Kashf Journal of Multidisciplinary Research
Vol:03– Issue03 (2026)
P-ISSN: 3007-1992 E-ISSN: 3007-200X
https://kjmr.com.pk

MICROMORPHOLOGICAL STUDIES ON TRICHOMES OF SPIRAEA L. (ROSACEAE) SPECIES FROM PAKISTAN AND ITS IMPLICATION AS A TAXONOMIC MARKER

S. ASMA AFTAB

Govt. Shah Abdul Latif Girls College Unit # 06, Latifabad, Hyderabad

****Corresponding Author:***(sasmaaftab@gmail.com)

DOI:(*https://doi.org/10.71146/kjmr869*)

Article Info

Abstract

Trichomes from the leaves of 8 species of *Spiraea* L. of Rosaceae from Pakistan, has been examined with S.E.M. During the study different types of trichomes were observed, they were either non-glandular, unicellular, with broad base and tapered towards the apex or glandular, unicellular, with broad base and swollen mid or apex. The surface of trichomes was smooth mostly. This study reveals that trichomes can be used as a taxonomic marker in the identification and determination of the relationship between the species.

Keywords:

Trichomes, SEM, Spiraea, Sparidae, Spiraeoidae, Rosaceae.

Research Highlights: The genus is divided into three groups, not only taxonomically but also on the basis of micromorphological studies of trichomes. Our findings completely match taxonomical groups based on morphological attributes.

Introduction: Taxonomically *Spiraea* L. belongs to the family Rosaceae, sub-family Spiraeoidae, tribe Spiraeeae (Hutchinson, 1964). It was represented by 18 species in Pakistan (Stewart 1972). After reviewing and adjusting circumscription 8 species are recognized in Pakistan (Omer, 2012). The species of *Spiraea* are mostly distributed in the temperate regions of the world. In Pakistan, they are found in northern and north western region. Some species are also cultivated as ornamental as well as nectiferous plants.

The taxonomic significance of trichomes has been emphasized by Sole Reder (1908), Metcalf and Chalk (1950), Uphoff & Hummel (1962), Aley Kutty & Inamdar (1980) and it is suggested that structure of trichomes can be used as an important taxonomic tool in systematic comparisons, which is due to their variety in the following plants. Fahn (1979), Werker & Fahn (1980) pointed out that trichomes are responsible for the secretion of aromatic oils. The systematic applicability of trichomes and other epidermal attributes had been discussed in detail with respect to evolutionary aspects by Bartlett (1981). Husain et al (1994) also provided evidence that micromorphological attributes of leaf indumentum can be used as an additionaltaxonomic attribute in science.

Husain et al (1994) have given a detailed account of S.E.M Studies of trichomes as taxonomic markers in representative species of two sect. in the genus *Pelargonium L*. (Geraniaceae).

Materials and Methods: The material used for the study, was obtained from the following herbaria K, BM, E, KUH and RAW. The specimens belong to 8 species of *Spiraea.* The dry leaves were used for SEM. The details of voucher specimens are provided in appendix. Leaf samples approximately of 5 cm were taken from herbarium specimens and mounted onto the Stubs with double sided cellophane tape from abaxial surface, after coating with 30˚A gold in a JEOL JSF-1500 Ion sputtering device at Centralized Research Laboratory, University of Karachi and examined with JEOL JSM-6380 Scanning Electron Microscope, at an accelerating voltage of 5 KV. For this investigation 2-5 samples of leaves, from each species were examined and only one voucher has been cited in the appendix I.

Results: The species of *Spiraea* are conspicuously hairy. The purpose of study was to examine structural types of trichomes in *Spiraea* L. with Scanning Electron Microscope. The trichomes of *Spiraea* have not been observed yet by any method. The trichomes of the leaf and stem are of more or less of same structure. Foliar trichomes are found mostly at the abaxial side and at the lower midribs, adaxial surface is mostly smooth or very sparsely hairy, but in some species (*S.brahuica*), both surfaces are densely hairy. Morphological study of trichomes, including size, presence, absence or the density, at abaxial , adaxial surface of leaf or position (lamina or midrib) of 8 species of *Spiraea* were examined with Light microscope & Scanning Electron Microscope.

Great variation in trichomes density was observed within different species. The examination reveals that in some species the hairs are similar but, in some cases, different types of trichomes were observed with variable density.

(a). One kind of trichomes has very small size with equal breadth all along the trichome length, up to 5 µm at the surfaces of leaf, they are found in*S.vacciniifolia, S.bella,*(Fig.1: A,B,C,D)and very sparsely at *S.hypericifolia*(Fig.2: A & B).

