

CYPSELA MORPHOLOGY OF *LACTUCA* L. AND ITS ALLIED GENERA (CICHOREAE-ASTERACEAE) FROM PAKISTAN AND KASHMIR

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Abstract

The systematic significance of the cypselas morphology of more 30 taxa (25 species, 1 subspecies and 4 varieties) belonging to 3 genera viz., *Lactuca* L., *Cicerbita* Wallr. and *Prenanthes* L. from Pakistan and Kashmir has been studied by using Light Microscope (LM) and Scanning Electron Microscope (SEM) and discussed. The morphological characters of cypselas such as size, number of ribs, number of cypselas per capitula, presence or absence of beak, number of series of pappus, color and size of pappus and carpopodium were quite useful for the delimitation of different taxa both at the generic and species level.

Key words: Asteraceae, Cichoreae, *Lactuca* L., *Cicerbita* Wallr., *Prenanthes* L.

Introduction

The tribe Cichorieae Lam. & DC. (Lactuceae Cass.) is characterized by the presence of milky latex and ligulate capitula. A number of classifications for Cichorieae have been proposed by various workers such as Stebbins (1940, 1953), Kirpicznikov (1964), Jeffrey (1966), Bremer (1994) and Lack (2007) but, until now, there is a disagreement among different authors regarding the rank and circumscription of various taxa belonging to the genus *Lactuca* L. and its allied genera because they have accepted these genera either in a broader or narrower sense (Bano & Qaiser, 2009, 2010 & 2011). While recent molecular phylogenetic analysis broadened the generic circumscription and have provided valuable information which improved our understanding of some groups within the tribe Cichorieae (Lee *et al.*, 2003, Kilian *et al.*, 2009). On the basis of morphological and molecular evidences, Bano & Qaiser (2011) also accepted the genus *Lactuca* L. in a broader sense and enumerated 13 species from our region. Similarly Lack (2007), Maberley (2008), Kilian *et al.* (2009) also adopted its broader generic concept. Furthermore Bano & Qaiser (2010) broadened the generic circumscription of the genus *Cicerbita* Wallr. and recognized 11 species from the area under consideration. Bano & Qaiser (2009) also accepted *Prenanthes* L. as an independent genus and recognized 3 species. Cypselas morphology may provide additional informative data to address such dispute and to evaluate inter and intra generic relationship of various plant species belonging to the family Asteraceae. Cypselas morphology was first used as a taxonomic character for recognizing group and genera in the tribe Anthemideae (family Asteraceae) by Cassini (1823). Lavielle (1912) studied the structure and development of the seed coat and fruit wall of the various members belonging to the tribes Cichorieae, Cynareae and Mutisieae. Extensive work has been done on the cypselas morphology of various tribes of the family Asteraceae from different parts of the world such as Dittrich (1968), Kynclova (1970), Singh *et al.* (1973), Singh & Pandey (1983), Shih (1988, 1991), Bruhl & Quinn, (1990), Bremer (1994), Blanca & Guardia (1997), Kilian (1997), Pak *et al.* (2001), Julio & Oliveria (2009), Marzinak & Oliveria (2010), Zhang *et al.* (2011b), Jana & Mukherjee (2012) and Roque & Funk (2013). Similarly, from Pakistan and

Kashmir some reports are also available on the cypselas morphology representing the family Asteraceae such as Inuleae (Abid & Qaiser, 2002), Plucheae (Abid & Qaiser, 2007), Gnaphaliaceae (Abid & Qaiser, 2008 a, b & c), Anthemideae (Abid & Qaiser, 2009), Senecioneae (Abid & Ali, 2010) and Mutisieae (Abid & Alam, 2011). Despite of these studies, few information are also available on the cypselas morphology of *Lactuca* L. and its allied genera belonging to the tribe Cichoreae. For instance, Haque & Godward (1984) studied the carpopodia of 2 sub-families, 10 tribes, 18 genera and 40 species of the family compositae. They concluded that the carpopodia of the sub family Lactucoideae were smoother, narrower, composed of fewer cells and derived from side by side fusion of separately formed sectors. El-Naga (1997) investigated the carpopodium of 40 species belonging to the tribe Lactuceae (Asteraceae) to assess their taxonomic significance. Zhu *et al.* (2006) studied the cypselas wall anatomy and surface sculpturing of 14 species of the genus *Lactuca* L. and its related genera by means of LM and SEM and evaluated their inter and intra generic relationship.

As evident from the literature a lot of work has been done on the cypselas morphology of different tribes of Asteraceae (including Cichoreae) both at the global and regional level but there is no detailed information are available on the cypselas morphology of the genus *Lactuca* L. and its allied genera especially from Pakistan and Kashmir. The objectives of the present study is to provide a detailed account of the cypselas morphology and to determine the extent to which these micro-morphological data can be used as a taxonomic character to delimit various taxa belonging to *Lactuca* L. and its allied genera.

Materials and Methods

Mature and healthy cypselas of 30 taxa belonging to *Lactuca* L., *Cicerbita* Wallr. and *Prenanthes* L., were studied using fresh (in few cases) and herbarium specimens of the following herbaria viz., BM, E, KUH, M and RAW (abbreviated a/c to Holmgren *et al.*, 1990). Following parameters were studied under Stereomicroscope (Nikon XN Model), Light microscope (Nikon Type 102) and Scanning electron microscope (Joel JSM- 6380 A). For SEM cypselas were directly mounted on a metallic stub with the help of double adhesive tape and coated with gold for a

period of 6 minutes in sputtering chamber and observed in SEM. Mostly 10 plants / species and 10 cypselas / plant were studied. The voucher specimens are given in Appendix I. The terminology used in accordance with Lawrence (1970) and Stearn (1983).

The following characters were studied under light microscope:

Cypselas: (i) Shape (ii) Color (iii) Size (iv) Number of ribs (v) Surface (vi) Number of cypselas per capitulum

Beak: (i) Beaked / beakless (ii) Size (iii) Color (iv) Shape (v) Surface

Pappus: (i) Series (ii) Form (iii) Size (iv) Color (v) Number

Carpopodium: (i) Shape (ii) Position (iii) Diameter of carpopodium and foramen of carpopodium were examined under scanning electron microscope

Observations

General characters of *Lactuca* L. (s.str.) and its allied genera

Cypselas obovate - oblanceolate, elliptic-linear, broad elliptic-oval, oblong, 5-18 mm long (including beak), 3-35, cypselas per capitulum. The basic colour is brown, however, variation occurs from yellowish-golden brown or dark brown, reddish, sandy-olive, blackish brown-black; strongly ribbed (1-9 or 12), ribs entire or wavy. Surface papillate, muricate and scabrid. Cypselas are much compressed - slightly compressed. Different types of hairs viz., pilose or

densely thick hair or even glabrous condition are also present. Beaked or not beaked. Beak is of different shapes viz., capillary, filiform, slender, stout or cylindrical. Pappus 1-2-seriate, 3-12 mm long. Pappus is of various colours such as white, snowy white, dirty white, lemon yellow or yellowish and cream and off white, setae 45-280, fragile and not fragile. Carpopodium completely or incompletely developed, symmetric or asymmetric, narrow circular or broad disc, with or without interruption, basal- sub basal in position, 114-446 µm in diameter; foramen of carpopodium 53.9-295 µm in diameter (Table 1; Figs. 1-8).

1. *Lactuca* L. It is represented by 13 species in the area under consideration.

Cypselas oblanceolate - obovate - oblong, elliptic-broad elliptic or oval, compressed, 7-18 x 1-3 mm, (4-) 14-38 per capitulum. The basic colour is brown, however, it may vary from golden brown- dark brown-blackish, brown-black; winged or not, muricate - scabrid or papillate surface; 1-many ribs; beak present or absent, if present then 3-9 mm long, mostly white, concolorous - greenish, smooth, filiform -capillary, appendages or without appendages. Pappus uniseriate or biseriate, 3-12 mm long, white - lemon yellow, cream-off-white, setae 50-195, fragile or not fragile, setae same throughout the whole length or widened towards apex. Carpopodium completely or incompletely developed, symmetric- asymmetric, narrow circular -broad ring with or without any interruption, basal - sub basal in position, 114-263(-399) µm in diameter, foramen 53.9-195(-247) µm in diameter (Table 1; Fig. 1-3A-O; Fig. 4A-G; Fig. 8L-O).

Key to the generabased on cypselas

- 1 + Cypselas 3 per capitulum, terete or prismatic, truncate or rounded at the apex **3. *Prenanthes***
 - Cypselas 5-35 per capitulum, neither terete nor truncate apically **2**
 2 + Cypselas up to 10 mm long, beak slender-stout, up to 3 mm long **2. *Cicerbita***
 - Cypselas up to 18 mm long, beak capillary- filiform or slender up to 13 mm long **1. *Lactuca***

Key to the species of *Lactuca* L.

