.5 mm without pappus, pale yellow, narrow elliptic, straight, rounded at both ends, basal region narrow than apex, margin entire, without beaked, ellipsoid in cross section. Surface tuberculate, containing 9 ribs; alternating with furrow; furrows wider than ribs. The distance between 2 ribbs near about 0.17 mm. Surface marking striated type, containing twin type of surface hair, made up of body and basal cells, ascending in orientation with the surface. On the surface phytomelanin layer absent. Surface hair biseriately forked type; tips of the body cells of hair situated in same plane. At the upper portion of cypsela, stylopodium present; inconspicuously arranged, fully immersed in the nectar. Corona absent. At the basal region of cypsela, carpopodium present, circular, complete ring like, distinguishable from other cells of the cypsela, thick-walled, non pitted, arranged in single row; cell size large, rectangular, longitudinally arranged. Diameter of carpopodium narrows than the base of cypsela. Upper part of cypsela pappus present, ecoronate, arranged in single row, homomorphic, represented by 6-11 unequally arranged barbellate-setose type of pappus bristles, white in colour, persistent.

Solidago gigantean **(Figure 2 R)**

Cypsela heteromorphic. Ray cypsela 2 mm x .5 mm with pappus, 1mmx.5mm without pappus, light brown, stripped, oblanceolate, straight, upper portion truncate, basal region slightly tapered, ellipsoidal in cross sectional configuration, striated, entire margin, without beak. Disk cypsela 1.5mmx.5mm with pappus, 1mmx.5mm without pappus, black, stripped, oblanceolate, straight, margin entire, and

upper portion truncate, basal region slightly tapered, without beake. Surface pubescent, containing 10 ribs, alternating with furrow; furrows wider than ribbs. The distance between 2 ribs near about 0.16 mm. On the surface phytomelanin layer absent. Surface hair pilose type, containing body and basal cell, ascending in orientation, biseriate forked; tips of the body cell of hair situated in different plane. At the upper portion of cypsela stylopodium present, inconspicuously arranged. Corona absent. At the upper portion of cypsela pappus present, homomorphic, arranged in single row, persistent, represented by serrulate setose type of pappus bristles, 22-30 in ray and 15-25 in disk cypsela, unequally arranged, white in colour. At the basal region of cypsela, carpopodium present, narrow than the base, symmetric, arranged in a complete ring like, carpopodial cells thick-walled, rectangular and arranged in 3-4 layers.

Solidago virgaurea **(Figure 2 S)**

Cypsela homomorphic, 4.0 mm x1 mm with pappus, 3.0 mm x1 mm without pappus,pale yellow, stripped, oblanceolate, truncate at both ends, without beak; basal region narrow than the apex. Ellipsoidal in cross sectional configuration. Surface pubescent, striated marking, containing 5 ribs, conspicuous, straight, containing vascular trace, alternating with furrows; furrows wider than ribs. The distance between 2 ribs near about 0.37mm. Margin entire. Surface hair ascending in orientation, non-glanduular, sparsely distributed, containing body and basal cells, biseriately arranged, forked type; tips of the body cells of hair situated in same plane. On the surface, phytomelan in layer not found. On the upper part of cypsela, stylopodium present, partially immersed in the nectary, cylindric. Corona absent. At the basal region of cypsela carpopodium present, narrow than the base; basal, symmetric, 4-6 celled complete ring like, thick-walled, not pitted, distinguishable from other cells of the cypsela. Carpopodial cells large, hexangular. At the upper part of cypsela bristilate pappus present, homomorphic, represented by numerous number, equal in length, unbranched, persistent, arranged in single row, pale yellow in colour.

Sonchus oleraceous **(Figure 2 T)**

Cypsela homomorphic, 8 mm x 1 mm with pappus, 5 mm x 1 mm without pappus, bright brown, banded, straight in direction,

upper part truncate, whereas basal region slightly tapered, oblanceolate, ellipsoidal in cross sectional configuration. Surface glabrous, crenulate, containing 12 ribs; alternating with furrow, furrows wider than ribs. The distance between two ribs 0.3mm. Surface hair absent. On the surface, phytomelanin layer not found. At the upper portion of cypsela stylopodium present; inconspicuously arranged, fully immersed in the nectar. At the basal region of cypsela, carpopodium present, diameter of it same as the base of the cypsela, asymmetric, complete ring like. Carpopodial cells are elongated, pitted, thin walled and arranged in 2-3 rows. At the upper portion of cypsela; pappus present, homomorphic, whitish, unequal, plumose type, free at the base, 8-11 in number, persistent, arranged in single row. Beak absent.