(b). The other type of trichomes is from 5 µm to 500 µm long, unicellular, broad at the base tapering towards the tip, with or without podium, either granulated or not, striated or not, terete or plane in transverse section. .

Taxonomically two groups of trichomes can be recognized in this category, one group with the trichomes having podium which is composed of 5-6 cells, e.g. *S.brahuica*(Fig.1:G,H), *S.pilosa* (Fig.2: E,F) and *S.hypericifolia*(Fig.2: A,B) . The other group without having podium or with unicellular podium, e.g. *S.canescens, S.bella* and *S.vacciniifolia.* (Fig.1: A-E).

1) S.affinis Parker**:** In *S.affinis* Parker, podium is not visible and trichomes are of two types, one is thick and other is thin and trifurcate (Fig. 2: C,D).

2) S.bellaSims**.:** The species has two types of trichomes; one is very small up to 5µm. The others are 200-300 µm long, with podium which is disc like, probably unicellular but has some striations at the surface or they may be separate cells. This species is very sparsely hairy.(Fig.1:A,B).

3) S.canescens D.Don**.:** The species has only one type of trichomes, with the length up to 100-500 µm. The podium is unicellular and smooth. The species is densely tomentose. (Fig.1: E).

4) S.vacciniifoliaD.Don**. :** The species has also two types of trichomes, one is very short in length up to 5 µm and without a podium, the other has the length 100-500 µm with circularly arranged surface cells around the podium. (Fig.1: C, D).

5) S.cantoniensis Lour**.:** In *S.cantoniensis* all the scans are devoid of any type of trichome, even at very high magnification, nothing is visible at the midrib, except some very fine lines (Fig.1: F).

6) S.hypericifoliaL**.:** The species has two type of trichomes as well, one is up to 5um long , the other is 100-500 um. The longer trichome has podium composed of 5-6 cells which greatly resembles with that of *S.brahuica* Boss. This species has great variations in the density of trichomes. (Fig. 2: A, B).

7) S.brahuicaBoiss.**:** The leaves of this species are densely tomentose that mostly the leaf surface is not visible. Trichomes length ranges from 200-600 µ m, but some of them are flat as well as cylindrical in transverse section. Podium mostly composed of 5-7 cells (Fig.1: G, H).

8) S.pilosa Franch**.:** The trichomes are similar to that of S.*brahuica*Boiss. But it differsin having some swollen portions in the trichomes sometimes near the base or just below the apex. Some trichomes merge with the other. This character is only observed in *S.pilosa* (Fig.2: E, F).

Discussion: After micromorphological study the taxa can be divided into three groups. One without trichomes, with smooth leaf surface, second group without podium or with simple unicellular podium while the third group has compound podium composed of 5-6 cells. First group includes only one species *S.cantoniensis,* second group includes S.*canescens, S.bella* and *S.vacciniifolia.* (Fig.1: A-E). The third group includes *S.brahuica*(Fig.1:G,H)*, S.pilosa* (Fig.2: E,F) and *S.hypericifolia*(Fig.2: A,B).

All these groups can be distinguished on the basis of taxonomical characters also. *S.cantoniensis* is differentiated from the other two groups not only on the basis of smooth leaves but also due to the wax deposits on lower epidermis and long acuminate sepal lobes.

Second group has stipules which are single or in pair but linear and acuminate and leaves are serrate or dentate. Margins are entirely serrate or dentations start from lower half of the leaf while the third group either is devoid of stipule or stipules are rounded or ovate and leaves have dentations only on the upper one third margins or near the apex.

Acknowledgements: We owe to pay our sincere thanks and gratitude to Dr. S.I.Ali, Eminent taxonomist, former V.C. University of Karachi for borrowing herbarium specimens from E, K, BM, RAW and KUH and for reviewing this manuscript. Thanks are due to Dr. Darakhshan Haleem Ex Dean of Science, University of Karachi, for providing facilities for Scanning Electron Micrography at Centralized Research Lab. University of Karachi.

Table: 1: Comparison of Different types of trichomes in *Spiraea* L.

	Species	Length (µm)	Width (µm)	Remarks
1	***S. affinis***	**90-100**	**8-10**	Podia not visible. Trichomes upright, thin, trifurcate.
		40-50	**±2**	
2	***S. bella***	**300-400**	**15-20**	Simple and visible disc-like podium. Sparsely hairy, trichomes suppressed.
		±4	**±1.5**	
3	***S.brahuica***	**200-300**	**10-20**	Podium striated. Trichomes dense, upright, cylindrical and ribbon-like, glandular and branched.
		30-40	**7-8**	
4	***S.canescens***	**90-100**	**8-10**	Simple visible smooth podium. Trichomes suppressed, densely tomentose.

