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MICROSTRUCTURAL FEATURES OF ACHENE OF *SIBBALDIA* SPECIES (ROSACEAE)

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Abstract

Achene of *Sibbaldia* species, exhibits a significant micro-morphological diversity, which can be used as an important taxonomic tool for their identification. The shape, size and ornamentation on the surface of Achene of 9 species of *Sibbaldia* were examined by using the SEM. Achene's are mostly obovoid, narrow obovoid, globular obovoid, with the range of variation reniform to orbicular. Mostly brown in colour, size ranges from 05 mm to 02.00 mm long, 04mm to 1.20 mm broad. Mircostructural features of achences of *S. micropetala* are different from all other species of *Sibbaldia* and thus its placement is questioned in genus *Sibbaldia of family Rosaceae.*

Key words: Achene Structure, *Sibbaldia* species, Rosaceae.

Introduction

Systematically genus *Sibbalidia* L., is placed in family Rosaceae. Sub – Family Rosoidaceae, tribe Potentillae, Hutchinson (1964). Rajput *et al*., (1997) enumerated 10 species of *Sibbaldia,* 9 of which have distribution in South East Asia, except one species (*S. procumbens)* which is also found in North America and Europe. Muravjova (1963) referred the origin of *Sibbaldia* to the upper Tertiary, and its primary centre of diversification appears to have been the mountains region of Central and Western China. Tahir & Rajput (2009) examined the foliar stomata and petal structure of corolla of all the species of *Sibbaldia* by using the S.E.M.

Achene is a one seeded coriaceous dry indehiscent, simple fruit, having its seed attached to fruit wall only at one point. Now a days it is generally realized that micro-morphological attributes are as important and valuable as macro-morphological ones, and must not be ignored in the identification and determining the relationship between the taxa.

During the micro-morphological investigation on different organs of *Sibbaldia* species, it was noticed that Achene structure can provide a good source of taxonomic information which can be used for the identification of *Sibbaldia* species. Moreover the Achene structure of *Sibbaldia* species has not been examined before by S.E.M.

Materials and Methods

Mature achenes of nine species belonging to genus *Sibbaldia* were examined; with the strereozoom microscopes and Scanning Electron Microscope (SEM), for each species 4-5 achenes, were measured depending upon the availability of achene, 2-5 samples were examined with the SEM.

The dried mature achenes were mounted onto the stubs with double sided adhesive tape. The samples were coated with 30^{o} gold in a palevon sputter coater, and were examined with Joel JSM-T 20 scanning Electron Microscope , at 20 KV Voltage, at the Department of Botany, University of Reading, England. The details of vouchers are provided under the Taxonomic observation of each species.

Taxonomic Observations

***S.adpressa* Bunge:** Achenes are orbicular to kidney shaped ca. 1.5 mm long and ca.1.0 mm broad, greenish brown. Rough and scarious surface of the achenes exhibits undulate type of pattern (Fig. 1 E&F)

Voucher specimen:- USSR, Siberia Guv. Irkutsk, al Flumen Lena, *Maskov- Skoji, Nilsson- Ehles.*n. 4-6-1989 (A).

***S. mircopetala* (D.Don) Handel-Mazzetti:** Achenes are narrow to broad avoid, dull brown 0.5 mm to 2.0 mm long, and 0.4 mm to 0.7 mm broad. Achens surface shows 3-4 prominent raised folds or ± transversely ribbed. The surface between folds exhibits a distinct colliculate pattern (Fig. 1 C&D).

Voucher specimen: - Nepal, Chipli north of Pokhara, *Stainton, Skykes&Wiliams* 4895 (US 2318032).

***S. purpusillodies* (W. W. Smith) Handel-Mazzetti:** Achens are brown, oboviod, 1.2 mm to 2.00 mm long 1.0 mm to 1.2 mm broad. Achene surface appears to be crustaceous and rough exhibiting light wavy pattern (Fig. 2 C &D).

Voucher specimen: - China, Yunnan: Mekong-Salween watershed, Rock 10087 (E).

***S. procumbens* Linn:** Achenes light to dark brown, obovoid 1.00 mm to 2.5 mm long, ca.1.0 mm broad. Achenes surface exhibits irregular fine reticulum (Fig. 2 E & F).