Sonchus wightianus **(Figure 2 U)**

Cypsela homomorphic, 6 mm x 1 mm with pappus, 4 mm x 1 mm without pappus, bright brown, banded, oblanceolate, straight, upper part truncate, whereas basal part slightly tapered, denticulate, ellipsoidal in cross sectional configuration. Surface glabrous, containing 10 conspicuous ribs; alternating with furrow, furrows wider than ribs. The distance between 2 ribs 0.20 mm. Surface hair absent. Morphologically phytomelanin layer absent. At the upper portion of cypsela; stylopodium present, inconspicuously arranged, fully immersed in the nectar. Corona absent. At the basal region of cypsela carpopodium present, narrower than the base, symmetric, complete ring-like. Carpopodial cells thick-walled, arranged in single row. At the upper portion of cypsela, pappus present, homomorphic, represented by serrulate setose type of pappus bristle, white in colour, 15-25 in number, united at the base, unequal in length, arranged in one row, persistent.

Tridax procumbens **(Figure 2 V)**

Cypsela heteromorphic. Disk cypsela 2.5 mm x 0.05 mm, whereas ray cypsela 3 mm x 0.05 mm. Disk cypsela yellow brown, oblanceolate, straight, upper portion truncate, whereas basal portion slightly tapered. Ray cypsela light brown, obovate, straight, upper portion truncate whereas basal portion tapered. Ellipsoidal in cross sectional configuration. Surface pubescent type containing 15-17 ribs, alternating with furrow; furrows wider than ribs. The distance between 2 ribs 0.02 mm. On the

surface phytomelanin layer observed. Surface hair ascending in orientation with the surface, containing body and basal cells. Pappus present; represented by plumose type of pappus bristles, arranged in 2 whorls, light brown, unequal. At the upper portion of cypsela, stylopodium present, inconspicuously arranged. At the basal region of cypsela, carpopodium present, narrower than the base, irregular ring like, outline visible. Carpopodial cells thick-walled, elliptic, not pitted, arranged in 2 rows, distinguishable from other cells of the cypsela.

Vernonia anthelmintica **(Figure 2 W)**

Cypsela homomorphic, 4 mm x 1 mm with pappus, 3 mm x 1 mm without pappus, brownish, srriated, straight, upper part truncate whereas lower part tapered, more or less elliptic in cross section. Surface pubescent, containing 10 ribs, conspicuous, alternating with furrow, furrows wider than ribs. The distance between 2 ribs 0.02 mm. Surface hair villous type, ascending in orientation, non-glandular, biseriate forked type, made up of body and basal cell. Tips of the body cells of hair situated in different plane. Sessile hairs also present on the surface. Sessile hairs with 2 celled. At the upper portion of cypsela, stylopodium present, immersed in the nectar. At the upper part of cypsela, pappus present, homomorphic, persisterent, represented by 20-22 serrulate setose type of pappus bristles, yellow white, unequal, represented in a single circle. At the basal region of cypsela, carpopodium present; narrow than the base, symmetric, complete ring like. Carpopodial cells thick-walled, rectangular, arranged in single row, distinguishable from other cells of cypsela.

Vernonia cinerea **(Figure 2 X)**

Cypsela homomorphic, 2 mm x 1 mm with pappus, 0.5 mm x 1 mm without pappus, light brown, srriated, oblong, straight, upper portion truncate whereas basal part tapered, trigonous in cross section. Surface pubescent, containing 2 ribs, conspicuous, alternating with furrow. Furrows wider than ribs. The distance between 2 ribs 0.021 mm. On the surface, vesicular body present. Surface hair sericeous- villous type, non glandular, biseriate forked type, made up of body and basal cells, tips of the body cells of hair situated in different plane, appressed- inclined in orientation with the surface. Sessile hairs not observed on the surface. At the upper part of cypsela,

stylopodium present, inconspicuously arranged. Pappus present in the form of two circle. Outer circle represented by scaly pappus made up of 11-15 pappus bristles, light brown, unequally arranged whereas inner circle represented by 20-25 serrulate-setose type of pappus bristles, white brown, unequally arranged. At the basal region of cypsela, carpopodium present, narrow than the base, complete ring like, made up of thick-walled, cubical cells, arranged in 4-6 rows.