5	***S.hypericifolis***	**180-200**	**8-10**	Podium star shaped, trichomes upright, bent.
6	***S.pilosa***	**190-200**	**10-15**	Complex multicellular podium, trichomes upright, glandular & branched.
7	***S.vacciniifolia***	**200-400**	**10-15**	Podium unicellular, trichomes suppressed, surrounded by cells.
		20-25	**± 2**	Short not tapering

Appendix I: List of the voucher specimens used in the S.E.M study of *Spiraea* leaf structure.

S.affinis Parker**:** Burzil valley, J.F.Duthie 14004, 11-09-1893,(E)195635.

S.cantoniensis Lour**.:** Hazara Distt. Abbottabad, Y.Nasir & Rubina Akhtar 11203, 8-3-1995 (RAW) 67443.

S.bellaSims: Gulmerg Kashmir, J. F. Duthie 11356, 2-06-1892 (E) 195632.

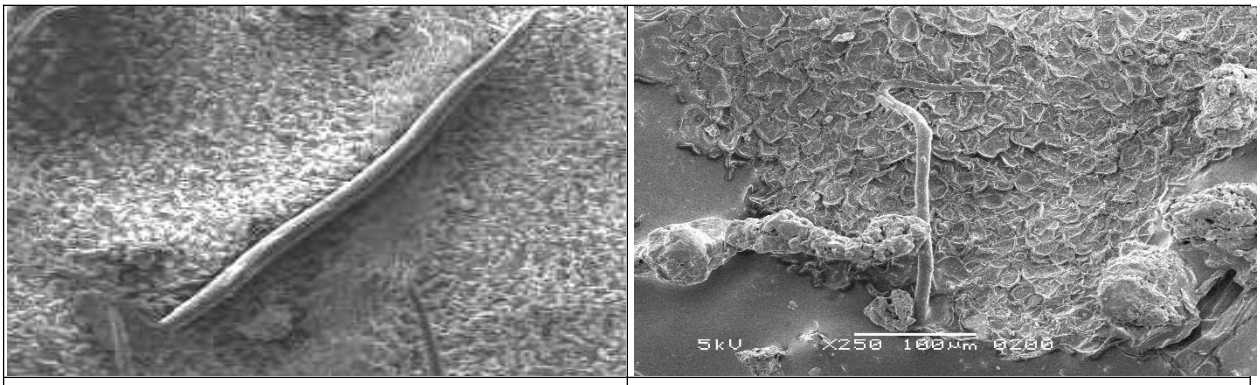
S.vacciniifoliaD.Don**.**:Hazara, Abbottabad, B.L.Burt, B-624, 14-5-1958, (E) 195647.

S.canescens D.Don.**:** Scinder Valley Kashmir, R.R.Stewart, July, 1912—13, (RAW) 28000.

S.hypericifoliaL**.:** Barper Glacier, Karakoram, Russel R.S. 1108, July 1939, (BM) 00834480.

