

SEM STUDIES OF THE CYPSELAS OF SOME *HIERACIUM* (ASTERACEAE)

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The cypselas of 11 species of *Hieracium* as studied by scanning electron microscope (SEM) revealed surface ornamentation which showed considerable differences. However, some basic similarities exist in all the species. The differences are used in delimitation of species. An artificial key based on these features is proposed.

Keywords: Cypselas surface ornamentation; *Hieracium*; Scanning electron microscope.

Introduction

Seed morphology has provided many diagnostic taxonomic characters. Chuang and Heckard¹ published the first paper on the structure of seeds of *Cordylanthus* using SEM. In recent years the importance of spermoderm characteristics of seeds using SEM has been widely recognised for identification and taxonomic studies²⁻¹⁰. Studies on surface of cypselas in different species of a single genus may be useful in taxonomic discussions of the larger genus *Hieracium* of the family Asteraceae. Documentation of cypselas surface patterns in this family has been undertaken and the present report forms part of this wider investigation.

Materials and Methods

Mature dried cypselas of *Hieracium amplexicaule* L., *H. bupleurifolium* (Tausch) Zahn, *H. bupleuroides* Gmel., *H. diaphanoides* Lbg. Ssp. *favaum* (Sudre) Zahn., *H. intybaceum* Jacq., *H. inuloides* Tausch., *H. lanatum* Vill., *H. pilosella* L., *H. sabaudum* L., *H. umbellatum* L., *H. vulgatum* fr. were obtained from "Jardin Botanique de l'Universite Louis Pasteur de strasbourg". For SEM studies the cypselas were affixed on aluminium stub with the help of transparent adhesive. The cypselas coated with gold and examined at a range of magnifications in a Leo 435VP scanning electron microscope at AIIMS, New Delhi.

Observations

1. *Hieracium amplexicaule* L. - Cypselas are oblong cylindrical, light brown with maximum axial length and breadth of 3.5×1.0 mm. The surface pattern is striated reticulate with tubercles. The tuberculae, originating from transverse walls, are acute and broader. The cypselas surface is covered with granules and flakes like wax deposits (Figs. 1A,B).

2. *Hieracium bupleurifolium* (Tausch) Zahn. - Cypselas are oblong cylindrical, dark brown with maximum axial length and breadth of 3.4×0.7 mm. The surface pattern is striated reticulate. Pronounced parallel smooth striations

with rare transverse and oblique connections are present (Figs. 1C,D).

3. *Hieracium bupleuroides* Gmel. - Cypselas are oblong cylindrical and light brown having maximum axial length and breadth of 4.5×0.8 mm. The surface pattern is striated reticulate, the reticulae appearing like parallel arranged hexagonal cells (Figs. 2A,B).

4. *Hieracium diaphanoides* Lbg. Ssp. *favaum* (Sudre) Zahn. - Cypselas are oblong cylindrical, dark brown having maximum axial length and breadth of 3.5 × 0.7 mm. The surface pattern is striated reticulate with tubercles. The jet-like broader tuberculae originate from transverse walls. The striations surface is covered with small granules (Figs. 2C,D).

5. *Hieracium intybaceum* Jacq. - Cypselas are oblong cylindrical and light brown having maximum axial length and breadth of 5.0×1.2 mm. The surface pattern is striated reticulate with tubercles. The ornamentation appears to be a parallel arrangement of rectangular cells. The tubercles originate from the transverse walls (Figs. 3A,B).

6. *Hieracium inuloides* Tausch - Cypselas are oblong cylindrical and dark brown having maximum axial length and breadth of 3.5×0.8 mm. The surface pattern is striated reticulate with tubercles. The tuberculae, originating from transverse walls, are broader and acute. The striations have wax deposits here and there (Figs. 3C,D).

