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 studies2-8. 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. bupluroides Gmel., H. diaphanoides Lbg. Ssp. favum (Sudre) Zahn., H. intybaceaum 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 bupluroides 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 parallely arranged hexagonal cells (Figs. 2A,B).
4. Hieracium diaphanoides Lbg. Ssp. favum (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 intybaceaum 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 lanatum 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. bupluroides* Gmel. (x19, x1000); (C-D) *H. diaphanoides* Lbg. *Sp. favaum* (sude) Zahn. (x21, x1000)

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

Fig. 4. Scanning electron micrographs of cypselas of *Hieracium*:
(A-B) *H. lavenum* Vill. (x21, x1000); (C-D) *H. pilosella* L. (x32, 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 L. - 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. Barthlott 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. in Nigella, Chaung and Heckard in Orthocarpus, Das et al. 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

F. Tuberculae small; parallel arrangement of rectangular cells...........H. intybaeum

G. Both granules and wax depositions present.

H. Tuberculae broader and acute..............H. amplexicaule

I. Either granules or wax depositions absent or present.

J. Granules present but wax depositions absent.

K. Pronounced tuberculae narrow and acute........H. vulgatum

L. Jet-like broader tuberculae....................H. diaphanoides, H. sabaudum

M. Waxy depositions present but granules absent.

N. Tuberculae broader and acute..................H. inuloides

O. Tuberculae very small; granules and wax depositions absent.............H. pilosella

P. Both granules and wax depositions present.

Q. Tuberculae mostly originate from transverse walls; striations thinner and loosely arranged.

R. Tuberculae very small; granules and wax depositions absent...........H. bupleurifolium

S. Reticulae appear like parallelly arranged hexagonal
cells......... \textit{H. buphuroides}\\ K, Granules and wax depositions present. \\ M Striations covered with thin waxy membrane having perforations.........\textit{H. lanatum}

\textbf{Acknowledgements}

The authors are thankful to Dr. A.S.R. Dathan for providing material. One (S.K.G.) of us is thankful to CSIR, New Delhi for providing Junior Research Fellowship.

\textbf{References}