- 1 + Pappus uniseriate **2**
 - Pappus biseriate, outer series form a crown-like structure **11**
 2 + Beak present **3**
 - Beak absent ***L. erostrata***
 3 + Cypselas 11-18 mm long, 1-ribbed, shortly papillate **4**
 - Cypselas 7-10 mm long including beak, 3-12 ribs, muricate-hispid **5**
 4 + Cypselas up to 18 mm long including beak, Beak capillary basally with 2 white, pendent appendages ***L. undulata***
 - Cypselas up to 14 mm long including beak, Beak filiform without appendages ***L. glaucifolia***
 5 + Cypselas 4 per capitulum **6**
 - Cypselas 14-22 per capitulum **7**
 6 + Cypselas brown, 6- 9 mm long including beak; beak up to 3 mm long ***L. orientalis***
 - Cypselas black, 7-14 mm long including beak; beak up to 8 mm long ***L. viminea***
 7 + Beak capillary-filiform, almost discoloured (white); pappus 3-5 mm long, lemon yellow or white, not fragile **8**
 - Beak slender or stout, almost concolorous (rarely pale apically); pappus 10-12 mm long, cream- off white, fragile **Group I (*L. tatarica*, *L. clarkei*)**
 8 + Cypselas with 3-7 ribs on each side; pappus lemon yellow or white; carpopodium without crack **9**
 - Cypselas with 7-9 ribs on each side, pappus white; carpopodium with an interruption **10**
 9 + Cypselas up to 3 mm long with 3 prominent ribs on each side, pappus up to 3 mm long ***L. dissecta***
 - Cypselas up to 5 mm long, 5-7 ribs on each side, pappus up to 6 mm long ***L. dolichophylla***
 10 + Cypselas brown; Carpopodium U shaped with 2-narrow interruption ***L. serriola***
 - Cypselas blackish; Carpopodium with extensive interruption ***L. sativa***
 11 + Cypselas up to 3 mm broad, narrow elliptic, 7-8 mm long including beak; beak 3 mm long ***L. crambifolia***
 - Cypselas up to 4 mm broad, elliptic or oval, 9-15 mm long including beak; beak 5-10 mm long ***L. persica***

Table 1. Cypselas characters of *Lactuca* L. (s.str.) and its related genera.

| Name of taxa | Main body of Cypselas | | | | | |
|---|---------------------------|---------------------|---------------------|---------------|------------|-------------------------------|
| | Shape | Surface | Colour | Size (mm) | No of ribs | No. of cypselas/ capitulum |
| <i>Lactuca dissecta</i> | Oblanceolate | Muricate | Dark brown | 2.5 - 3 x 1.3 | 3 | 15 - 20 |
| <i>L. dolichophylla</i> | Oblanceolate | Muricate-hispid | Brown - dark brown | 4 - 5 x 1.3 | 5 - 7 | 14 - 20 |
| <i>L. glaucifolia</i> | Oblanceolate | Muricate-papillate | Yellow-golden brown | 3 - 4 x 1.2 | 1 | 15 - 20 |
| <i>L. sativa</i> | Oblanceolate-obovate | Scabrid-Pilose | Blackish | 4 x 1.3 | 7 - 9 | 18 - 20 |
| <i>L. serriola</i> | Oblanceolate-obovate- | Scabrid-Pilose | Brown | 3.5 - 5 x 1.3 | 7 - 9 | 18 - 22 |
| <i>L. undulata</i> | Oblanceolate - obovate | Papillate | Yellowish-brown | 3 - 5 x 1.2 | 1 | 12 - 18 |
| <i>L. orientalis</i> | Ellipsoid-linear-oblong | Scabrid-hispid | Brown | 4 - 6 x 1 | 5 - 7 | 4 |
| ssp. <i>maristanica</i> | Ellipsoid-linear-oblong | Scabrid-hispid | Brown | 4 - 6 x 1 | 5 - 7 | 4 |
| <i>L. viminea</i> | Linear-elliptic | Scabrid-hispid | Black | 3.5 - 6 x 1 | 5 - 7 | 4 |
| <i>L. erostrata</i> | oblanceolate | Hispid | Dark brown | 4.5-5 x 1.5 | 5 - 7 | 4 |
| <i>L. clarkei</i> | Ellipsoid | Smooth | Blackish | 4 - 5 x 1.5 | 6 - 8 | 16 - 18 |
| <i>L. tataricum</i> | Ellipsoid | Smooth | Sandy brown-olive | 4 - 5 x 1.5 | 6 - 8 | 22 |
| <i>L. crambifolia</i> | narrow elliptic | Hispid | Brown | 4-5 x 2.5-3 | 1 | 25 - 30 |
| <i>L. persica</i> | Broad elliptic- ovate | Hispid | Golden brown | 4-5 x 3-3.5 | 1 | 32 - 38 |
| <i>Cicerbita chitralensis</i> | Elliptic-linear | muricate-hispid | Black | 3 x 1.2 | 8 - 14 | 20 - 22 |
| <i>C. picridiformis</i> | Cuneate- linear | muricate-hispid | Reddish-bl. brown | 3 - 4 x 1 | 8 - 10 | 20 |
| <i>C. alii</i> | Cylindrical- Oblanceolate | Densely thick hairy | Greyish Black | 5 - 7 x 2 | 3 | 20 - 25 |
| <i>C. decipiens</i> | Elliptic-oblong-linear | Scabrid | Brown-blackish | 5.5 - 8 x 1.5 | 6 - 8 | 6 - 8 |
| <i>C. decipiens</i> var. <i>multifida</i> | Elliptic-oblong | Scabrid | Brown-blackish | 5.5 - 8 x 1.5 | 6 - 8 | 6 - 8 |
| <i>C. lesseritiana</i> | Elliptic-linear | Hispid | Brown | 4.5 - 5 x 1.5 | 6 - 8 | 25 - 30 |
| <i>C. lesseritiana</i> var. <i>dentata</i> | Elliptic-linear | Hispid | Brown | 4.5 - 5 x 1.5 | 6 - 8 | 30 |
| <i>C. lesseritiana</i> var. <i>lyrata</i> | Elliptic-linear | Hispid | Brown | 4.5 - 5 x 1.5 | 6 - 8 | 28 - 30 |
| <i>C. macrorhiza</i> | Elliptic - oblong | Hispid | Black | 5 x 1.5 | 5 | 13 - 15 |
| <i>C. qaiseri</i> | Elliptic-linear | Hispid | Brown | 5 x 1.5 | 6 - 8 | 22 |
| <i>C. rapunculoides</i> | Linear-ellipsoid | Scabrid-hispid | Brown | 6 - 9 x 1.5 | 7 - 9 | 5 |
| <i>C. gilgiiensis</i> | Oblanceolate-cylindrical | Densely thick hairy | Black | 4 - 6 - 7 x 2 | 1 - 3 | 32 |
| <i>Prenanthes brunoniana</i> var. <i>brunoniana</i> | Oblong | Hispid | Brown | 5 x 1-1.5 | 3 - 5 (-7) | 3 |
| <i>P. brunoniana</i> var. <i>alliarifolia</i> | Oblong | Hispid | Brown | 5 x 1-1.5 | 3 - 5 (-7) | 3 |
| <i>P. atchisoniana</i> | Oblong | Hispid | Black | 7 x 1.5 | 3 - 5 | 3 |
| <i>P. stewartii</i> | Oblong | Hispid | Brown | 5 x 1.5 | 3 - 5 (-7) | 3 |

Table 1. (Cont'd.).

| Name of taxa | Beak of Cypselia | | | |
|---|--------------------|-------------------|----------------------------|---------|
| | Shape | Surface | Colour | |
| | | | Length (mm) | |
| <i>Lactuca dissecta</i> | Filiform | Smooth | White | 5 - 6 |
| <i>L. dolichophylla</i> | Filiform | Smooth | White-greenish | 3 - 4 |
| <i>L. glaucifolia</i> | Filiform-capillary | Smooth | White | 8 - 9 |
| <i>L. sativa</i> | Filiform | Smooth | White | 3 - 4 |
| <i>L. serriola</i> | Filiform-slender | Smooth | Whitish | 4 - 5 |
| <i>L. undulata</i> | Capillary | Smooth | White | 8 - 13 |
| <i>L. orientalis</i> | Stout-slender | Scabrid-hispid | Brown | 2 - 3 |
| ssp. <i>nuristanica</i> | Stout- slender | Scabrid-hispid | Brown | 2 - 3 |
| <i>L. viminea</i> | Slender-filiform | Scabrid-hispid | Black-white apically | 3.5 - 8 |
| <i>L. erostrata</i> | Truncate apically | Scabrid-hispid | Pale apically | 0.0-0.2 |
| <i>L. clarkei</i> | Slender-stout | Smooth | Pale | 1 - 2 |
| <i>L. tataricum</i> | Slender-stout | Smooth | Pale-concolorous | 1 - 1.5 |
| <i>L. crambifolia</i> | Slender-filiform | Smooth | Concolorous-pale | 3 - 4 |
| <i>L. persica</i> | Filiform-capillary | Smooth | Concolorous-pale | 7 - 10 |
| <i>Cicerbita chitratensis</i> | Slender | Smooth | Concolorous-pale | 1.5 - 2 |
| <i>C. picridiformis</i> | Slender | Smooth | White | 2 - 2.5 |
| <i>C. alii</i> | Stout-eylindrical | Papillate | Concolorous | 2 |
| <i>C. decipiens</i> | Stout | Scabrid | Concolorous-white apically | 1.5 - 2 |
| <i>C. decipiens</i> var. <i>multifida</i> | Stout | Scabrid | Concolorous-white apically | 1.5 - 2 |
| <i>C. lessertiana</i> | Slender | Smooth | Cream-pale | 1.5 - 2 |
| <i>C. lessertiana</i> var. <i>dentata</i> | Slender | Smooth | Cream-pale | 1.5 - 2 |
| <i>C. lessertiana</i> var. <i>lyrata</i> | Slender | Smooth | Cream-pale | 1.5 - 2 |
| <i>C. macrorrhiza</i> | Stout | Hispid | Concolorous | 1.5 |
| <i>C. qaiseri</i> | Slender | Smooth | Pale | 2 |
| <i>C. rapunculoides</i> | Slender-stout | Hispid | Concolorous | 1.5 - 3 |
| <i>C. gilgiiensis</i> | Stout-eylindrical | Papillate-scabrid | Concolorous | 1-2 |
| <i>Prenanthes brunoniana</i> var. <i>brunoniana</i> | Truncate-rounded | Smooth | Concolorous apically | 0 |
| <i>P. brunoniana</i> var. <i>alliaricefolia</i> | Truncate-rounded | Smooth | Concolorous apically | 0 |
| <i>P. aitchisoniana</i> | Truncate-rounded | Smooth | Concolorous apically | 0 |
| <i>P. stewartii</i> | Truncate-rounded | Smooth | Concolorous apically | 0 |

Table I. (Cont'd.).