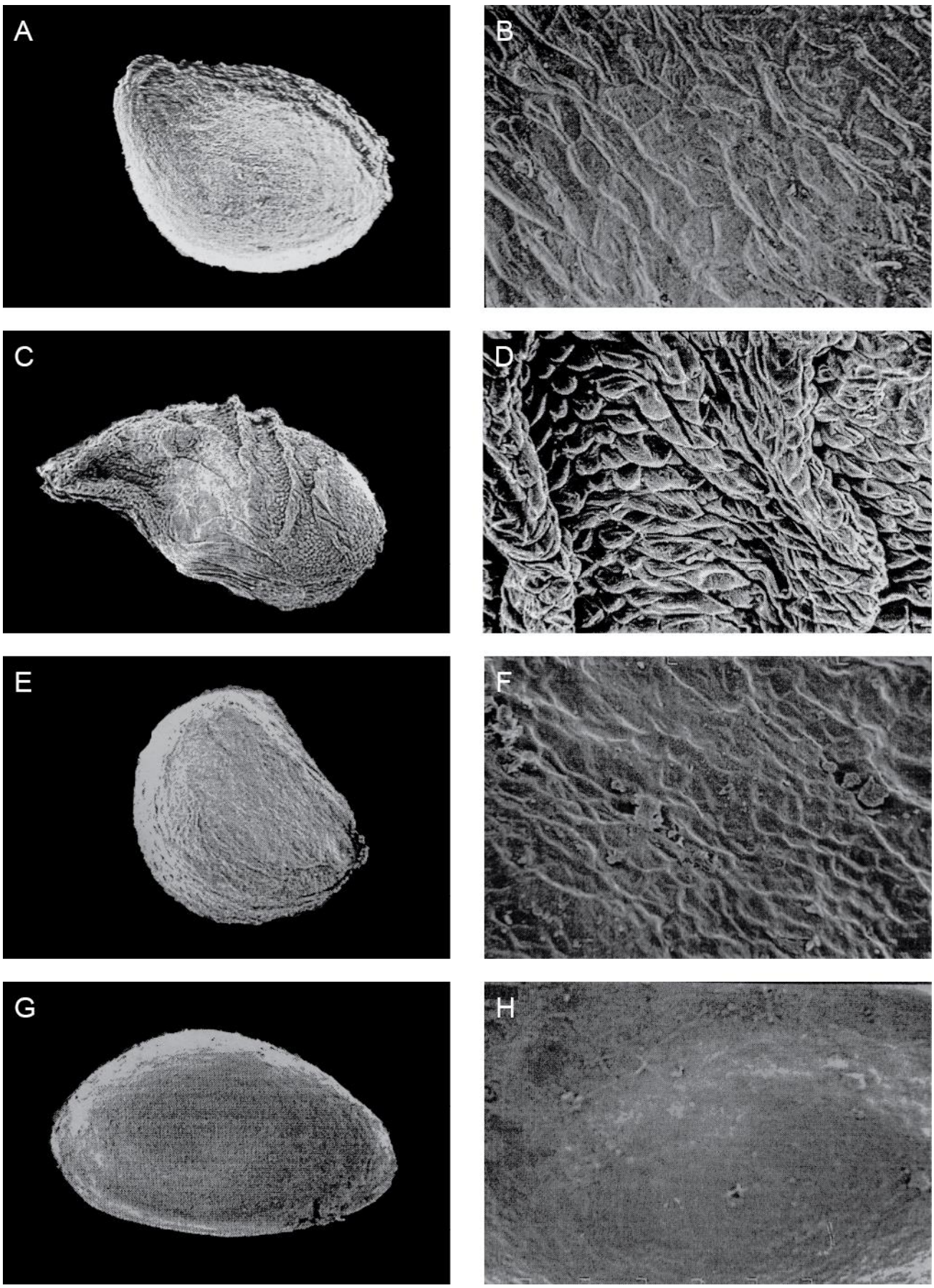

Fig. 1. Scanning Electron Micrographs (SEM) of Achenes of *Sibbaldia* species.
A, *S. purpurea* (Achene), B, *S. purpurea* (Surface pattern), C, *S. micropetala* (Achene), D, *S. micropetala* (Surface pattern), E, *S. adpressa* (Achene), F, *S. adpressa* (Surface pattern), G, *S. tenuis* (Achene), H, *S. tenusis* (Surface pattern).

