

Seed surface characteristics of Acanthaceae

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ABSTRACT

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Seed surface characteristics of 3 species of family Acanthaceae were studied under scanning electron microscope (SEM). The study reveals surface features of seed coat of dry, ripe seeds of *Andrographis paniculata* (Burm.F) Wall. ex Nees., *Barleria cristata* L. and *Ruellia tuberosa* (L.). Seeds are subquadrate, orbicular to obovate in shape and their surface is glabrous, silky hairy. They vary in size and colour also. *Andrographis* is yellowish-brown, *Barleria* is brownish silky hairy and *Ruellia* has whitish hairy coating. Hilar variations are also observed in these species. The seed coat pattern of *Andrographis* shows rugulate pitted ornamentation and irregular surface. In *Barleria* and *Ruellia*, it shows hairy surface. In *Barleria*, it develops in zig-zag manner and in *Ruellia* it shows tubular fibrous hairy processes on surface. The diversity in seed morphology can be described in terms of size, shape, surface sculpture and hilum morphology. Seed coat structure within a genus can be useful for assessing relationship and delimiting taxa.

Key-words: Scanning electron microscopy (SEM), seed coat, morphology, Acanthaceae.

INTRODUCTION

During the geologic past, evolution of seed played an important role in diversification of angiosperms. A true seed is a mature ovule containing embryo, stored nutrients and integuments of different layers called protective seed coat or testa (Esau 1977). Seeds are basic and important source of food and therefore their study is important for identification and classification. On morphological level, seed coat plays a major role for the identification. The important features of the seed are shape, size, seed coat surface, position of hilum, colour, etc. Detailed surface features were studied by scanning electron microscopy. The important diagnostic features like tufts of hairs, hairy variations and other surface details are characteristic features of seed coat of Acanthaceae.

MATERIAL AND METHOD

Dry, ripe seeds of *Andrographis paniculata* (Burm.F.) Wall. ex Nees, *Barleria cristata* L. and *Ruellia tuberosa* (L.) were collected from various places for studying their surface characteristics. For morphological study, individual seed was mounted on pin-type stubs using double sided adhesive tape or conductive silver paint to prevent charging of the surface during scanning and then was coated with a very thin layer of gold in a Polaron sputter coating unit. For spermoderm study, photomicrographs were taken by scanning electron microscope (LEO 430) at the Birbal Sahni Institute of Palaeobotany, Lucknow.

OBSERVATION

The seeds of *Andrographis paniculata* possess rugosely pitted and glabrous surface with elongated