V. galamensis **(Figure 2 Y)**

Cypsela homomorphic, 6 mm x 1 mm, blackish, srriated, obovate, straight, upper part truncate whereas basal part tapered, elliptical in cross-sectional configuration. Surface pubescent, containing 2 ribs, conspicuous, alternating with furrow. Furrows wider than ribs. The distance between 2 ribbs 0.01 mm. Surface hair sericeous, non glandular, biseriate forked type, made up of body and basal cells, appressed to ascending in orientation with the surface. Tips of the body cells of hair situated in different plane. Sessile hairs not observed on the surface. Pappus represented by small bristeles. At the upper part of cypsela, stylopodium present, inconspicuous, fully immersed in the nectar. At the basal region of cypsela, carpopodium present, narrow than the base, quadrangular, symmetric. Carpopodial cells thick-walled, rectangular, horizontally placed, arranged in single row, distinguishable from other cells of cypsela.

V. hymenolepis **(Figure 2 Z)**

Cypsela heteromorphic. Ray cypsela 4 mm x 1 mm, brownish, stripted, oblanceolate, margin entire, straight, upper part truncate whereas basal prt tappered. Disk cypsela 3 mm x 1 mm, black, stripted, oblanceolate, straight, margin entire, upper part truncate whereas lower part tappered. More or less trigonous in cross section. Surface pubescent, containing 10- 13 ribs, conspicuous, alternating with furrow. Furrows wider than ribs. The distance between 2 ribs approximately 0.02 mm. On the surface, only sessile hairs present. Sessile hairs with 2 celled. At the upper part of cypsela, stylopodium present, unenlarged, partially immersed in the nectary. Pappus absent. At the basal region of cypsela, carpopodium present, narrow than the base, pentangular. Carpopodial cells thick-walled, circular, medium in size,

arranged in 5-7 rows, distinguishable from other cells of the cypsela.

V. stenolepis **(Figure 2 Z1)**

Cypsela homomorphic, 5 mm x 1 mm with pappus, 4.5 mm x 1 mm without pappus, brownish, stripped, narrow oblanceolate, straight, upper part truncate whereas basal part tapered. Circular in cross section. Surface pubescent, containing 10 ribbs, alternating with furrow. Furrows wider than ribs. The distance between 2 ribs 0.02 mm. Surface hair tomentose type, made up of body and basal cell, non-glandular, ascending in orientation. Cypselar hair biseriate forked type; tips of the body cells of hair situated in different plain. On the surface, sessile hairs also present. Sessile hairs with 2 celled. At the upper portion of cypsela, pappus present; hetero-morphic, represented by 2 whorls. Outer whorl represented by bristelate pappus and inner whorl represented by 4 scaly pappus. At the upper part of cypsela stylopodium present, inconspicuous. At the basal region of cypsela, carpopodium present, narrow than the base, symmetric, arranged in a ring.

DISCUSSION

Diversity of seed morphology continue to be generally neglected by many taxonomist. The lack of reliable seed morphological data has hindered the identification of isolated seeds and reduced their significance in the phytogenetic consideration of the taxa consigns. Several workers who had earlier contributed to the morphological features of seeds in this family [4, 5, 6, 7, 8]. They described them as small, enclosed in the achene, with thin papery seed coat. Corner [9] noted that most botanist are satisfied with the external features of the achene and a few have enquired into the development of the embryo and ovule. It is clear, nevertheless, the seed coat has not completely deteriorated in the achene but has retained the exotesta palisade. From the systematic point of view, the exomorphology of cypselas is of great value and these features may be employed for better understanding of the taxa. The taxonomist has 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. Regarding the cypselas of the Anthemideae, Bremer[10]

have elucidated a valuable statement "The fruits (cypselas) provide much information in the Anthemideae". On the basis of studied genera, cypselas are heteromorphic (*Tridax procumbens*). Shape of the cypsela is variable from genus to species. The shape of seeds varies from oblong to obovate, cylindrical, ellipsoidal and lanceolate. Other features of the seeds are beak as exemplified in *Crepis palaestina, C. foetida, C. alpina*. With awn in *Acanthospermum hispidum*. Seed size ranges from 2 mm in *Solidago Canadensis*, *Vernonia cinerea, Solidago gigantea, Solidago Canadensis,* to 18 mm in *Crepis alpina.* Before now, Corner[11] , gave general features in this family. From taxonomic point of view, the morphology of seeds is of grait value and it's characters support the concept of use in better understanding of the systematic of these taxa.The science of seed identification has become increasingly important in modern scientific agriculture and without it, there would be little use in perfecting the methods of cultivating useful plants. Structure and orientation of pappus have diacritical value for differentiation of taxa. Among the studied taxa, in *Vernonia stenolepis* containing 4 awn like structure. In *Tridax procumbens,* pappus bristles arranged in 2 whorls. So, micro morphological features of pappus are taxonomically significant as proposed by[12]. In *Bidens frondosa*, pappus is represented by retrorsely barbed awns. Over the yers the knowledge of seed characters has been used to meet the needs for correct labelling of seeds in commercial channels to detect the adulteration, potential toxic plant materials and to assure consumer of high quality seeds.