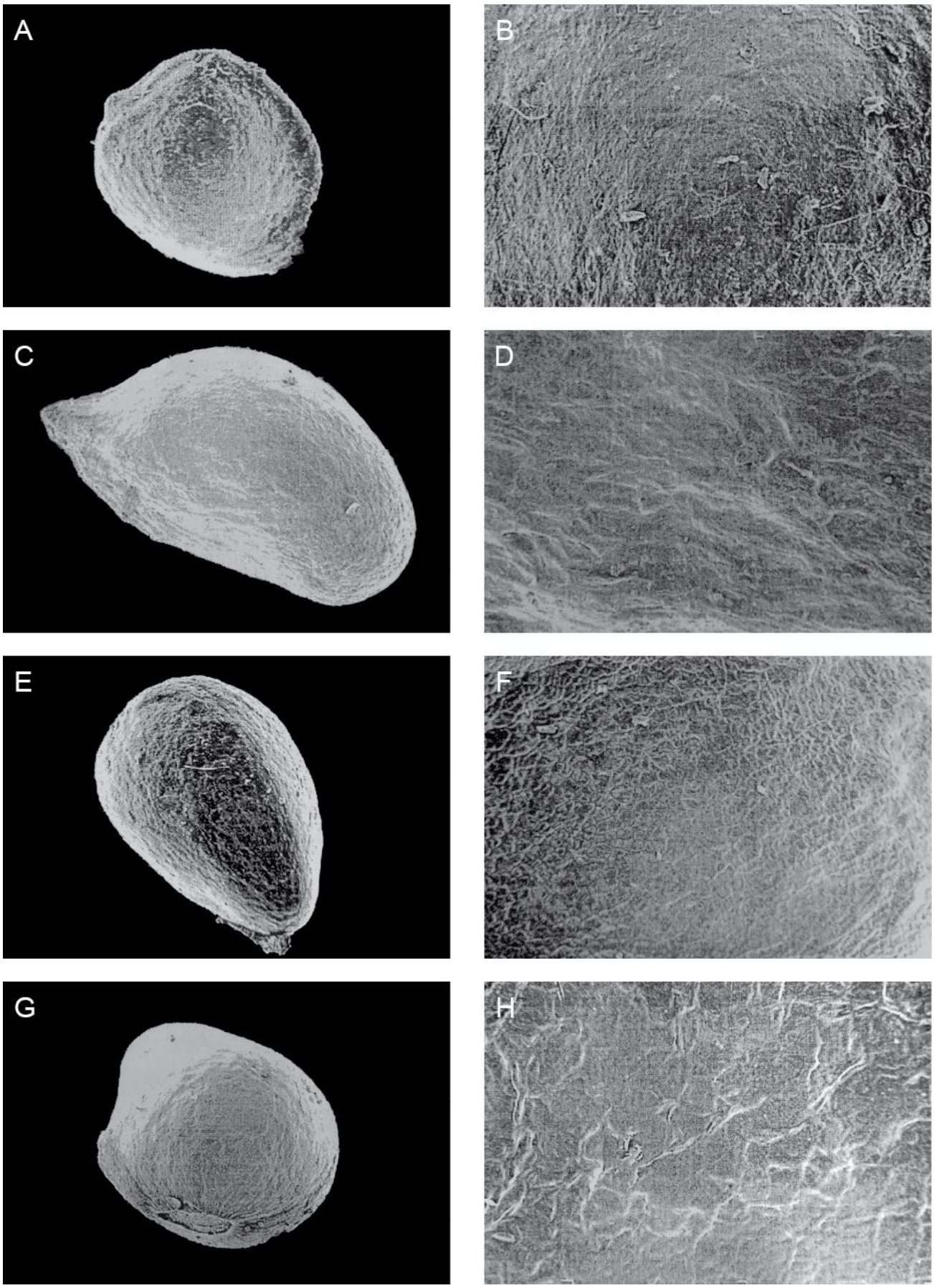

Fig. 2. Scanning Electron Micrographs (SEM) of Achenes of Sibbaldia species.
A, *S. tetrandra* (Achene), B, *S. tetrandra* (Surface pattern). C, *S. purpusillodies* (Achene), D, *S. purpusillodies* (Surface pattern), E, *S. procumbers* (Achene), F, *S. procumbens* (Surface pattern), G, *S. sikkimensis* (Achene), H, *S. sikkimensis* (Surface pattern).