| Name of taxa | Pappus | | |
|---|---------------|-----------|-------------|
| | No. of Series | Number | Length (mm) |
| <i>Lactuca dissecta</i> | Uniseriate | 45 - 90 | 3 |
| <i>L. dolichophylla</i> | Uniseriate | 130 - 195 | 5 - 6 |
| <i>L. glaucifolia</i> | Uniseriate | 70 - 110 | 3 - 4 |
| <i>L. sativa</i> | Uniseriate | 110 - 159 | 4 - 6 |
| <i>L. serriola</i> | Uniseriate | 130 - 170 | 4 - 5 |
| <i>L. undulata</i> | Uniseriate | 60 - 115 | 4 - 5 |
| <i>L. orientalis</i> | Uniseriate | 120 - 185 | 6 - 8 |
| ssp. <i>nuristanica</i> | Uniseriate | 130 - 190 | 6 - 8 |
| <i>L. viminea</i> | Uniseriate | 80 - 190 | 6 - 7 |
| <i>L. erostrata</i> | Uniseriate | 110 - 179 | 5 - 6 |
| <i>L. clarkei</i> | Uniseriate | 150 - 220 | 9 - 11 |
| <i>L. tataricum</i> | Uniseriate | 168 - 235 | 9 - 11 |
| <i>L. crambifolia</i> | Biseriate | 150 - 175 | 8 - 10 |
| <i>L. persica</i> | Biseriate | 190 - 220 | 8 - 10 |
| <i>Cicerbita chitralensis</i> | Biseriate | c. 140 | 5 - 6 |
| <i>C. picridiformis</i> | Biseriate | 80 - 110 | 3 - 4 |
| <i>C. alii</i> | Biseriate | 150 - 250 | 7 - 8 |
| <i>C. decipiens</i> | Biseriate | 160 - 225 | 7 |
| <i>C. decipiens</i> var. <i>multifida</i> | Biseriate | 160 - 250 | 7 |
| <i>C. lessertiana</i> | Biseriate | 90 - 185 | 5 - 7 |
| <i>C. lessertiana</i> var. <i>dentata</i> | Biseriate | 105 - 185 | 5 - 6 |
| <i>C. lessertiana</i> var. <i>lyrata</i> | Biseriate | 105 - 195 | 5 - 7 |
| <i>C. macrorrhiza</i> | Biseriate | 150 - 209 | 6 - 7 |
| <i>C. qaiseri</i> | Biseriate | 119 - 190 | 6 - 7 |
| <i>C. rapunculoides</i> | Biseriate | 70 - 120 | 8 - 9 |
| <i>C. gilgitensis</i> | Biseriate | 170 - 220 | 7 - 8 |
| <i>Prenanthes brunoniana</i> var. <i>brunoniana</i> | Biseriate | 90 - 139 | 6 - 8 |
| <i>P. brunoniana</i> var. <i>alliaricaefolia</i> | Biseriate | 80 - 125 | 6 - 8 |
| <i>P. aitchisoniana</i> | Biseriate | 100 - 120 | 6 - 7 |
| <i>P. stewartii</i> | Biseriate | 110 - 129 | 6 - 7 |

Table 1. (Cont'd.)

| Name of taxa | Carpopodium | | |
|---|---|------------------------------|--------------------------|
| | Shape | Diameter of carpopodium (µm) | Diameter of foramen (µm) |
| <i>Lactuca dissecta</i> | Completely developed symmetrical narrow circular ring without interruption | 114 - 118 | 71.8 - 108 |
| <i>L. dolichophylla</i> | Completely developed symmetrical narrow circular ring without interruption | 221 - 263 | 148 - 195 |
| <i>L. glaucifolia</i> | Completely developed symmetrical broad circular ring without interruption | 185 - 194 | 53.9 - 119 |
| <i>L. sativa</i> | Incompletely developed asymmetrical broad ring with extensive interruption | 248 - 263 | 127 - 136 |
| <i>L. serriola</i> | Incompletely developed asymmetrical U-shaped with 2-narrow interruption | 214 - 233 | 121 - 143 |
| <i>L. undulata</i> | Completely developed symmetrical broad circular ring without interruption | 228 - 261 | 124 - 125 |
| <i>L. orientalis</i> | Completely developed asymmetric narrow circular ring without interruption | 333 - 399 | 203 - 247 |
| ssp. <i>nuristanica</i> | Completely developed asymmetric narrow circular ring with an interruption | 345 - 376 | 235 - 246 |
| <i>L. viminea</i> | Completely developed asymmetric narrow circular ring without interruption | 294 - 305 | 167 - 182 |
| <i>L. erastrata</i> | Completely developed asymmetric narrow circular ring without interruption | 293 - 327 | 211 - 215 |
| <i>L. clarkei</i> | Completely developed asymmetric narrow circular ring without interruption | 168 - 279 | 115 - 235 |
| <i>L. tataricum</i> | Completely developed asymmetric narrow cordate ring without interruption | 172 - 294 | 126 - 298 |
| <i>L. crambifolia</i> | Incompletely developed asymmetrical irregular ring with interruption | 192 | 150 |
| <i>L. persica</i> | Incompletely or one sided development asymmetrical with extensive interruption | 216 | 197 |
| <i>Cicerbita chitralensis</i> | Completely developed symmetrical narrow circular ring without interruption. | 230-272 | 137-178 |
| <i>C. picridiformis</i> | Completely developed symmetrical narrow circular ring without interruption. | 233 | 149 |
| <i>C. alii</i> | Completely developed symmetrical narrow circular ring without interruption | 353 - 407 | 218 - 288 |
| <i>C. decipiens</i> | Incompletely developed asymmetrical ring with interruption or 3-4 lobed | 395 - 401 | 283 - 286 |
| <i>C. decipiens</i> var. <i>multifida</i> | Incompletely developed asymmetrical ring with interruption or 3-4 lobed | 380 - 417 | 210 - 280 |
| <i>C. lessertiana</i> | Completely developed narrow circular ring without interruption | 303 - 375 | 210 - 232 |
| <i>C. lessertiana</i> var. <i>dentata</i> | Completely developed narrow circular ring without interruption | 335 - 380 | 218 - 240 |
| <i>C. lessertiana</i> var. <i>lyrata</i> | Completely developed narrow circular ring without interruption | 354 - 391 | 213 - 245 |
| <i>C. macrorhiza</i> | Completely developed narrow circular ring without interruption | 288 | 194 |
| <i>C. qaiseri</i> | Completely developed narrow circular ring without interruption | 380 - 410 | 270 - 268 |
| <i>C. rapunculoides</i> | Completely developed narrow circular ring without interruption | 267 - 398 | 171 - 292 |
| <i>C. gilgitensis</i> | Completely developed narrow circular ring without interruption | 370 - 446 | 229 - 295 |
| <i>Prenanthes brunoniana</i> var. <i>brunoniana</i> | Completely developed asymmetric narrow ring without interruption and 2-lobed | 322 - 343 | 204 - 228 |
| <i>P. brunoniana</i> var. <i>allariaefolia</i> | Completely developed asymmetric narrow ring without interruption and 2-lobed | 311 - 336 | 219 - 230 |
| <i>P. aitchisoniana</i> | Completely developed asymmetric narrow ring without interruption and slightly lobed | 524 - 546 | 346 - 381 |
| <i>P. stewartii</i> | Completely developed asymmetric narrow ring without interruption and lobed | 404 - 457 | 223 - 322 |

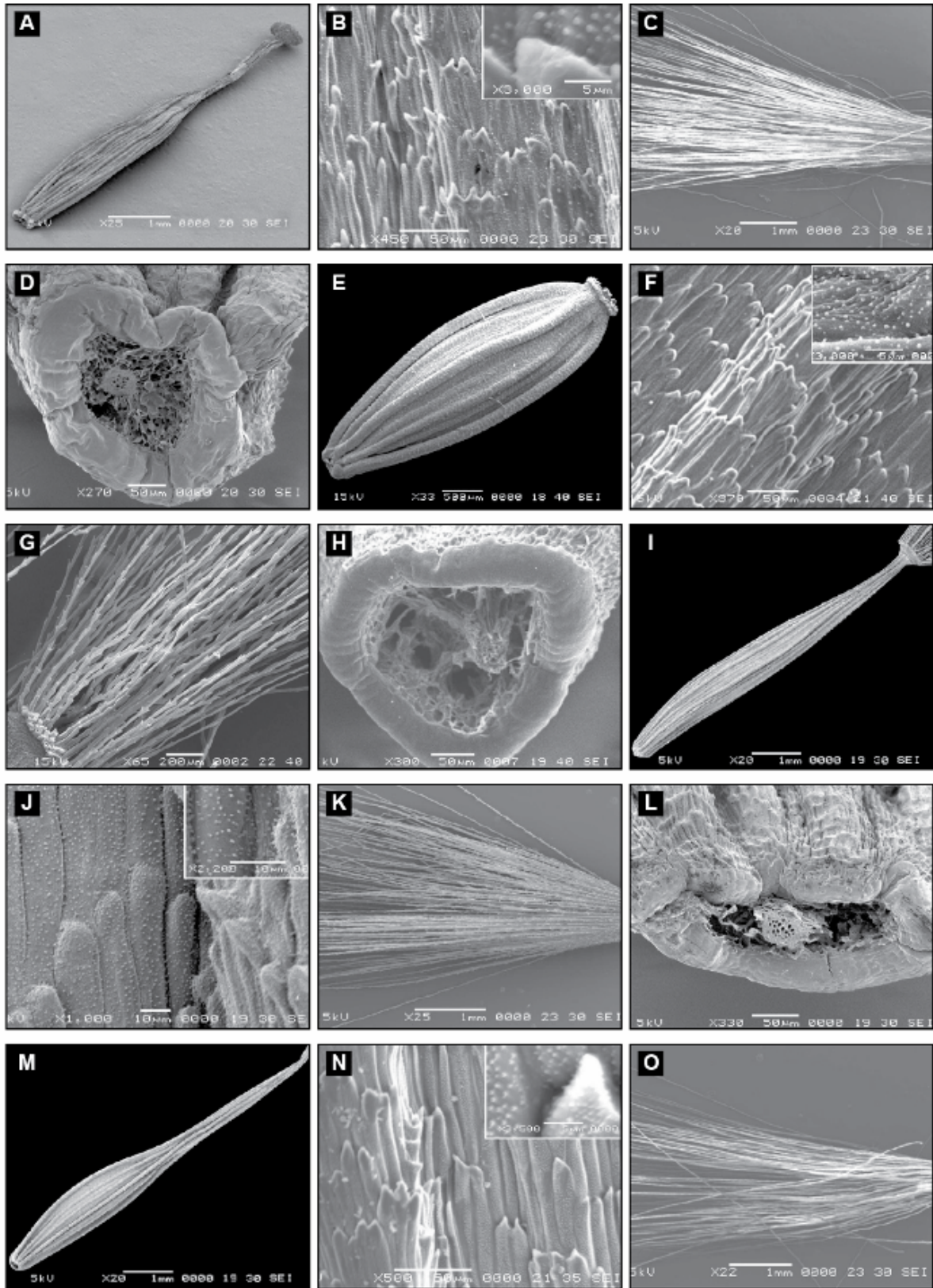


Fig. 1. Scanning Electron Micrographs (SEM) of cypselas: *Lactuca orientalis* subsp. *orientalis*: A, cypselas; B, surface; C, pappus; D, carpodium. *Lactucae rostrata*: E, cypselas; F, surface; G, pappus; H, carpodium. *Lactuca orientalis* subsp. *nuristanica*: I, cypselas; J, surface; K, pappus; L, carpodium. *Lactuca viminea*: M, cypselas; N, surface; O, pappus (Scale bar: J = 10µm; B, D, F, H, L, N = 50 µm; A, C, I, K, M, O = 1 mm; G = 200 µm; E = 500 µm)