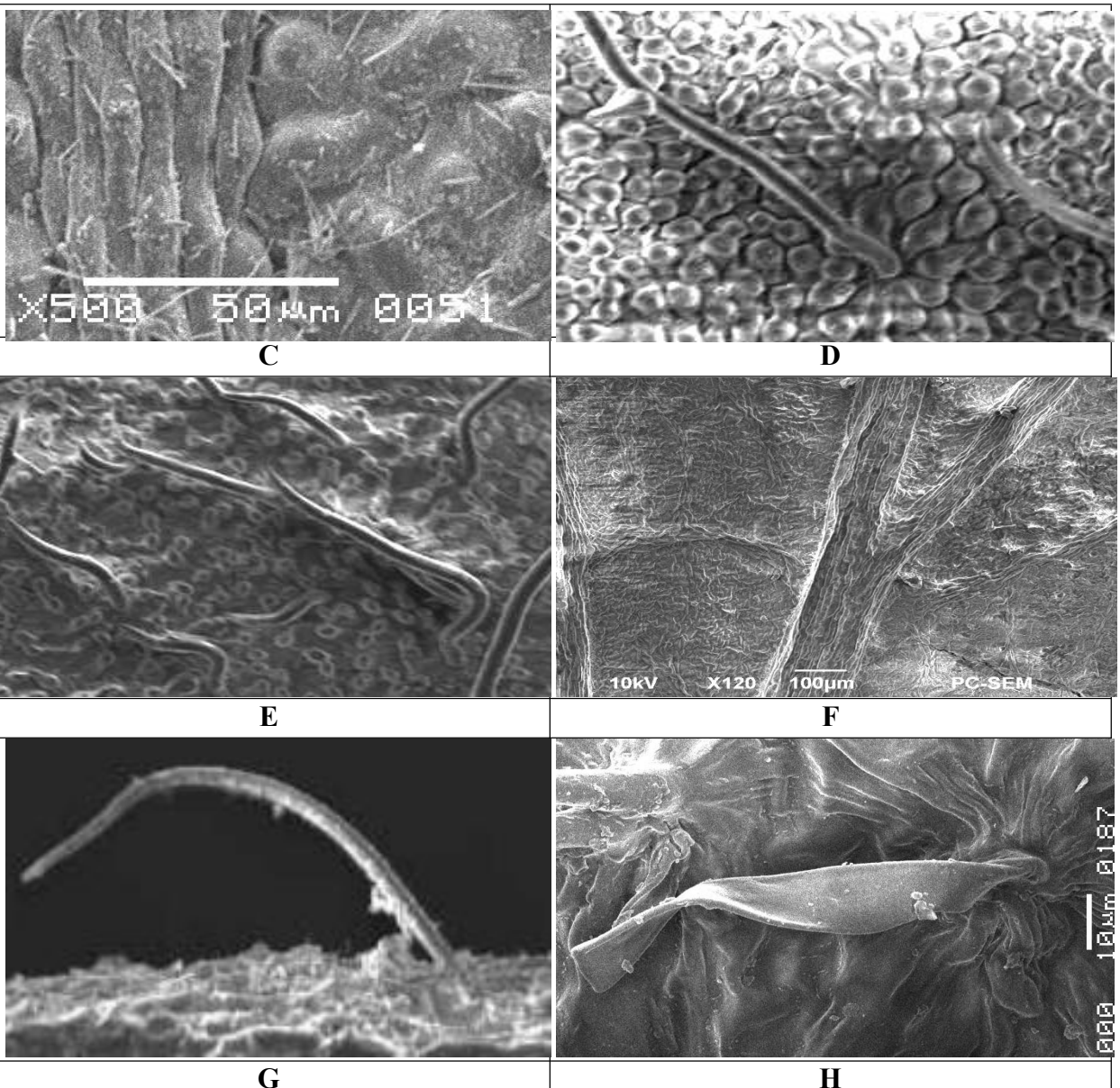
S.brahuicaBoiss**.**: Chehl Tun, Balochistan, Stocks 1867, (K) H2004/01711 2, 0075648, 0075649.

S.pilosa Franch**.**: Bashgalian, Kafiristan, S.W. Chitral, J.D.A.Stanton, 19-6-1958,



A	B

00834484(BM).

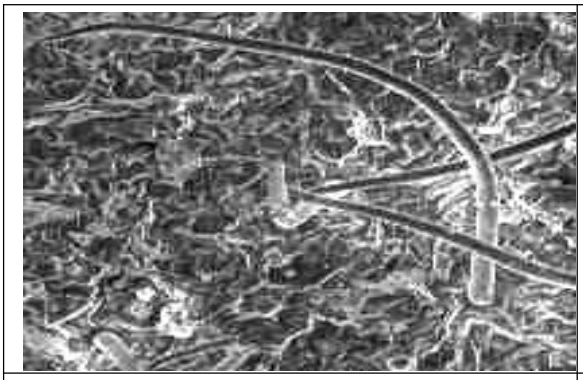


C D

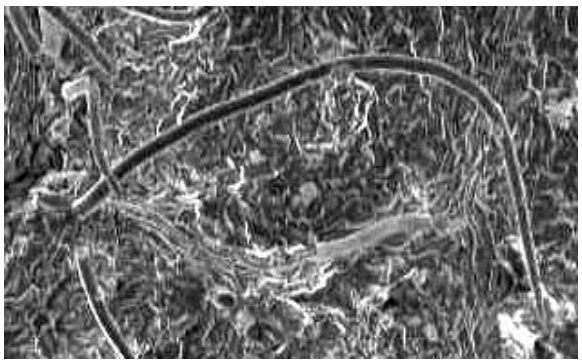
E F

G H

Fig.1: *S.bella*Sims.A,B; *S.vaccinifolia*D.Don.:C,D; *S.canescens*D.Don. E; *S.cantoniensis*F; *S.brahuica*Boiss. G& H.