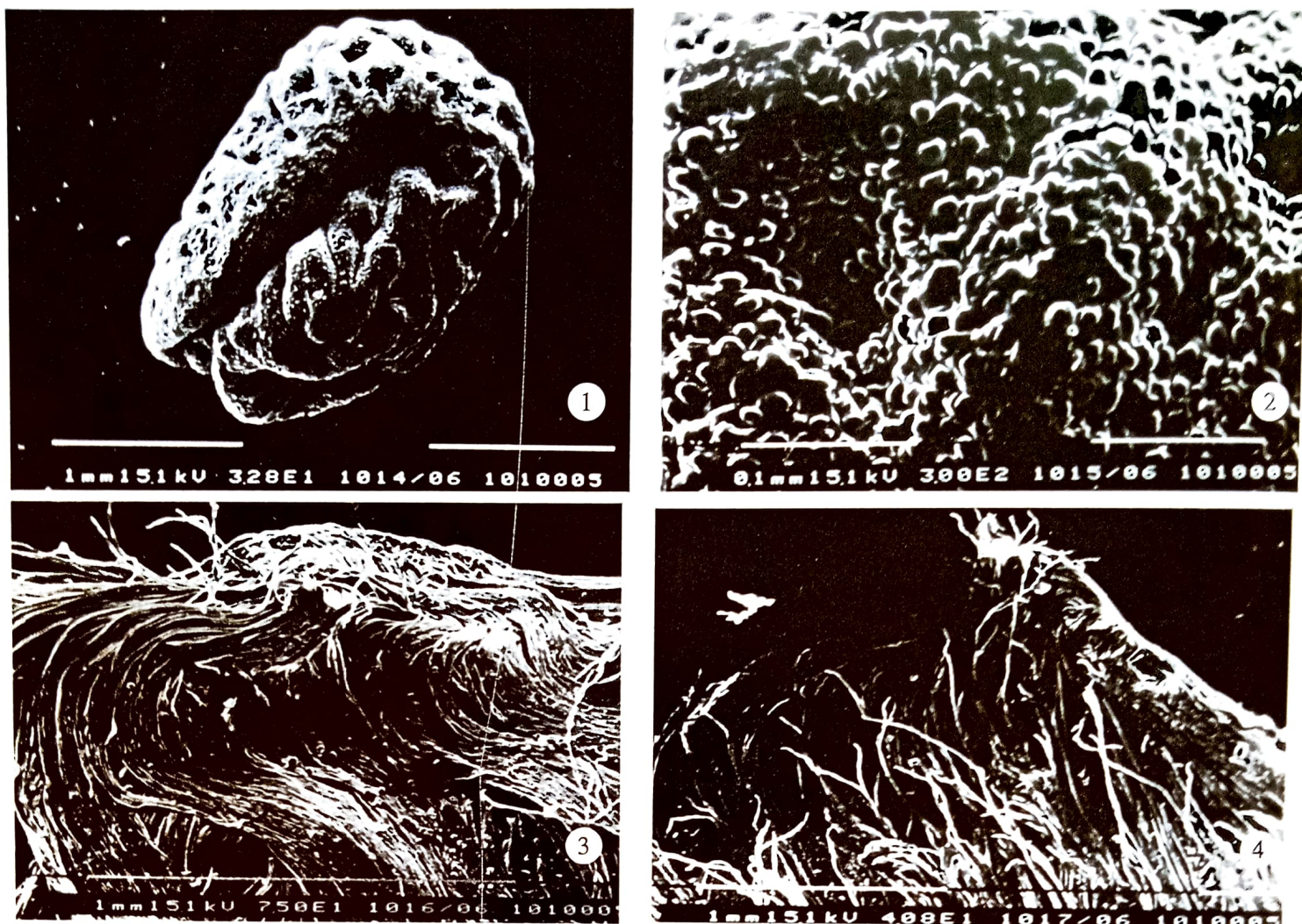


Plate 1

1. *Andrographis paniculata* (Burm.F.) Wall. ex Nees, seed shows irregular surface with pits, x328. 2. *Andrographis paniculata* (Burm.F.) Wall. Ex Nees, rugulate pitted ornamentation, x300. 3. *Barleria cristata* L., seed shows silky hairy structure with zig-zag manner, x750. 4. *Barleria cristata* L., shows tapering end with hairy surface, x408

notch on surface. The hilum is circular and apical. Seeds are yellowish brown in colour and sub-quadrant in shape. In another view, seed surface shows rugulate, pitted ornamentation, pits are large, tuberculate ornamentation on surface (Plate 1, figures 1-2).

The seeds of *Ruellia tuberosa* show whitish hairy surface. Seeds are hygroscopic, glabrous and tapering

at the base. The hilum is elliptical and hairy and apical in position. Seed is brownish, with thick hairy deposition on the surface. Hairs are small tube like. At the base of seed, thick mass is deposited with elongated hairy projections. Middle portion shows long hair, walls are slightly dented. Structural variation is present at middle portion with minor granulated deposition (Plate 2, figures 4-6).

Plate 2

1. *Barleria cristata* L., seed surface showing thick hairy zig-zag pattern, x850. 2. *Barleria cristata* L., surface patches and gaps between them, x406. 3. *Barleria cristata* L., showing minor granulated deposition on elongated fibre, x101. 4. *Ruellia tuberosa* (L.), thick hairy deposition with slightly dentate walls, x150. 5. *Ruellia tuberosa* (L.), long tubular hairy processes tapering towards end, x252. 6. *Ruellia tuberosa* (L.) thick hairy processes, x203.