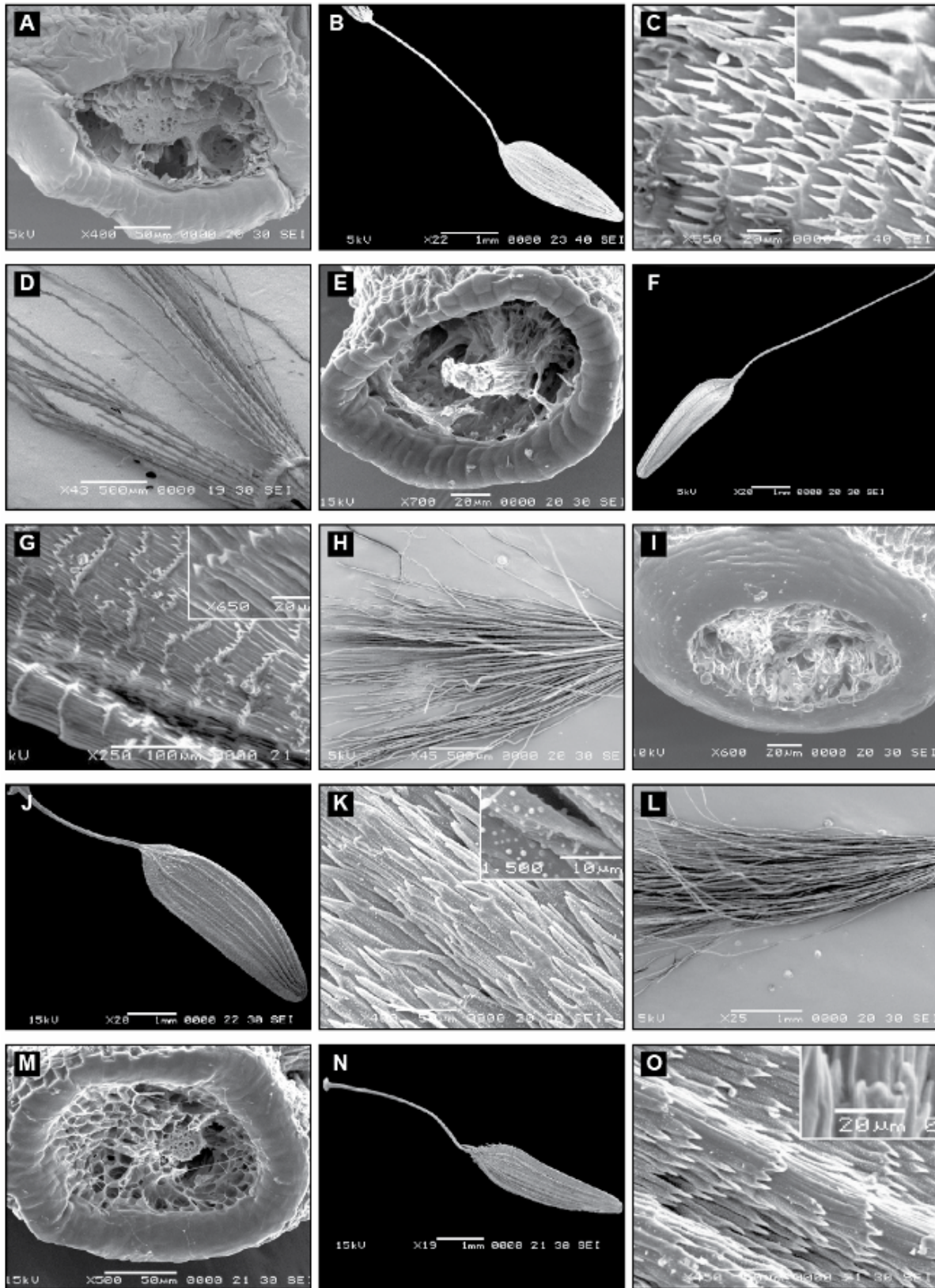


Fig. 2. Scanning Electron Micrographs (SEM) of cypselas: *Lactuca orientalis* subsp. *nuristanica*: A, carpodium. *Lactuca dissecta*: B, cypselas; C, surface; D, pappus, E, carpodium. *Lactuca glaucifolia*: F, cypselas; G, surface; H, pappus; I, carpodium. *Lactuca dolichophylla*: J, cypselas; K, surface; L, pappus, M, carpodium. *Lactuca serriola*: N, cypselas; O, surface (Scale bar: C, E, I = 20 μ m; A, K, M = 50 μ m; B, F, J, L, N = 1 mm; G = 100 μ m; O, 450 μ m; D, H = 500 μ m)

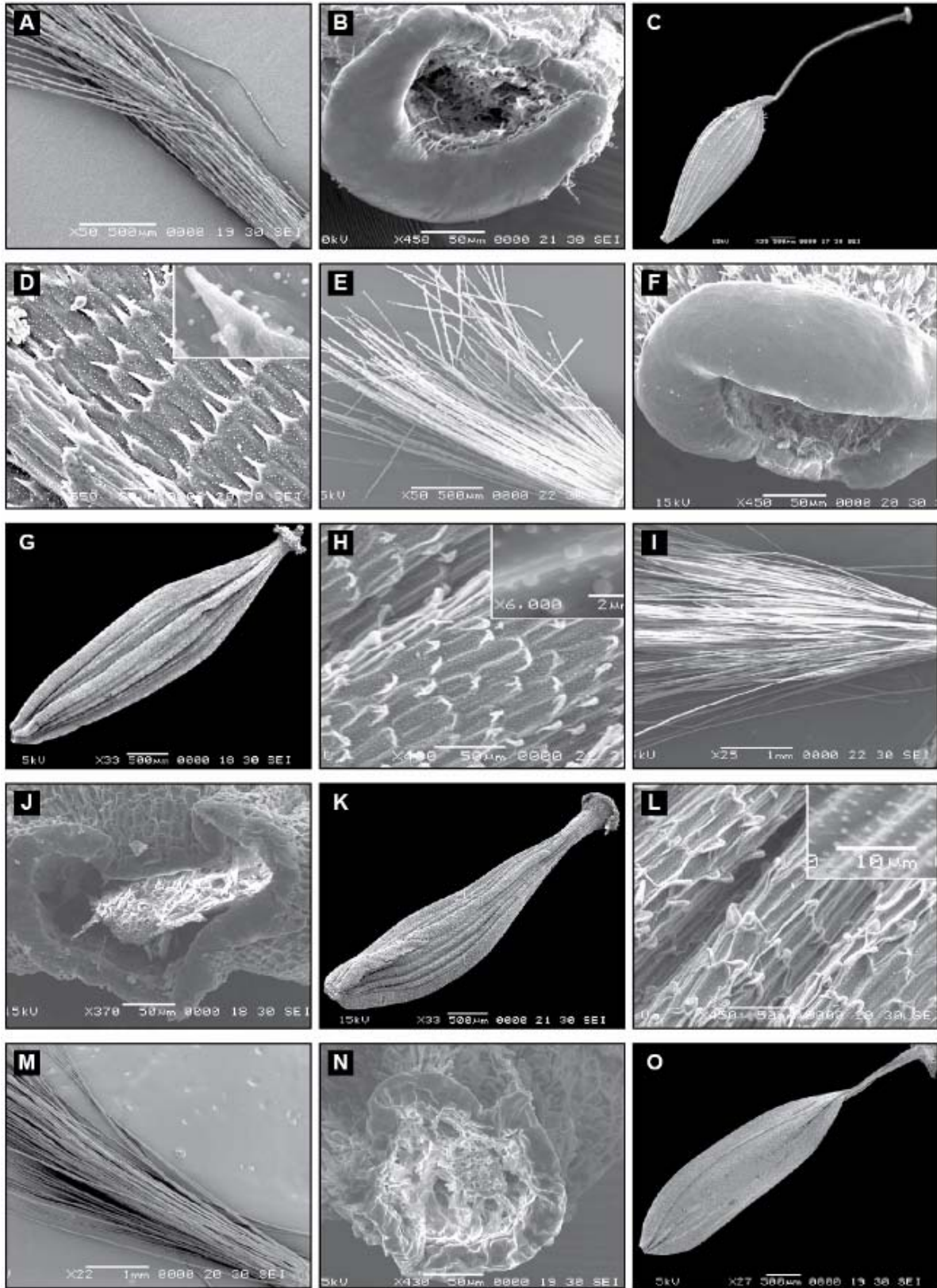


Fig. 3. Scanning Electron Micrographs (SEM) of cypselas: *Lactuca serriola*: A, pappus; B, carpododium. *Lactuca sativa*: C, cypselas; D, surface; E, pappus; F, carpododium. *Lactuca tatarica*: G, cypselas; H, surface; I, pappus; J, carpododium. *Lactuca clarkei*: K, cypselas; L, surface; M, pappus; N, carpododium. *Lactuca crambifolia*: O, cypselas (Scale bar: D = 25µm; B, F, H, J, L, N = 50 µm; I, M = 1 mm; = 100 µm; O, 450 µm; A, C, E, G, K, O = 500 µm)

