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TOXONOMIC STUDY OF THE TRICHOMES IN THE SOME MEMBERS OF THE GENUS *CONVOLVULUS* (CONVOLVULACEAE)

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Abstract

Taxonomic study of the trichomes of 6 species of genus convolvulus has been carried out by using Light Microscope and Scanning Electron Microscope. Variation in trichome density on different parts has been noticed. In *Convolvulus pseudocantabricus* a prominent pepillate type of ornamentation has been observed like Pneuomatophore.

Introduction

The taxonomic value of the trichomes and their significance in systematic and phylogenic relationship is well known in *Lamiaceae* and such related families as *Verbenaceae* and *Scrophulariaceae* (Metcalf & Chalk, 1950; Abu Assab & Cantino, 1987; Cantino, 1990; Navarro & Oualadi, 2000, Khokhar, 2009). Many species of *Lamiaceae* produce valuable essential oils, which are accumulated within glandular trichomes on the leaf surface (Wagner, 1991; Timothy *et al*., 1994, Khokhar, 2009). The taxonomic value of trichomes is diminished because of the varying terminology used in the past and because none of the previous classifications accommodate the full diversity of the trichome spectrum (Khokhar, 2009). The botanical literature contains more than 300 descriptions (uniseriate, capitate, sessile etc) of trichome types in order to characterize their great variation (Khokhar, 2009). The trichome appendages arise from anticlinal and periclinal divisions of epidermal cells to form trichome, that function as glandular or non glandular trichomes (Esau, 1965; Johanson, 1975; Fahn, 1979; Wagner, 1991; Werker, 2000; Kolb & Muller, 2004) differences in the habits of plant trichomes are used in plant classification i.e., taxonomically very useful. Functionally trichomes protect the plant from herbivores, heat and sunlight (Croteau, 1977; Werker, 1993; Duke, 1994). They also control leaf temperature as well as water loss. Glandular trichomes produce various substances, which are stored at the plant surface (Wagner, 1991; Kolb & Muller, 2004). The structure, density and distribution of trichomes and the epicuticular flavonoids are markedly different among the species; they may provide a useful taxonomic tool (Syzmanski *et al.*, 1999, Valkama *et al*., 2003) besides other morphological characters. The greatest significance of trichomes is in the identification of angiospermic plants. They are constant in a species when present or show a constant range of form. In some angiospermic families, Restionaceae and Centrolepidacea*e* individual species can be defined on the form of their trichomes alone. The relative sizes of the basal cells and the cells of free portion vary from species to species (Cutler, 1985). The trichome type is only one of many characters used in identification. However some families are easily recognized by their trichomes, e.g., the T-shaped trichomes of Malpighiaceae and *Rhododendrons* have been classified on the basis of leaf hairs, as an aid to the identification of species (Cutler, 1985). The trichomes types forming indumentum are characters of high taxonomic value in the differentiation of *Quercus* species and when employed in combination with other morphological features permit correct species identification (Liamas, 1995). Many workers have discussed the systematic significance of the trichomes in Solanaceae (Cannon, 1909; Metcalf & Chalk, 1950; Ahmad, 1964a,b; Sizova; 1965; Roe, 1967; Roe, 1971; Rajput *et al.,* (1985); Reis *et al*., 2002).

Materials and Methods

The material for the study of trichomes was taken from the herbarium specimens present at Sindh University Herbarium and Karachi University Herbarium and also fresh material was collected from the different species growing in the different parts of the Sindh province. In all cases 3-5 samples for each specimen were examined, but only one voucher specimen for each species is cited. For this investigation the trichomes were examined by Light microscope, steriozoome and Scanning Electron Microscope, their details are given below. For light microscopic study both temporary and permanent slides were prepared following the standard techniques. Temporary slides of the material were prepared for quick view, with the help of Lactic acid and observed under the compound microscope. The small piece of plant material ca 0.5-1.0cm was placed on the slide and a few drops of lactic acid were applied for 10-20 minutes. After that every trichome was separated from its attachment and observed under the microscope (Perveen, 2006).