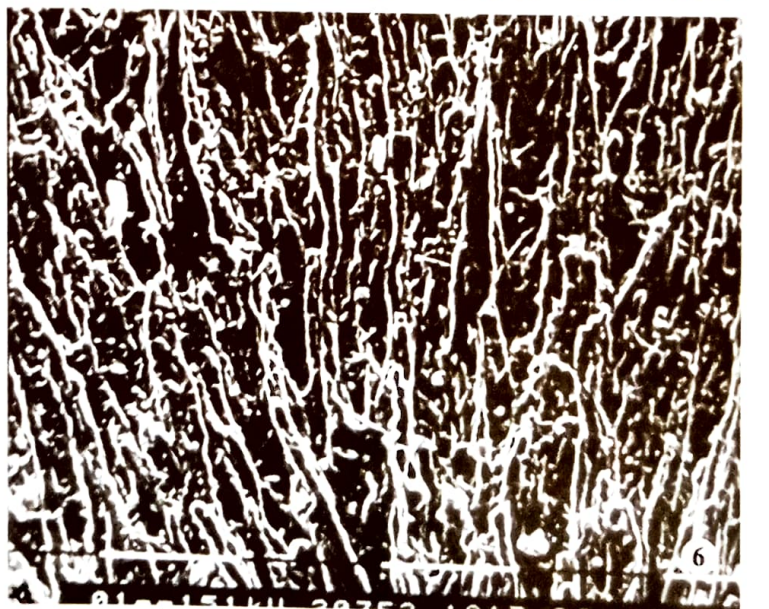
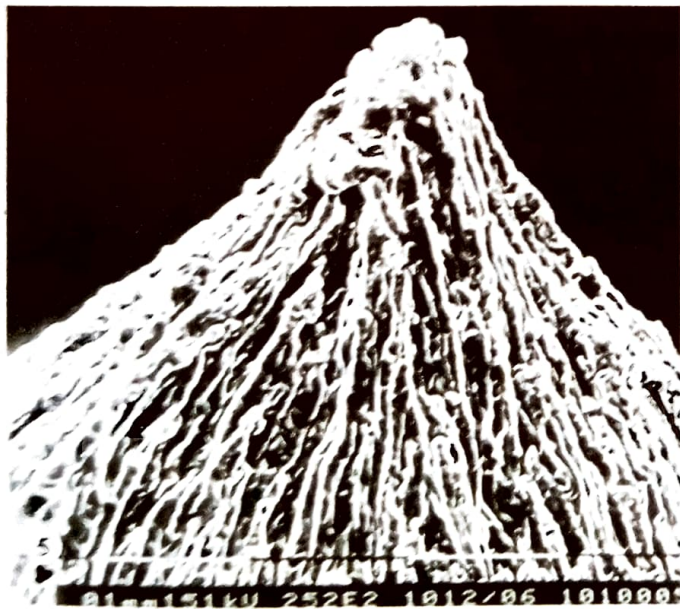
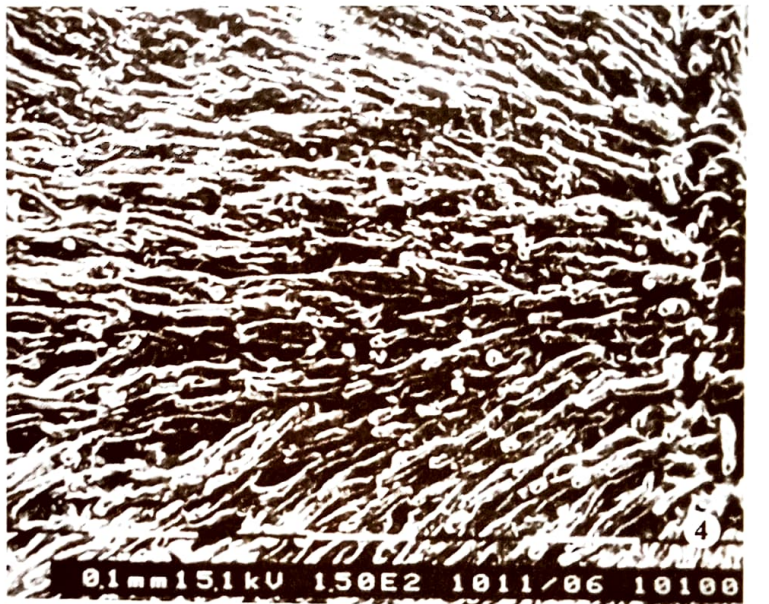
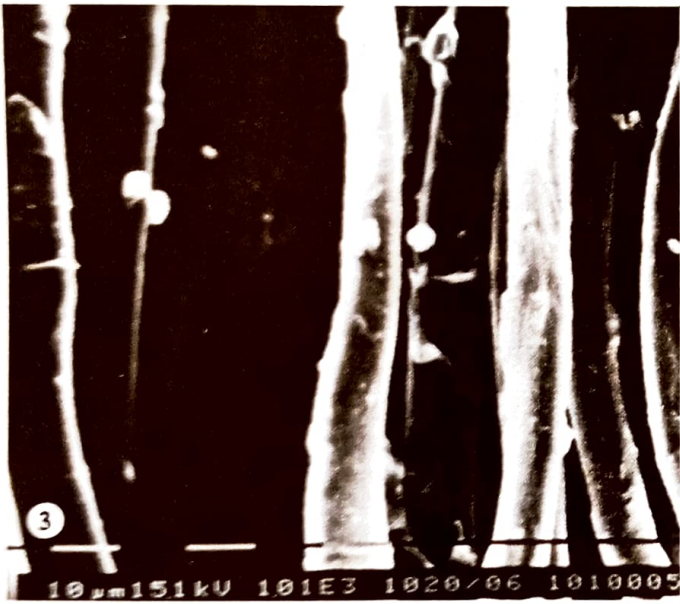
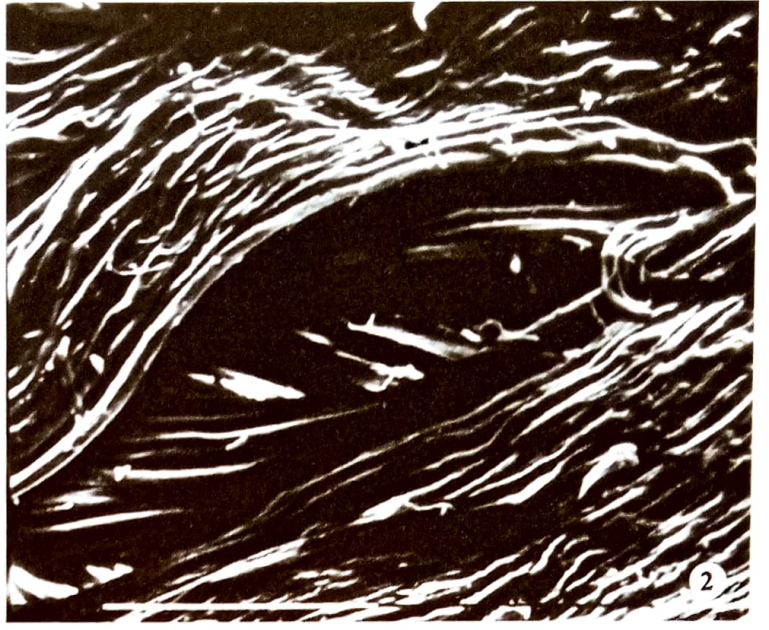