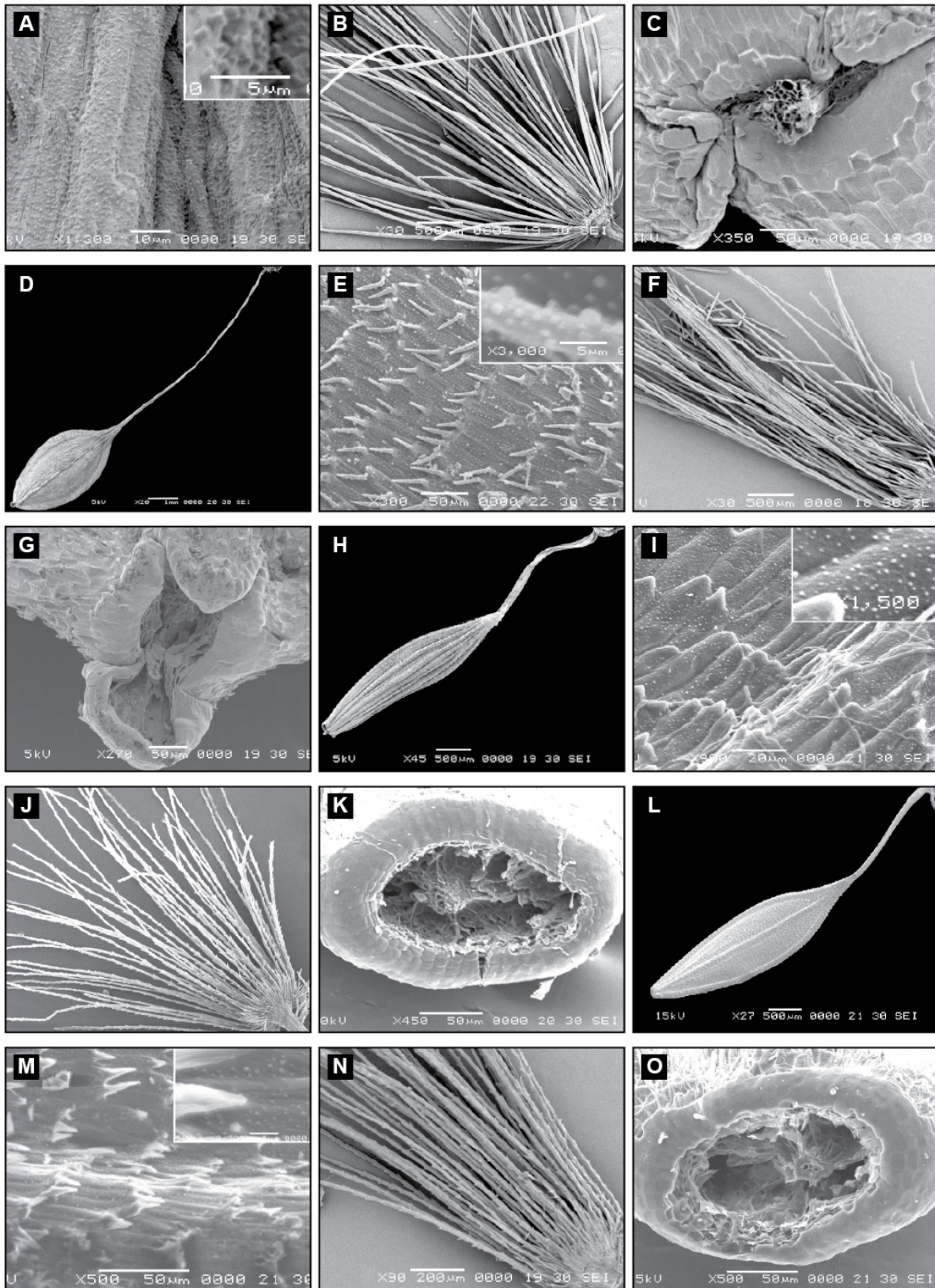


Fig. 4. Scanning Electron Micrographs (SEM) of cypselas: *Lactuca crambifolia*: A, surface; B, pappus; C, carpodium. *Lactuca persica*: D, cypselas; E, surface; F, pappus; G, carpodium. *Cicerbita chitralensis*: H, cypselas; I, surface; J, pappus; K, carpodium. *Cicerbita picridiformis*: L, cypselas; M, surface; N, pappus; O, carpodium (Scale bar: A= 10 μ m; I = 20 μ m; C, E, G, K, M, O = 50 μ m; D, J = 1 mm; N= 200 μ m; B, F, H, L = 500 μ m)

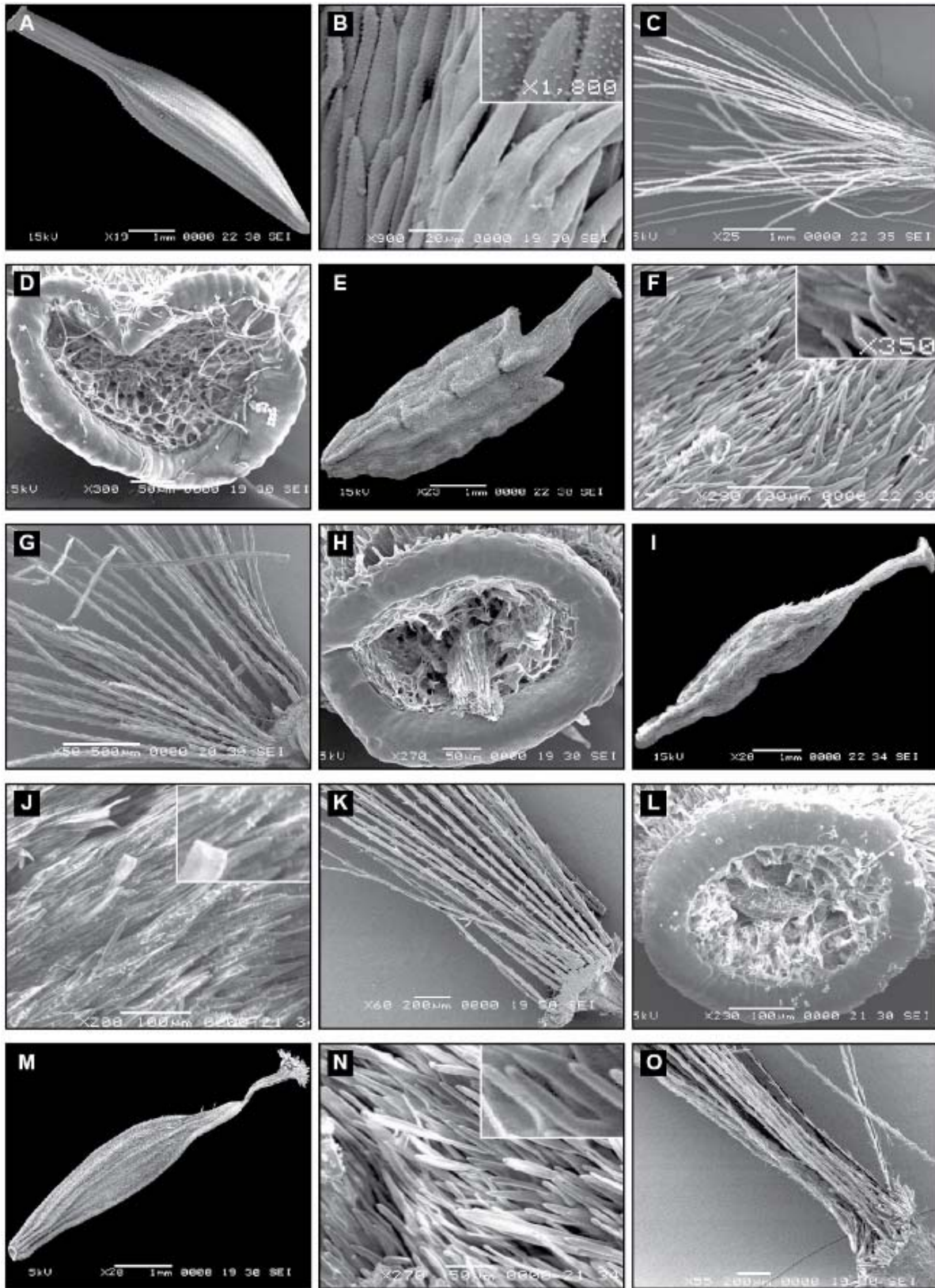


Fig. 5. Scanning Electron Micrographs (SEM) of cypselas: *Cicerbita qaiserii*: A, cypselas; B, surface; C, pappus; D, carpodium. *Cicerbita alii*: E, cypselas; F, surface; G, pappus; H, carpodium. *Cicerbita gilgitensis*: I, cypselas; J, surface; K, pappus; L, carpodium. *Cicerbita macrorrhiza*: M, cypselas; N, surface; O, pappus (Scale bar: B = 20 μ m; D, H, N = 50 μ m; A, C, E, I, M = 1 mm; F, J, L = 100 μ m; K, O = 200 μ m; G = 500 μ m)