ACKNOWLEDGEMENT

The authors are grateful to the Directors and Curators of the Herbaria (Mention on Table 1) for sending identified mature cypselas for this study.

Table 1

List of studied taxa and their source of origin

STUDIED TAXA	SOURCES
1. ***Acanthospermum hispidum*** **D C.**	Instituto De Investigacao Cientifica De Angola, Herbario (LUAI). Col: A. Menezes, No- 4223, Dated 28.6.1972
2. ***Bidens frondosa*** **L.**	Humboldt- Universidad Zu Berlin, Institut fur Biologie, Spezielle Botanik u. Arboretum, D – 12437 Berlin, Germany.
3. ***Centaurea aspera*** **L.**	Botanischer Garten der Universitat Zurich, Zollikerstrasse 107, CH-8008 Zurich/ Switzerland. Specimen no.- XX0BRISS-20093677
4. ***C. saobiosa*** **L.**	Humboldt- Universitat Zu Berlin, Institut fur Biologie, Spezielle Botanik u. Arboretum, D – 12437 Berlin, Germany. Specimen no.- 72
5. ***C. stoebe*** **L.**	Humboldt- Universitat Zu Berlin, Institut fur Biologie, Spezielle Botanik u. Arboretum, D – 12437 Berlin, Germany. Specimen no.- 74
6. ***Crepis alpina*** **L.**	Botanic Garden of the University of Copenhagen, Denmark.
7. ***Crepis aspera*** **L.**	Botanic Garden of the University of Copenhagen, Denmark.
8. ***Crepis dioscoridis*** **L.**	Botanic Garden of the University of Copenhagen, Denmark.
9. ***Crepis foetida*** **L.**	Botanic Garden of the University of Copenhagen, Denmark.

10. *Crepis neglecta* L.	Botanic Garden of the University of Copenhagen, Denmark.
11. *Crepis palaestina* (Bois.) Bornm	Botanic Garden of the University of Copenhagen, Denmark.
12. *Crepis pulchra* L.	Botanic Garden of the University of Copenhagen, Denmark.
13. *Hieracium racemosum* W. & K. ex Wild.	Institut fur Pharmakognosieder Universitat Wien, Pharmaziezentrum, AlthanstraBe 14, A- 1090 WIEN, AUSTRIA(FLORA of AUSTRIA- from Lower Austria, Thermenlinie, Glaslauterriegel north of the Heberlberg 2 Km southwest of Gumpoldskirchen, 275 m s .m. 48°02'N, !6°16'E, 23 September 2 0 0 1 , In deciduous leaved forest,)
14. *Leontodon crispus (Wild.)* Finch et P.D.Sell:	Botanic Garden and Museum of the University of Copenhagen (Natural History Museum of Denmark)
15. *Leontodon muelleri* (Sch.Bip) Fiori	Botanic Garden and Museum of the University of Copenhagen (Natural History Museum of Denmark)
16. *Melampodium perfoliatum* (Cav.) Kunth	Botanischer Garten der Universitat Zurich, Zollikerstrasse 107, CH- 8008 Zurich,Switzerland. Specimen number: XXOMJG 19- 46810, 78, 2009 Drawer.
17. *Solidago Canadensis* L.	Humboldt – Universitat Zu Berlin, Institut fur Biologie, SpeZiele Botanik U. Arboretum, D- 12437 Berlin, Germany.
18. *Solidago gigantea* Ait.	Humboldt – Universitat Zu Berlin, Institut fur Biologie, SpeZiele Botanik U. Arboretum, D- 12437 Berlin, Germany.