Voucher specimen:- Pakistan, GangalwatGol, Kafristan S.W. of Chitral, *Stainton* 2722 (A)

***S. purpurea* Royle:** Achenes oboviod to orbicular, 1 – 2 mm long, ca. 1.0 mm broad. Purple to dull brown in color. Epidermal surface forming wrinkled longitudinal in irregular fashion pusticulate-coliculate pattern, surrounded by persistent style and stigma (Fig. 1 A&F).

Voucher specimen:- Kashmir, Bangar Kishtwar district *Ludlow & Sheriff* 9279 (BM).

***S. sikkimensis* (Prain) Chatterjee:** Achenes obovoid to orbicular, purplish brown to black in colour, normally depressed on one side, mostly surmounted by the persistent style-stigma. Achene 1.2-1.6 mm long, ca. 1.3 mm broad. Surface is crustaceous and showing undulate pattern, sparsely irregular wrinkled (Fig. 2G & H).

Voucher specimen:- China, Mekong Salwin divide (28º12ºN) Forrest 14223 (E).

***S. tenuis* Handel-Mazzetti:** Achenes brown in colour, oboviod, ca.1.0 mm long ± 0.6 mm broad. Achene surface is rough with no prominent pattern (Fig. 1 G & H).

Voucher specimen:- China, Sichuan Province, Donrergo, in Prato alpino, 4300-4400 m, 20 July 1922, *Harry Smith* 2806 (A).

***S. tetrandra* Bunge:** Achene ± orbicular or obvoid, ca, 1.2 mm in diameter, achene surface without any prominent pattern giving crustaceous appearance. (Fig. 2 A & B).

Voucher specimen:- Pakistan Charesa Glacier Base camp, 13 miles east of Nagar, *Polunin* 6130(E).

Results and Discussions

The Seeds and small fruits exhibit a complex and high morphological and micro-morphological diversity providing valuable taxonomic information. Their shape, size, colour, can be of high systematic significance, Barthlolt (1984), Akein (2007 & 2008), Jaun *et al.*, (2000). Generally the pollen, fruit and seed characters are not or very slightly influenced by environmental factors.

The achens of the following species of *Sibbaldia, S. adpressa, S. mircropetala, S. purpusilliodes, S. procumbers, S. purpurea, S. sikkimensis, S. tenuis* and *S. tetrandra* were examined with the stereozoom microscopes and SEM. The present observation revealed that, shapes, size and colours in the species of *Sibbaldia* have limited taxonomic significance. Size was not very useful for discriminating the species of *Sibbaldia.* Whereas five species of *Sibbaldia* out species of 9 showed faint pattern or no pattern on the achene surface e.g. *S. procumbens, S. purpusilloides, S. sikkimensis, S. tetrandra* and *S. tenuis.*

The colour of the achenes present in the species of *Sibbaldia* varied from dull brown to dark brown, purple brown to black brown, hence it was not easy to distinguish the species on the colour of achenes, except the *S.sikkimens is* which had purple brown to black colour of achene. The shape of achens of *Sibbaldia* species ranged from ovoid-orbicular, obovoid-reniform to oblong orbicular.

The achene of *S.tetrandra* was strictly orbicular, whereas the achene of *S. mircopetala*is was broader, at proximal end and tapering towards the funcile. The fruit seed surface morphologies are beneficial for systematic studies different types of achene surface pattern were observed e.g. Undulate wavy, distinctly colliculate, light wavy, smooth to slightly reticulate.

The achenes of *S. mircopetala,* are of unique type, and can readily be distinguished by the symmetrically ribbed, and caliculate pattern. This type of achene structure is unusual in *Sibbaldi a*species: Rajput *et al.,* (1994) while investigating the petal structure and stomata already questioned the placement of *S. mircopetala* under the genus *Sibbaldia* of family Rosaceae.

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