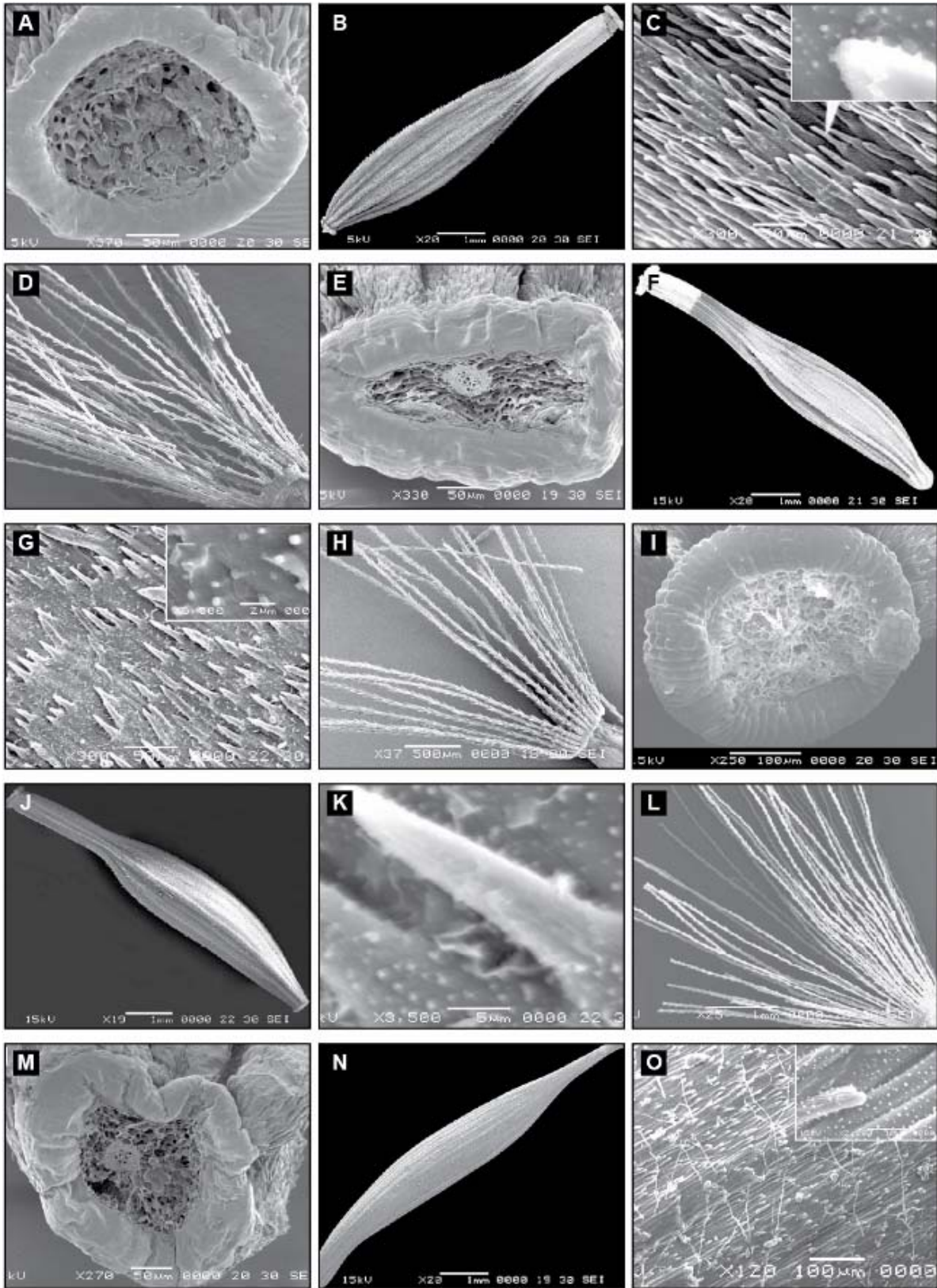


Fig. 6. Scanning Electron Micrographs (SEM) of cypselas: *Cicerbita macrorhiza*: A, carpopodium. *Cicerbita lessertiana* var. *lessertiana*: B, cypselas; C, surface; D, pappus; E, carpopodium. *Cicerbita lessertiana* var. *lyrata*: F, cypselas; G, surface; H, pappus; I, carpopodium. *Cicerbita lessertiana* var. *dentata*: J, cypselas; K, surface; L, pappus; M, carpopodium. *Cicerbita rapunculoides*: N, cypselas; O, surface (Scale bar: A, C, E, G, H, M = 50 µm; B, F, J, L, N = 1 mm; I, O = 100 µm; D, H = 500 µm; K = 5 µm)

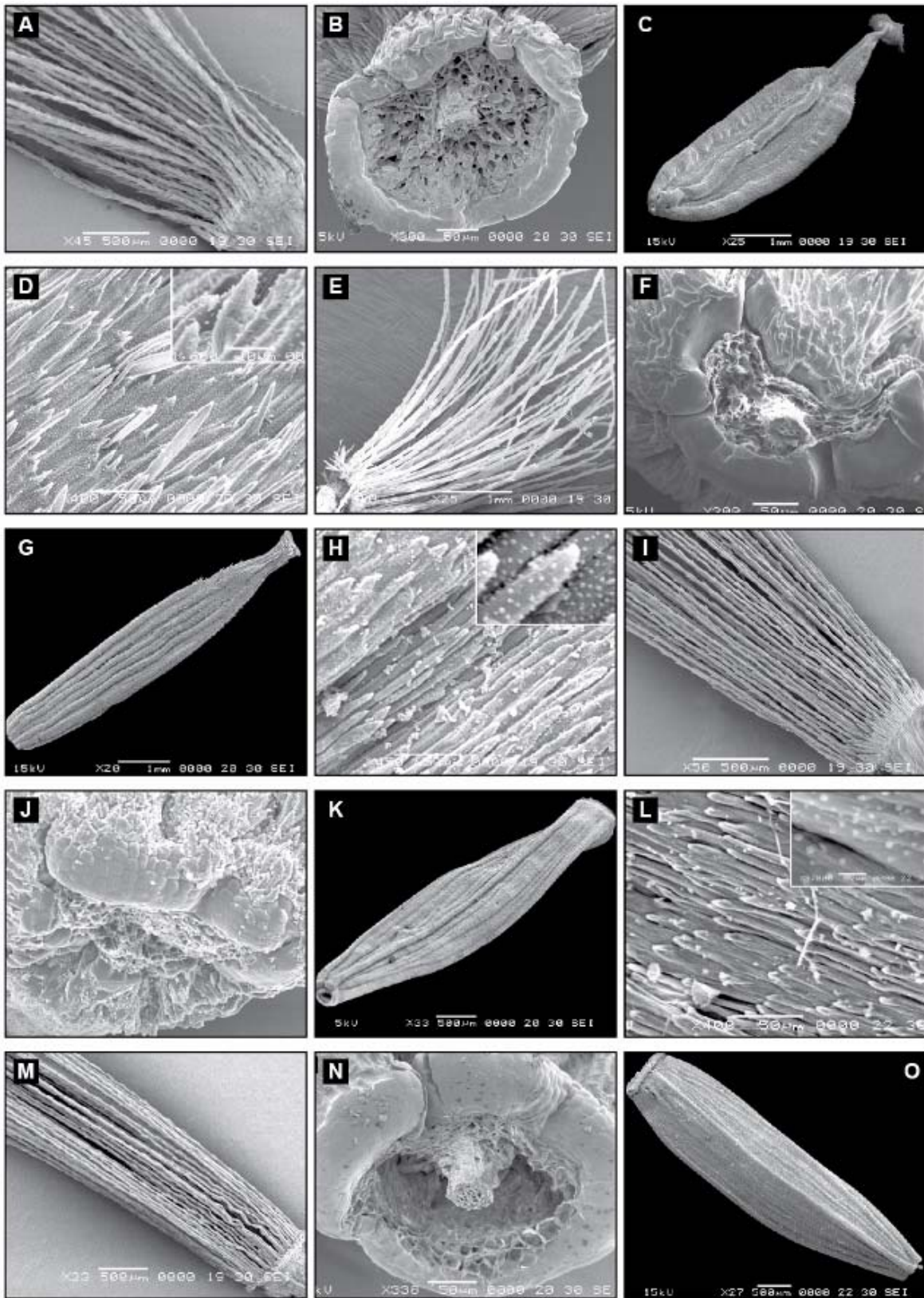


Fig. 7. Scanning Electron Micrographs (SEM) of cypselas: *Cicerbita rapunculoides*: A, pappus, B, carpophodium. *Cicerbita decipiens* var. *decipiens*: C, cypselas; D, surface; E, pappus; F, carpophodium. *Cicerbita decipiens* var. *multifida*: G, cypselas; H, surface; I, pappus; J, carpophodium. *Prenanthes brunoniana* var. *brunoniana*: K, cypselas; L, surface; M, pappus; N, carpophodium. *Prenanthes brunoniana* var. *alilariaefolia*: O, cypselas (Scale bar: B, D, F, H, L, N = 50 μm; C, E, G, J = 1 mm; A, I, K, M, O = 500 μm)