19. *Solidago virgaurea* L. ssp.	Botanischer Garten und Institut fur Systematische Botanik, Zollikerstrasse 107, CH- 8008 Zurich,Switzerland.
20. *Sonchus oleraceous* L.	Botanischer Garten der Universitat Wien Rennweg 14, A-1030 Wien (Austria), Lower Austria, Thermenlinie, wine yards east of the Heberlberg 2 km southwest ofGumpoldskirchen, 275 m s.m. 480 02'N, 160 16'E, 23 September 2001, Leg. W. Till s/n, On cultivated ground.
21. *Sonchus wightianus* L.	Kalyani Township. B.J- 201
22. *Tridax procumbens* L.	B. Nordenstum, 2009.02.02. Swedish Museum of Natural History, P.O. Box 50007, SE-10405 Stockholm, Sweden. Ref No: Colombia, Cartagena, 8.11.1928, Herb. Erik Wall s.n.(S).
23. *Vernonia anthelmintica* Willd.	Kalyani Township.
24. *Vernonia cinerea* (L.) Less.	Kalyani Township.
25. *V. galamensis* Less.	NORTH CENTRAL REGIONAL, PLANT INTRO. STATION Ames, IA. 50011, PI 500003, LOT: 87 nc so 01, ORIGIN: Kenya, FOR: 100 CT Y MAINJARBOX, ORDER # 940162
26. *V. hymenolepis A*. Rich.	NORTH CENTRAL REGIONAL, PLANT INTRO. STATION Ames, IA. 50011, PI 312850, LOT: 88 nc po 01, CULT: 14533, ORIGIN: Ethiopia, FOR: 100 ct Y MAINJAR, ORDER # 940162
27. *V. stenolepis* Oliv.	NORTH CENTRAL REGIONAL, PLANT INTRO. STATION Ames, IA. 50011, Ames 8594, LOT: 88nt ao01, ORIGIN: UNCERTAIN, For: 100 ct Y MAINJAR, ORDER # 940162