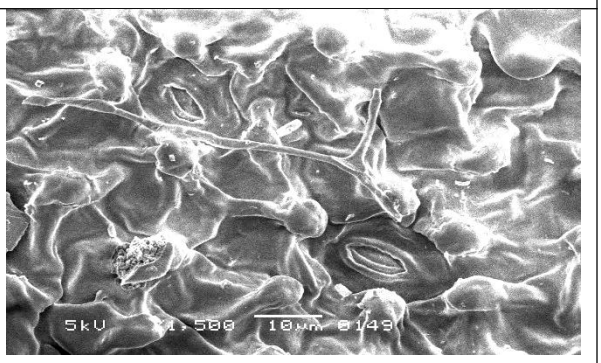


A

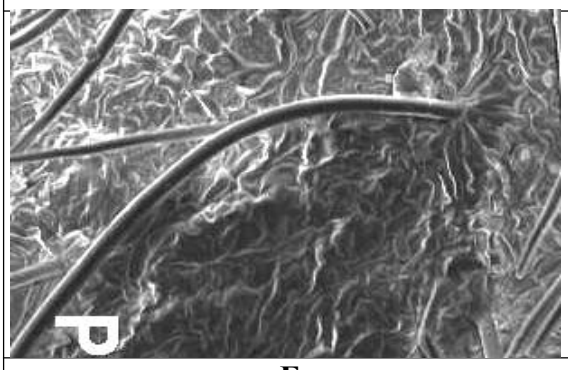


B

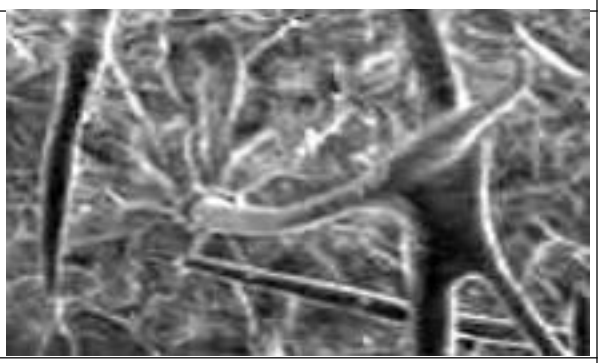
C



D



E



F

Fig.2: *S.hypericifolia*L. A, B;*S.affinis* Parker, C,D; *S.pilosa*FranchE,F.

References:

Aleykutty, K.M. & Inamdar J. A..1978. Structure, Ontogeny and Classify. Of Trichomes in Ranales.*Feddes Repertorium*, 9: 12 : 95-108.

Barthlott, W. 1981, Epidermal and seed characters of plants: systematic applicability and some evolutionary aspects– *Nordic. Bot*. 1: 345-355.

Carolin R.C. 1970, The trichomes of the Goodeniaceae– *Pro.Linn.Soc.N.S.W.*96:17-22.

Essau, K. (1965). *Plant Anatomy, p.167*; John Willey & Sons, New York.

Fahn, A. 1979, *Secretary Tissue in Plants*, Academic Press, London.

Lanrein S., Borosova R., and *et al* Rosaceae (I)Metcalf , C. R. & Chalk L.1950. *Anatomy of Dicotyledons,*Clarendron press, Oxford.

Omer,S.A. 2012, *Taxonomic study of Spiraea,* (M.Phil. Thesis), University of Sindh, Jamshoro.

Qaiser, M. 2002. Asteraceae (I)-Anthemideae In: *Flora ofPakistan*. (Eds.): S.I. Ali and M. Qaiser. Karachi &Missouri Botanical Press, Missouri Botanic Garden,Missouri, U.S.A. pp. 207: 1-8

Sole Reder, H. 1908. *Sys. Anat. Of Dicot. Vol. II,* Oxford at Clarendron Press.

Stern, W. T. 1966. *Botanical Latin*. Hafner Publishing Co. New York.

Tahir S.S., Liz-Balchin M., Husain S.Z. and Rajput M.T.M 1994. SEM Studies of Trichomes in ……Geraniaceae, *Pak. J. Bot. Vol. 26 p 397.*

Uphoff, Hummel & Staesche. 1962. *Plant Hairs,* Geb ruder Borntraeger.

Werker E. & Fahn A. 1981. Secretory Hairs of *Inula viscose* L. …, *bot. Gaz.*142:4, pp 461-476, University of Chicago Press.

Willis, J.C. 1973, *A Dict. of the Flowering Plants and Ferns*. Cam.Uni.Press