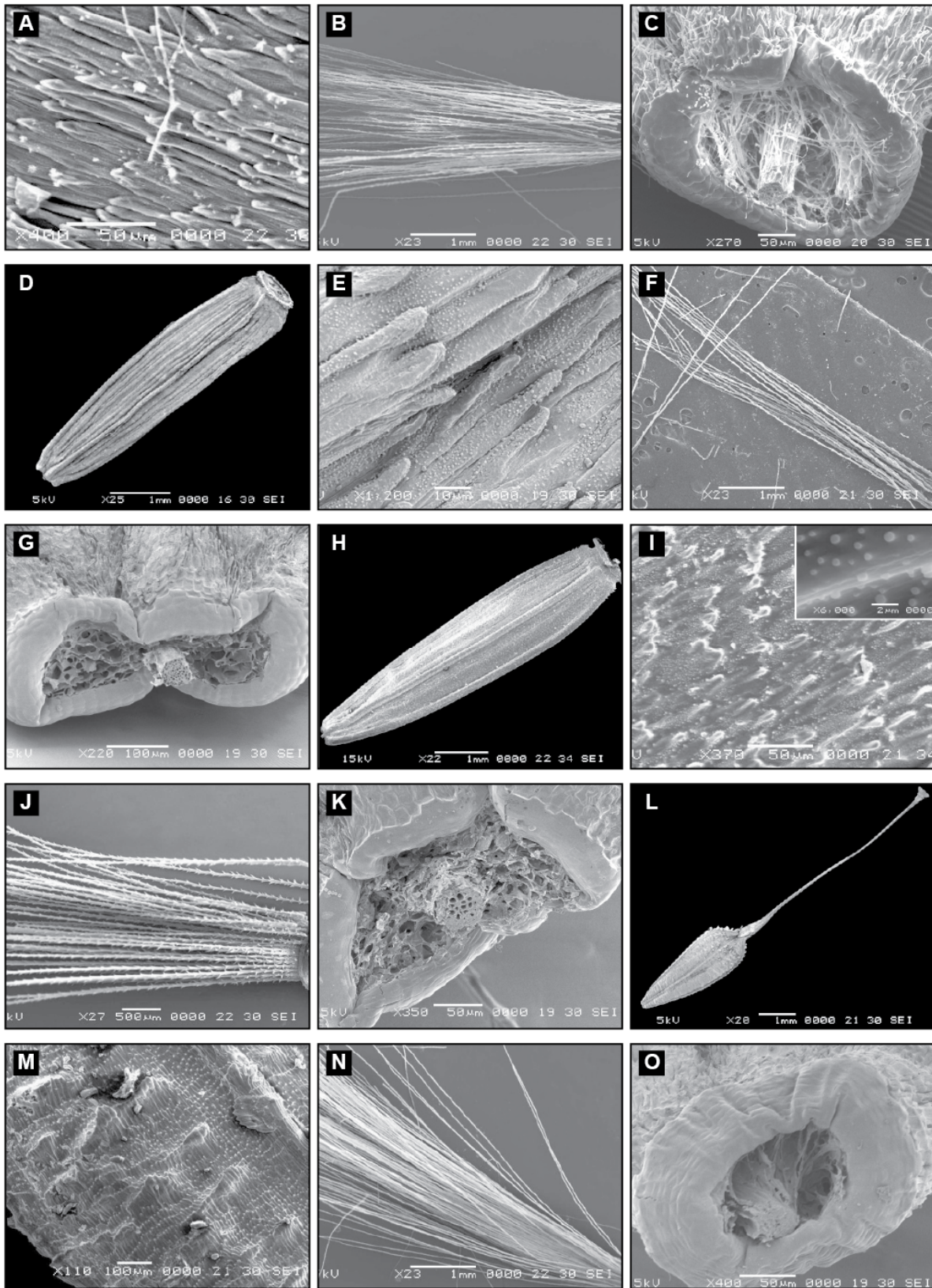


Fig. 8. Scanning Electron Micrographs (SEM) of cypselas: *Prenanthes brunoniana* var. *atilariaefolia*: A, surface; B, pappus; C, carpodium. *Prenanthes aitchisoniana*: D, cypselas; E, surface; F, pappus; G, carpodium. *Prenanthes tewartii*: H, cypselas; I, surface; J, pappus; K, carpodium. *Lactuca undulata*: L, cypselas; M, surface; N, pappus; O, carpodium (Scale bar: E = 10 μ m; A, C, I, K, O = 50 μ m; B, D, F, H, L, N = 1 mm; G, M = 100 μ m; J = 500 μ m)

2. *Cicerbita* Wallr. It is represented by 11 species in our area. However, cypselas of *C. benthamii* (C.B. Clarke) Roohi Bano & Qaiser and *C. polyclada* (Boiss.) Beauv., could not be studied due to non availability of the material.

Cypselas 5-32 per capitulum, 5-12 x 1-2 mm, almost cuneate, elliptic - linear or oblong, oblanceolate - cylindrical, reddish-blackish, brown-dark brown, greyish black or black, ribs narrow, irregular, 3-7(-14) on each side, entire or wavy, muricate - hispid, scabrid- hispidulous or densely thick hairs are also present, beak 1.5-3 mm long, concolorous, white-

concolorous, smooth, slender, smaller than the body; cream or white mostly towards the apex; pappus biseriate, setae of outer pappus small, up to 1 mm, transparent, setae of inner pappus 3-12 mm long, dirty white or white or snowy white, setae 80-250, widened towards the apex, fragile or not-fragile. Carpodium completely developed, asymmetric or symmetric, narrow circular ring with or without interruption, lobed or unlobed, basal or sub basal in position, 267-446 μm in diameter, foramen 137-295 μm in diameter (Table 1; Fig. 4H-O, Fig. 5 and 6A-O, Fig. 7A-J).

Key to the species and species group of *Cicerbita* Wallr.

- 1 + Carpodium lobed or with interruption *C. decipiens*
 - Carpodium un-lobed or without interruption 2
- 2 + Cypselas red-black elliptic, 5-6 mm long; beak slender; pappus 3-5 mm long; carpodium 230-272 μm in diameter, foramen 137-178 μm in diameter 3
 - Cypselas brown - black, oblanceolate- cylindrical or ellipsoid-linear, 6-12 mm long, beak stout; pappus 5-12 mm long; carpodium 267- 446 μm in diameter, foramen 171- 295 μm in diameter 4
- 3 + Cypselas red when young afterward dark brown or blackened; beak white up to 3 mm long; pappus 3-4 mm long *C. picridiformis*
 - Cypselas black; beak concolorous or pale up to 2 mm long; pappus 5-6 mm long *C. chitralensis*
- 4 + Cypselas greyish-black, upto 7 mm long including beak; beak up to 2 mm long; pappus 8-12 mm long, snowy white 5
 - Cypselas brown - dark brown, upto 9 mm long including beak; beak up to 3 mm long; pappus 6-9 mm long, dull white or white 6
- 5 + Cypselas 6-8 x 2 mm, oblanceolate-cylindrical, ribs and margin become wavy, densely thick hairy, carpodium 353-446 μm in diameter and foramen 218- 295 μm in diameter **Group I** (*C. alii* & *C. sherwalii*)
 - Cypselas 5.5 x 1-1.5 mm, elliptic, ribs and margin entire, carpodium 288 μm in diameter, foramen 194 μm in diameter *C. macrorhiza*
- 6 + Cypselas 5 per capitulum, 12 mm long including beak; beak concolorous; pappus 8-9 mm long, diameter of carpodium 267-398 μm and foramen 171-292 μm *C. rapunculoides*
 - Cypselas c.30 per capitulum, 6-8 mm long including beak; beak discolorous; pappus 5-7 mm long, carpodium 303-391 μm in diameter, foramen 210-245 μm in diameter **Group I** (*C. astorensis* & *C. lessertiana*)

3. *Prenanthes* L. It is represented by 3 species in our area.

Cypselas 3 per capitulum, mostly oblong, cylindrical, 5-7 mm long, brown- black. Surface finely scabrid, narrow towards the base, truncate or rounded apically, angled or prismatic or having 2 facies, outer with 3 prominent ribs; inner with 5-7

narrow ribs on each side, beakless. Pappus biseriate, outer setae small; inner 6-8 mm long, dirty white, deciduous, setae 80-140. Carpodium narrow circular ring or U-shaped with 2-sided interruption, carpodium 311-546 μm in diameter, foramen 204-381 μm in diameter (Table 1; Fig. 7K-O and Fig. 8A-K).

Key to the species of *Prenanthes* L.

- 1 + Cypselas brown, 5mm long **Group I** (*P. brunoniana* & *P. aitchisoniana*)
 - Cypselas black, 7mm long *P. stewartii*

Appendix I. List of the voucher specimen for cypsela morphology.