7. *Hieracium lantaum* Vill. - Cypselas are oblong cylindrical and dark brown having maximum axial length and breadth of 4.5×0.8 mm. The surface pattern is striated reticulate. The striations are often covered with thin waxy membrane having perforations. Granules and flakes like wax deposits are seen here and there (Figs. 4A,B).

8. *Hieracium pilosella* L. - Cypselas are oblong cylindrical and light brown having maximum axial length and breadth of 2.5 × 0.7 mm. The surface pattern is striated reticulate with tubercles. Striations are thinner and loosely arranged. Small tubercles mostly originate from the longitudinal walls (Figs. 4C,D).

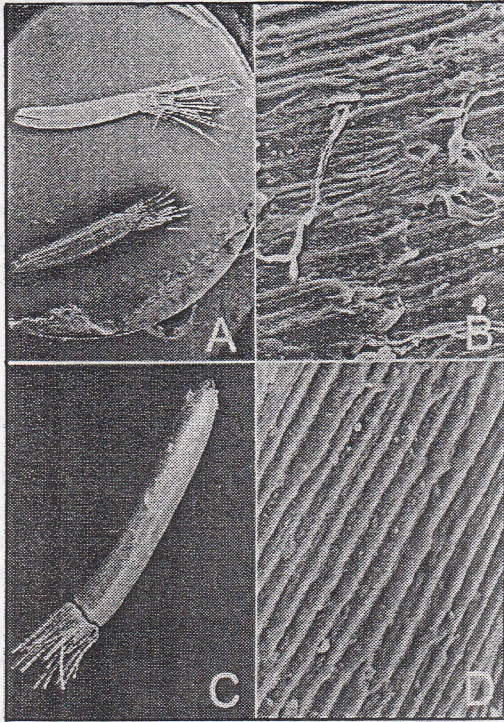


Fig.1. Scanning electron micrographs of cypselas of *Hieracium* : (A-B) *H. amplexicaule* L. (x10,x1000); (C-D) *H. bupleurifolium* (Tausch Zahn) (x24,x1000)

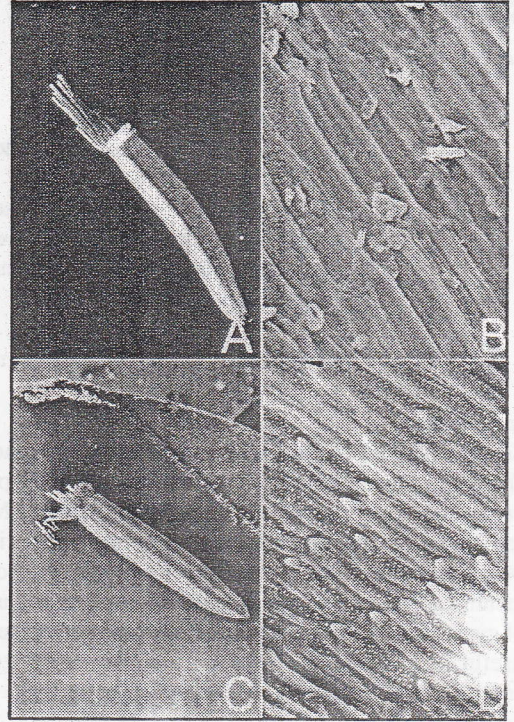


Fig.2. Scanning electron micrographs of cypselas of *Hieracium* : (A-B) *H. bupleuroides* Gmel. (x19,x1000); (C-D) *H. diaphanoides* Lbg. Ssp. *favaum* (sudre) Zahn. (x21,x1000)