Plate 2

The seeds of *Barleria cristata* show silky hairy surface and hairy patches developed in zig-zag manner. Seed is orbicular to ovate. The hilum is circular, hairy and apical in position. SEM study reveals long, sticky hairy patches in zig-zag manner. The hilar region is circular and hairy. The granular deposition is present on surface. The basal portion also shows thick, hairy deposition. The hairy ridges and furrows are highly developed on the surface. Many layers are deposited on one another forming hairy layers that are in patches with gaps between them. The thick elongated fibres show minor granulated deposition on fibre surface (Plate 2, figures 4-6).

DISCUSSION

Three seed samples belonging to family Acanthaceae were studied. In external view, size, shape, colour, weight, symmetry, hilum position and shape are the important features of the seed.

In *Andrographis paniculata* seed size ranges from 0.13 cm to 0.24 cm, in *Barleria cristata* L. from 0.25 cm to 0.34 cm and in *Ruellia tuberosa* (L.) from 0.12 cm to 0.21 cm. *Andrographis paniculata* seeds are sub-quadrate, *Barleria cristata* seeds are trigonous or orbicular and *Ruellia tuberosa* seeds are obovate to orbicular in shape. They are yellowish brown, brownish with silky hairy and reddish brown with whitish hairs respectively. The average weight of 15 seeds of *Andrographis paniculata* is 1.373 mg, *Barleria cristata* 7.173 mg and *Ruellia tuberosa* 0.813 mg. The seeds also show hilar variation as apical position and circular or elliptical in shape.