| Taxa | Collector, number, herbarium |
|---|---|
| <i>Lactuca undulata</i> | S. Omer, S. Nazimuddin & A. Wahid 972 (KUH); S. Abedin 4968 (KUH); Zaffar Ali 4783 (KUH); Rubina Rafiq & Sikander Hayat HG-97-119 (RAW); Jennifer Lamond 1078 (E). |
| <i>Lactuca orientalis</i> subsp. <i>orientalis</i> | R.R. Stewart 18909 (KUH); Surraya Khatoon, Atta Muhammad & Gul Jan 460 (KUH); A. Ghafoor & S. Omer 2191 (KUH), M. Ahmed 2733 (KUH). |
| <i>Lactuca orientalis</i> subsp. <i>nuristanica</i> | S. Omer & A. Ghafoor 1621 (KUH); A. Rashid 1103 (KUH); S. Omer & M. Qaiser 2437 (KUH); T. Ali, S.Z. Hussain & Gohar Khan 2212 (KUH); S. Abedin & M. Qaiser 9148 (KUH); T. Ali et al. 2344 (KUH); M. Qaiser 1229 (KUH); M.A. Siddiqui, M. Nasir & Zafar 4180 (BM). |
| <i>Lactuca viminea</i> | M. Qaiser 77 (KUH); A. Ghafoor & S. Omer 2213 (KUH); M. Qaiser & A. Ghafoor 4335 (KUH) T. Ali & Tufail Ahmed 1204 (KUH); R.R. Stewart 28043 (KUH); A. Ghafoor & S. Omer 2232 (RAW); S.M.A. Kazmi & M. Salim 3311 (M); B.L. Burt 1529 (E). |
| <i>Lactuca erostrata</i> | Jan Alam & Alika 3016 a,b (KUH); Ali Noor 1726, 1733 (KUH). |
| <i>Lactuca dissecta</i> | T. Ali, M. Qaiser & M. Ajmal Khan 585 (KUH); S. Abedin 8138 (KUH); M. Qaiser & A. Ghafoor 6758 (KUH); M. Qaiser & Rizwan Yousuf 8074 (KUH); S. Abedin & M. Qaiser 8960 (KUH); G.R. Sarwar & S. Omer 163 (KUH); Jan Alam s.n. (KUH); Y. Nasir, Rubina Akhtar & Hanif 13074 (RAW); A. Ghafoor 230 (RAW); Mohindar Nath 15452 (RAW). |
| <i>Lactuca glaucifolia</i> | Jennifer Lamond 1113 (E); Jennifer Lamond 638 (E); Jan Alam, R.B. Tareen & Jahangir 2550 (KUH); Jan Alam & Saleem 3706 (KUH); A. Ghafoor & Rizwan Yousuf 1448 (KUH); G. Tusil 28263 (M). |
| <i>Lactuca dolichophylla</i> | S. Omer & M. Qaiser 2765 (KUH); M. Qaiser & A. Ghafoor 5012 (KUH), S. Abedin & M. Qaiser 8965 (KUH); T. Ali, M. Qaiser & M. Ajmal Khan 527 (KUH); O. Polunin 56/768 (BM); O. Polunin 56/425 (BM); J.F. Duthie 12538 (BM); Ludlow & Sheriff 7962 (BM); Mrs. M.A. Evershed s.n. (BM), R.R. Stewart 21292 (RAW). |
| <i>Lactuca serriola</i> | Haidar Ali 4634 (KUH); M. Qaiser & A. Ghafoor 5001 (KUH); T. Ali & Tufail Ahmed 1094 (KUH); Fazal Karim 66 (KUH); T. Ali & Nadeem Ahsan 1947 (KUH); T. Ali & G.R. Sarwar 2619 (KUH); A. Ghafoor & T. Ali 3888 (KUH); Nasir Siddiqui 995 (RAW). |
| <i>Lactuca sativa</i> | Roohi Bano s.n. (KUH); M. Qaiser & A. Ghafoor 4436 (KUH) |
| <i>Lactuca tataricum</i> | Jan Alam & Mir Alam 2250 (KUH); Jan Alam 1960 b (KUH); Jan Alam & Naik Alam 20656 (KUH); Jan Alam & Mir Alam 23306 (KUH); Jan Alam & Zaheer Alam s.n. (KUH); Sajjad Haider 589 (KUH); Haidar Ali 2124, 5151 (KUH); M. Qaiser, S.Omer & S.Z. Hussain 8393 (E); J.D.A Stainton 8415 (BM); Hans Hartmann 1403 (RAW). |
| <i>Lactuca clarkei</i> | Haidar Ali 3036 (KUH); C.B. Clarke 30035, 30390 c (BM). |
| <i>Lactuca crambifolia</i> | Surg. Lt. Harris I.M.S 16,300 (BM); J.D.A. Stainton 2296 (BM); Jan Alam & Karim Madad 1898 (KUH); Jan Alam & Mehboob Ali 2004 (KUH); Sherwali Khan & Shabbir Hussain s.n. (KUH). E. Nasir & G.L. Webster 5835 (KUH); A. Ghafoor & S. Omer s.n. (KUH). |
| <i>Lactuca persica</i> | Abdul Ghafoor & Rizwan Yousuf 1181 (KUH); S. Nazimuddin, S. Abedin & Hameedullah 804 (KUH); S. Nazimuddin & S. Abedin 629 (KUH); S. Omer & A. Ghafoor 1773 (KUH), S. Omer & A. Ghafoor 1798 (KUH); Rubina Akhtar 12608 (RAW). |
| <i>Cicerbita picridiformis</i> | J.D.A Stainton 2590 (BM); Haidar Ali 820 (KUH); Haidar Ali 5393 (KUH); Haidar Ali 5090 (KUH); Haidar Ali 5922 (KUH). |
| <i>Cicerbita chitralensis</i> | S. Omer & A. Ghafoor 1551 (KUH); A. Ghafoor & Rizwan Yousuf 1445 (KUH). |
| <i>Cicerbita qaiseri</i> | O. Polunin 56/717 g (BM); Jan Alam & Fazal Karim 1602 (KUH); Kamal Akhtar Malik & S. Nazimuddin 1676 (KUH); Sherwali Khan 72 (KUH). |
| <i>Cicerbita alii</i> | Ludlow & Sheriff 7867 (BM); Ludlow & Sheriff 9255 (BM), R. Scott Rusell 16031 C (BM); O. Polunin 56/577, 56/567 (BM). |
| <i>Cicerbita gilgitensis</i> | Sherwali Khan & Shabbir Hassan 640 (KUH); Sherwali Khan & Shabbir Hassan 665, 666 (KUH). |
| <i>Cicerbita macrorrhiza</i> | Sherwali Khan & Shabbir Hassan 651 (KUH); A. Rehman 64 (RAW). |
| <i>Cicerbita lessertiana</i> | Ludlow & Sheriff 8032 (BM); C.B. Clarke 24568 (BM); M.A. Evershed s.n. (BM); Sherwali Khan & M. Ali 496 (KUH). |
| <i>Cicerbita lessertiana</i> var. <i>lyrata</i> | Ali Noor 303 (KUH); Jan Alam & Fazal Karim 1415 (KUH); Jan Alam s.n. (KUH); Sherwali Khan & Shabbir Hassan 667, 668 (KUH); R.R. & I.D. Stewart s.n. (RAW); R.R. Stewart 19984 (KUH). |
| <i>Cicerbita lessertiana</i> var. <i>dentata</i> | Ali Noor et al. 584 (KUH); Sherwali Khan & M. Ali 496 (KUH). |
| <i>Cicerbita rapunculoides</i> | R.R. & I.D. Stewart 18463, 19287 (KUH); Ali Noor s.n. (KUH); R.R. & I.D. Stewart 19158 (RAW); R.R. Stewart 18755, 19011 (RAW); E. Nasir & G. L. Webster 6522 (RAW), R. Scott 171 (BM); C.B. Clarke 30836 D (BM). |
| <i>Cicerbita decipiens</i> var. <i>decipiens</i> | R.R. Stewart 12730 (M); Mrs. M.A. Evershed s.n. (BM); R.R. Stewart s.n. (RAW); Sherwali Khan & Shabbir Hussain 384 (KUH); Jan Alam s.n. (KUH); Jan Alam & Noor Din 2861 (KUH); Ali Noor et al. 384 (KUH). |
| <i>Cicerbita decipiens</i> var. <i>multifida</i> | S. Abedin & M. Qaiser 8993 (KUH); S. Omer & M. Qaiser 2512 (KUH); Jan Alam & M. Qaiser 2122 (KUH); Ali Noor & A. Mutalib 155 (KUH); Ali Noor 188 (KUH); Ali Noor & M. Alam 356 (KUH). |
| <i>Prenanthes brunoniana</i> | M. Qaiser & A. Ghafoor 5029 (KUH); Y. Nasir & Zafar Ali 7878 (KUH); Y. Nasir & Nazir 9394 (KUH); A. Ghafoor & T. Ali 4185 (KUH); T. Ali, M. Qaiser & M. Ajmal Khan 479 (KUH); R.R. Stewart, Nasir Siddiqui 1543 (RAW); R.R. Stewart 15271 (RAW) R.R. Stewart 15882 a (RAW); R.R. Stewart 15213 a (RAW). |
| <i>Prenanthes aitchisoniana</i> | R.R. Stewart & A. Rehman 24610 (BM, RAW); A. Ghafoor & T. Ali 4042 (KUH). |
| <i>Prenanthes stewartii</i> | R.R. Stewart 12147 (RAW). |

DISCUSSION

Cypsel morphology are generally regarded as affording the most critical taxonomic characters such as form, size, number and appearance of ribs, shape, colour, beak, nature and series of pappus, and tubercles (Sears, 1922; Jana & Mukherjee, 2012). A extensive literature survey based on the morphological characters of cypsel by various workers such as Blake (1928), Kynclova (1970), Grau (1980), Mateu & Guemes (1993), Mukherjee & Sarkar (1995), Mukherjee (2000), Abid & Qaiser (2002, 2008, 2009, 2010 & 2011), Garg & Sharma (2005 & 2007), Kilian *et al.* (2009) and Bano & Qaiser (2009, 2010 & 2011) reveals that cypsel characters play indispensable role and provided systematically most valuable features for the delimitation of taxa in the family Asteraceae (including Cichoreae). Therefore, in many instance cypsel morphology has also been used to describe new genera and species (Källersjö, 1985, 1988; Nordenstam, 1994; Hermann, 1999; Nordenstam, 2006, Nordenstam *et al.*, 2006; Bano & Qaiser, 2011).

The present study shows a wide variations in macro and micro morphological characters of cypsel of the studied taxa belonging to the following genera viz., *Cicerbita* Wallr., *Lactuca* L. and *Prenanthes* L. (Table 1). These studied genera can be alienated in to two groups on the basis of the number of series of pappus (i.e., pappus uniseriate or biseriate) except that of the genus *Lactuca* L. which falls in both groups. For instance, uniseriate pappus are present in all the studied species of *Lactuca* L. excluding *L. crambifolia* (Bunge) Boiss. and *L. persica* Boiss. in which pappus are biseriate (Fig. 4B and F). Tournefort (1694) was the first to recognize and describe Cichoreae as a taxonomic entity and divided the tribe in to two groups on the basis of presence or absence of pappus. Kilian *et al.* (2009) mentioned that no other morphological feature has received so much attention in the systematic of Cichoreae as the pappus, which had been used as the key feature for subdividing the tribes. Similarly, some earlier workers such as Vailliant (1719) Kynclova (1970), Lovell *et al.* (1986), Bremer (1994), Swelankomo *et al.* (2007), Mukherjee & Sarkar (2008), Abid & Qaiser (2008, 2009) and Bano & Qaiser (2011) also classified the taxa on the basis of pappus in the family Asteraceae. On the other hand, presence or absence of beak have been extensively used systematically but are quite helpful for the identification of taxa such as beakless cypsel is examined in *Lactuca erostrata* Roohi Bano & Qaiser, *Prenanthes brunoniana* Wall ex DC., *P. aitchisoniana* (Beauv.) Roohi Bano & Qaiser and *P. stewartii* Roohi Bano & Qaiser (Fig. 1E, Fig. 7K & O, Fig. 8D & H) whereas in the remaining studied taxa cypsel is beaked (Table 1). Similarly, carpodium features have also found quite useful for the taxonomic classification of the various taxa of the family Asteraceae (Robinson & King, 1977; Haque & Godward, 1984; Mukerjee & Nordenstam, 2004; Zarembo & Boyko, 2008; Abid & Qaiser 2009). The

present results agree with earlier investigation and employed carpodium characters in the systematic of the genus *Lactuca* L. and its allied genera (Table 1). The other external features such as size of cypsel including beak, number of cypsel per capitulum, number of ribs and colour of pappus have also found supportive for taxonomic delimitation of the studied taxa (Table 1). Although the colour of cypsel is not reliable distinguished character thus of limited taxonomic value. Firstly because there is much variation in colour i.e., from yellow-golden brown, dark brown, red- dark red or black, sandy brown- olive green, brown – black. Secondly, the colour of cypsel changes with the level of maturity such as in the case of *Cicerbita picridiformis* (Boiss.) Roohi Bano & Qaiser cypsel is red when young afterward black when mature. Bhar & Mukherjee (2004) has also been made such observation in the tribe Anthemideae (Asteraceae). Similarly, the shape of cypsel is not considered as an essential taxonomic character for the delimitation of taxa, more clearly, because the shape of one species overlaps with other and usually varies from obovate - oblanceolate, elliptic-linear, broad elliptic-oval and oblong.

Thus foregoing discussion conclude that from the systematic point of view, the exomorphology of cypsel is of great value and show a diversity which are taxonomically considerable both at the generic and species level that have also been used to strengthen the systematic position of the taxa represented the genera *Cicerbita* Wallr., *Lactuca* L. and *Prenanthes* L. However, at the infraspecific level cypsel morphology is not supportive as they shared same cypsel features.

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(Received for publication 20 September 2014)