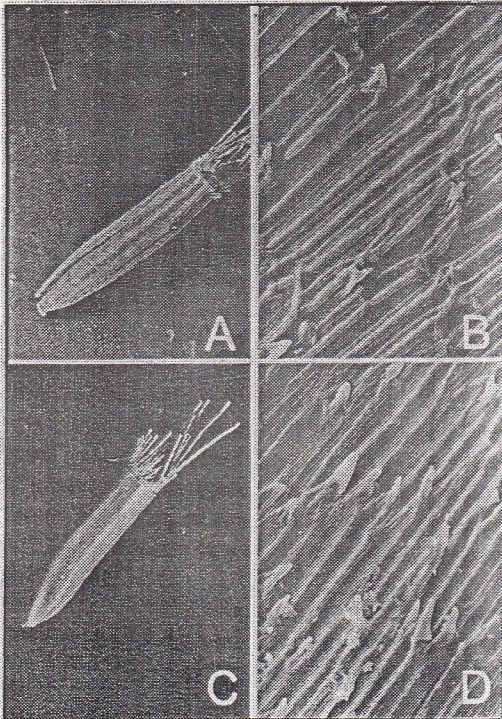


Fig.3. Scanning electron micrographs of cypselas of *Hieracium* : (A-B) *H. intybaceum* Jacq. (x20,x1000); (C-D) *H. inuloides* Tausch. (x22,x1000)

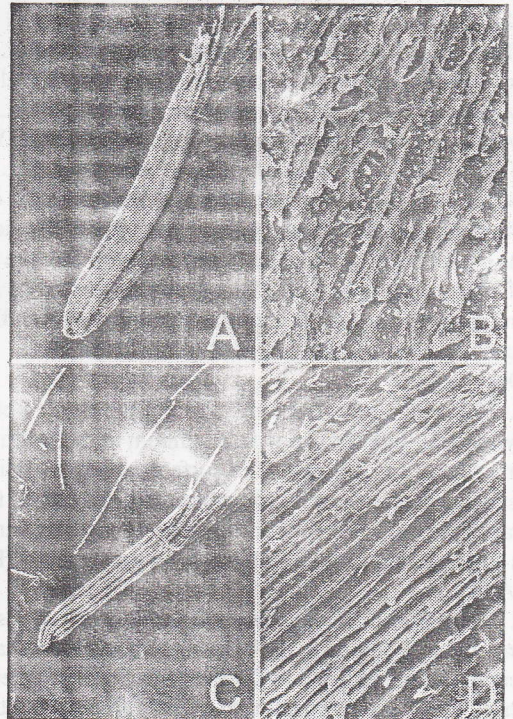


Fig.4. Scanning electron micrographs of cypselas of *Hieracium* : (A-B) *H. lanatum* Vill. (x21, x 1000); (C-D) *H. pilosella* L. (x32,x1000)

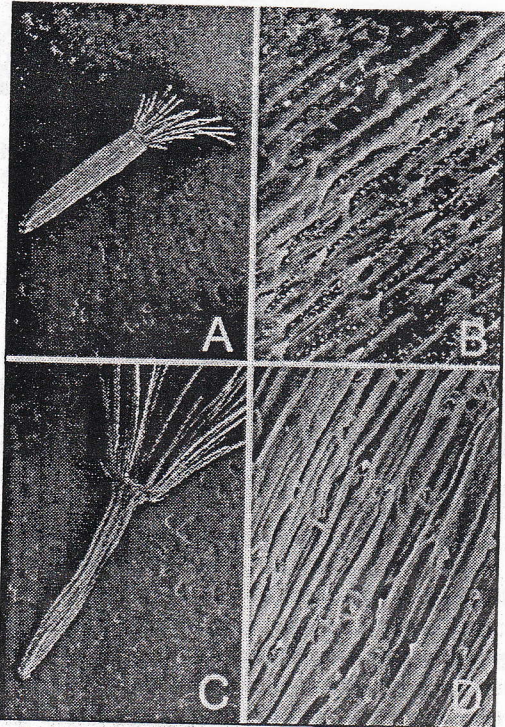


Fig.5. Scanning electron micrographs of cypselas of *Hieracium* : (A-B) *H. Sabaudum* L. (x19, x1000); (C-D) *H. umbellatum* L. (x27,x1000)