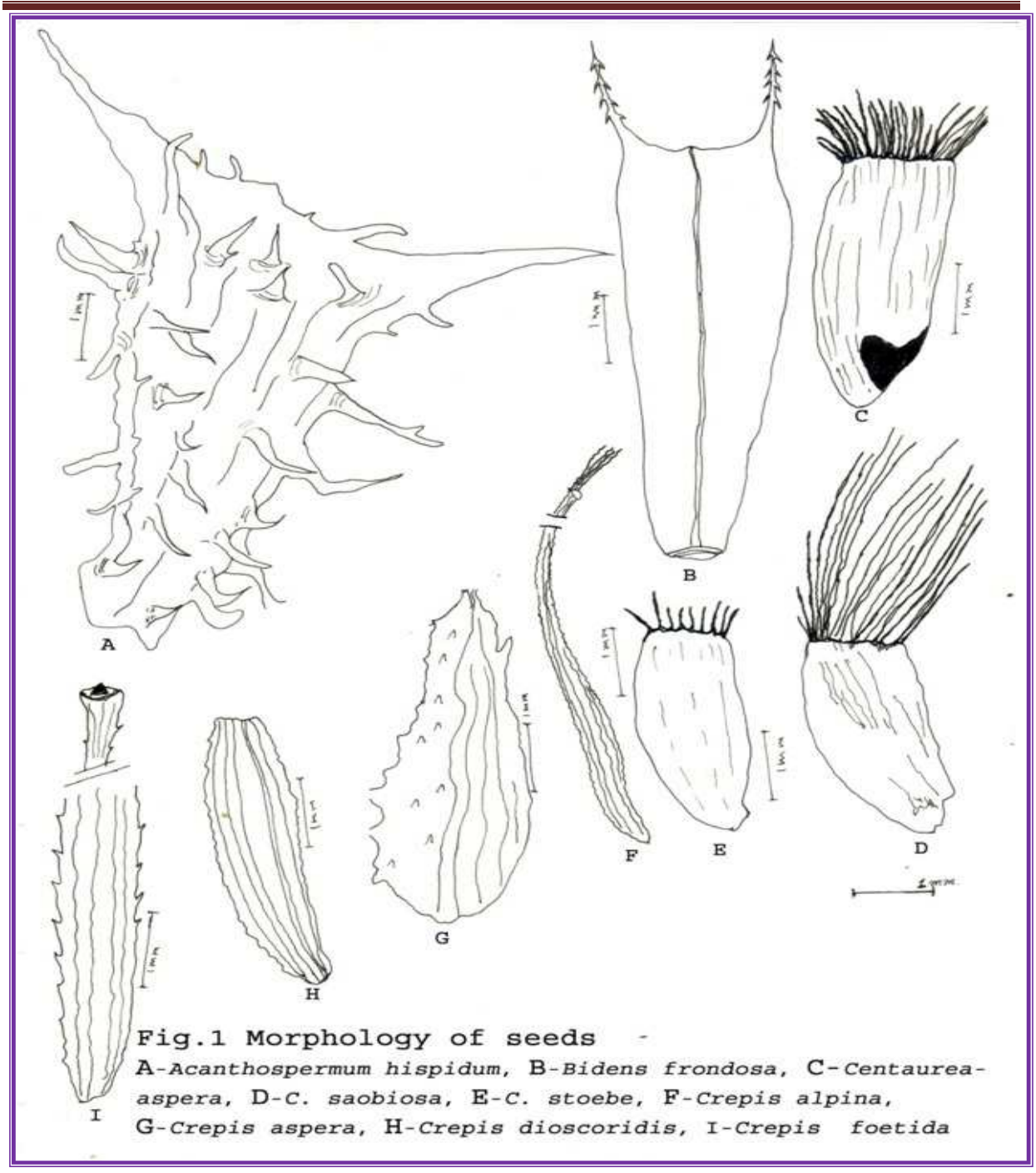

Fig.1 Morphology of seeds
A-*Acanthospermum hispidum*, B-*Bidens frondosa*, C-*Centaurea-aspera*, D-*C. saobiosa*, E-*C. stoebe*, F-*Crepis alpina*, G-*Crepis aspera*, H-*Crepis dioscoridis*, I-*Crepis foetida*

Fig.2 Morphology of seeds

J-*Crepis neglecta*, K-*C. palaestina*, L-*C. pulchra*, M-*Hieracium racemosum*, N-*Leontodon crispus*, O-*L. muelleri*, P-*Melampodium perfoliatum*, Q-*Solidago canadensis*, R-*S. gigantea*, S-*S. virgaurea*, T-*Sonchus oleraceous*, U-*S. wightianus*, V-*Tridax procumbens*, W-*Vernonia anthelmintica*, X-*V. cinerea*, Y- *V. galamensis*, Z- *V. hymenolepis*, Z1- *V. -*

REFERENCES

1. Martin AC and WD Burkley: 1973. Seed identification Manual. University of California Press. Burkley, Los Angeles & London. 1973; pp. 221.

2. Corner EJH: The seeds of dicotyledons. Cambridge Univ. Press. Cambridge. England. 1976; 1,2: pp. 311

3. Bhar I and Mukherjee SK: Macromorphological and Micromorphological study of cypselas in seven species of the tribe anthemideae-(Asteraceae). J. Econ. Taxon. Bot. 2004; 28(3): 788-794.

4. Singh B: Development and Structure of Angiosperm Seed, 1. Bull. Natn. Bot. Gdns. India 1964; 89: 1-115.

5. Sehgal CB: Morphological and embryological studies on *Erigeron bonariensis*. Beitr. Biol. Pfl. 1966; 42: 161-183.

6. Ditrich M: Morphologische Untersuchungen an den fruchten der subribus cardueae – centaureinal (Compositae). Willdenowia, 1968; 5: 67-107.

7. Bhar I and Mukherjee SK: Macromorphological and Micro morphological study of cypselas in seven species of the tribe Anthemideae-(Asteraceae). J. Econ. Taxon. Bot. 2004; 28(3): 788-794.

8. Jana BK and Mukherjee SK: Diversity of cypselar features of seven species of the genus *Crepis* L. in Compositae. Indian Journal of fundamental and applied Life sciences. 2010; 2(1): 51-58.

9. Corner EJH: The seeds of dicotyledons. Cambridge Univ. Press. Cambridge. England. 1976; 1, 2: pp. 311.

10. Bremer K: Major clades and grades of the Asteraceae. In: Compositae: Systematic s. Proceedings of the International Compositae Conference, Hind, D.J.N., Editor- in – Chief, 1996; 1: 1-7

11. Corner EJH: The seeds of dicotyledons. Cambridge Univ. Press. Cambridge. England. 1976; 1, 2: pp. 311.

12. Mukherjee SK and Sarkar AK: Study of macro-morphological and anatomical structures of cypselas of eighteen taxa of the tribe Vernonieae (Asteraceae). Not. Bot. Soc., 2001; 55: 85-104.