Seed surface also constitutes an important feature for morphological identification. Various surface patterns were studied, e.g. hairy pattern like silky hairy, reddish brown with whitish hairy structure. The hairy pattern was observed in *Barleria cristata* L. and *Ruellia tuberosa* (L.). In *Barleria cristata* the hairy surface is in zig-zag manner but in *Ruellia tuberosa* it is tubular dentate in appearance. In *Andrographis paniculata* glabrous and rugosely pitted surface is formed.

Each seed sample gives specific spermoderm information. In family Acanthaceae, *Andrographis paniculata*, *Barleria cristata* and *Ruellia tuberosa*

were studied under SEM and glabrous pitted tuberculate ornamentations have been observed along with hairy surface variation in patches or in tubular form. Waxy deposition was found to be invariably present on the surface. *Andrographis paniculata* shows specialized seed coat feature in that seed coat is not prominent and endosperm functions as seed coat, being a special identity of this genus. This family shows unitegmic ovule with massive integument (Bhatnagar & Johri 1972).

The morphological observation on seeds of Acanthaceae revealed number of variations in their seed parameters. Therefore, on the basis of this surface study the seeds can be differentiated on micromorphological characters. These structures help in the protection of cellular surface from external agents. In *Barleria cristata*, the granulated waxy deposition is present on the hairy surface. The main function of seed coat is protection against attack by microorganism or insects, mechanical injury and desiccation and to help in dispersal (Bhatnagar & Johri 1972). According to Chuang and Heckard (1972), the seed coat pattern is diversified among species and furnishes an important feature for classification.

From the evolutionary point of view, family Acanthaceae shows number of surface variations on generic level. Seeds are developed as an ultimate culmination of growth and development and depict the variations in morphological, anatomical and spermoderm characters signifying the seed taxa.

The seeds of angiosperms have mostly dry seed coat and complex structure. Morphologically, seed shows great variation in surface. These are the primary parameters of seed morphology, but secondary parameters like surface pattern variation at micromorphological level help in solving various taxonomical problems related to surface of seeds. This secondary surface study is possible only through scanning electron microscopy. Due to high resolution power, the magnified portion of seed surface shows great variations.

The important micromorphological features of Acanthaceae are well described through SEM. In *Andrographis paniculata*, the surface features were

not explained properly at this level. The seed surface is irregularly folded with elongated notch but during SEM investigation the surface shows pitted ornamentation. Pits are large, somewhat tuberculate on surface, tubercles dome shaped and variable in size with blunt apices. In *Barleria cristata*, seed shows brownish silky hairy pattern on surface but in SEM study it shows highly granulated deposition on hairy surface, presence of zig-zag hairy surface with deposition of hairy patches. *Ruellia tuberosa* shows hairy smooth surface, seeds somewhat reddish brown with normal hairy structure but during our SEM study the hairs are long somewhat elongated, dented with granulated deposition. So, on the basis of above study the seeds exhibit differentiation in size, shape, colour, symmetry along with distinguishing features in surface pattern which become clearly evident in SEM investigation showing great variations having evolutionary and taxonomic significance.

Andrographis paniculata shows unitegmic, massive ovule which protects the internal part of the seed. *Barleria cristata* and *Ruellia tuberosa* also show hairy surface pattern which protects the testa, tegmen and other internal part of seed and also provides nourishment to the seed. The problems related to taxonomic level or surface pattern of this species, which could not be solved at primary level, are solved by

secondary level study. Thus, it reveals the highly developed evolutionary characters from primary to secondary level. Seeds of the species of this family have high medicinal value, owing to the presence of various alkaloids, proteins, carbohydrates and other components which are medicinally important. The members of this family possess bitter tonic, febrifuge, antidyentric, antiperiodic properties, effective against chronic malaria, jaundice, anemia, bowel complaints and loss of appetite (Sharma 2003). The characters which are highly evident at microlevel study related to surface pattern are responsible for its therapeutic value.

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Corrigendum

Please read *larjiana* in place of *largiana* throughout the following paper.

Srivastava S. N. & Rai M. 2011. *Frullania largiana* var. *didyhatii* var. nov. from Kumaun region in Western Himalaya. *Geophytology* 41(1-2): 109-112.