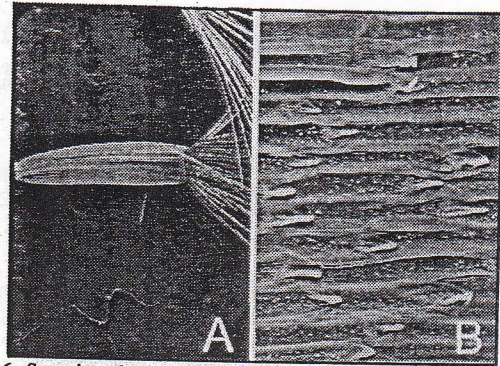


Fig.6. Scanning electron micrographs of cypselas of *Hieracium* : (A-B) *H. vulgatum* fr. (x19,x1000)

9. *Hieracium sabaudum* L. - Cypselas are oblong cylindrical and dark brown measuring maximum axial length and breadth of 4.5×0.8 mm. The surface pattern is striated reticulate with tubercles. The jet-like broader tuberculae are borne on transverse walls. The striations surface is covered with small granules (Figs. 5A,B).

10. *Hieracium umbellatum* L. - Cypselas are oblong cylindrical and light brown having maximum axial length and breadth of 3.0 × 0.6 mm. The surface pattern is striated reticulate. The parallel thicker striations are closely packed and the very small tubercles mostly originate from the transverse walls (Figs. 5C,D).

11. *Hieracium vulgatum* fr. - Cypselas are oblong cylindrical and light brown having maximum axial length and breadth of 4.0×0.8 mm. The surface pattern is striated reticulate with tubercles. The tuberculae are acute and originate from transverse walls. Striations surface have many granules (Figs. 6A,B).

Results and Discussion

Variations observed in the surface patterns of cypselas at high magnification are generally species specific. Barthlott⁶ described and grouped surface characters in four categories usable in taxonomic studies namely, cellular arrangement or patterns, shape of the cells, relief of outer cell walls and epicuticular secretions.

Accordingly many workers have prepared

artificial keys to the spermoderm patterns of different taxa and emphasized the systematic value of these characters. Bahadur *et al.*¹¹ in *Nigella*, Chaung and Heckard¹ in *Orthocarpus*, Das *et al.*¹² in *Ipomea* have provided such keys. The data presented here reveal species specific variations in the basic striated reticulate surface patterns of cypselas of *Hieracium*. A tentative key on the basis of different patterns of the cypselas surfaces in the eleven species of this genus has been proposed as follows:

- A. Striations with tubercles
 - B. Tuberculae originate from transverse walls
 - C. Both granules and wax depositions absent or present.
 - D. Granules and wax deposition absent
 - E. Tuberculae very small; long striations parallelly arranged.....*H. umbellatum*
 - E₁. Tuberculae small; parallel arrangement of rectangular cells.....*H. intybaceum*
 - D₁. Both granules and wax depositions present.
 - F. Tuberculae broader and acute.....*H. amplexicaule*
 - C₁. Either granules or wax depositions absent or present.
 - G. Granules present but wax depositions absent.
 - H. Pronounced tuberculae narrow and acute.....*H. vulgatum*
 - H₁. Jet-like broader tuberculae.....*H. diaphanoides, H. sabaudum*
 - G₁. Waxy depositions present but granules absent.
 - I. Tuberculae broader and acute.....*H. inuloides*
 - B₁. Tuberculae mostly originate from longitudinal walls; striations thinner and loosely arranged.
 - J. Tuberculae very small; granules and wax depositions absent.....*H. pilosella*
- A₁. Striations without tuberculae
 - K. Granules and wax depositions absent
 - L. Striations parallel with rare transverse and oblique connections*H. bupleurifolium*
 - L₁. Reticulae appear like parallelly arranged hexagonal

- cells.....*H. bupluroides*
 K., Granules and wax depositions present.
 M Striations covered with thin waxy membrane
 having perforations.....*H. lanatum*

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