For the permanent slides trichome material was taken from the specimens with razor blade by scraping the surface of stem, leaf, petiole, pedicle, and calyx then it was transferred into watch glass, treated with alcoholic series 30-90% for 20-30 minutes and xylene for 15

minutes (Khasim, 2002). The dehydrated trichomes were transferred onto the slide, having sufficient amount of the Canadabolsom and was covered by glass cover slip. Prior to the formation of permanent slides all the specimens were examined with the (Kyowa) Steriozoome Microscope for color, nature and density of the trichomes. Permanent slides were prepared and observed under light microscope (Biolux and Kyowa trinocular) and photographs were also taken on different magnifications with PANTEX Camera on Konica 100 ASA film. The trichomes were measured with micrometer. Microscopes were fitted with 10X eye pieces and a trinocular observations tube incorporating PANTEX camera having 2.5X projection eye piece and with 10X, 20X, 40X and 100X objectives (Gersbach, 2002).

For the SEM study the specimens of about .05-1.0 cm were mounted onto the stubs with double sided cellophane tape and were sputter coated with Jeol JFC-1500 Ion sputter device with C-30-50nm gold. Specimens were examined and images were taken with the Scanning Electron Microscope (SEM) Jeol JSM-T200 & Jeol JSM-T6380 with the accelerating voltage at 05-15KV with different magnifications at Biological Research Centre and Central Research Laboratory University of Karachi, Karachi.

Results and Disscussion

The plant hairs or trichomes of flowering plants are useful because of their generally occurrence on different plant parts and the ease with which they can be examined with simple or electron microscope. Taxonomic study of the trichomes of some representative species of genus *Convolvulus* has been carried out. The trichomes can be of great systematic significance and often even common types are used for diagnostic purposes in association with other characters. A practical classification of trichomes is provided by Theobald *et al.,* (1979) provided a glossary of plant hairs, terminology and practical classification of trichomes. The same is used in describing and classifying the trichomes found in *Convolvulus* species. In this contribution the trichome morphology, including size, orientation, ornamentation, structure, of 5 species of the Genus *Convolvulus* viz. *C. arvensis* L., *C. prostratus* Forssk., *C. pseudocantabricus* Scherenk., *C. rhinospermus* Haschst and *C. scindcus* Stocks of family Convolvulaceae were studied using the light microscope (LM) and scanning electron microscope (SEM). A comparison of trichomes characters is provided in Table 1. Great variation in the trichomes density on different plant parts was observed within different species. The trichomes examined in the species of genus *Convolvulus* indicates that in most cases the hairs were similar and essential features found on different plant parts like leaf, stem, sepals, petiole etc but size and density was frequently different. Short trichomes were found in *C. arvensis* Fig. 1A & B which ranged from 25-160µm long and 05-14µm long and longest trichomes are found in *C. rhyniospermus* Fig. 2 A,B,C & D which ranges from 120µm - 1200µm. In *C. arvensis* the trichomes are very thin (05µm-14µm). Thick trichomes were found in *C. pseudocantabricus* Fig. E,F,G & H which ranges from 20-25µm.

During this study an interesting and beautiful ornamentation was observed on the trichomes of *C. pseudocantabricus* Schrenk Fig.2 F & H . Which is very rare in this species the trichomes are thick, stiff with very prominent papillate ornamentation, like pneumatophores of mangrove plants. A unique type of splitting character of trichome like suture in legume also noticed in some members of this genus e.g. *C. prostratus* Forssk.Fig 1 C & D , *C. rhinospermus* Hoschst Fig. 2B, which is not common in the hairs of flowering plants. Rajput & Tahir (2009) reported that these types of hairs in a few species of *Sibbaldia* of family Rosaceae which were collected from Siberia.

In *C.sindicus* two types of trichomes are found, on upper surface of leaf trichomes are large and thin, Fig. 3 A,C & D, whereas on the lower surcace of the leaf the trichomes are very thick, and curly, with very prominent basal cell, Fig. 3B.

Table- 1 Size of trichomes in the species of genus *Convolvulus*.

Name of species	Length of trichome in µm				Width of trichome in µm			
	Minimum	Maximum	Average	St. Dev.	Minimum	Maximum	Average	Standard. Dev.
Convolvulus arvensis L.	25	160	79	±49.32	5	14	8.9	±3.25
C. prostratus Forssk.	84	900	448.4	±276.85	10	35	17.7	±6.55
C. pseudocantabricus Schrenk.	270	480	371.5	±80.07	20	50	31.8	±9.00
C. rhyniospermus Hoscsht.	120	1200	752	±375.79	15	32	23.3	±5.56
C. scindicus Stocks.	350	950	652	±203.24	08	20	15.3	±4.16

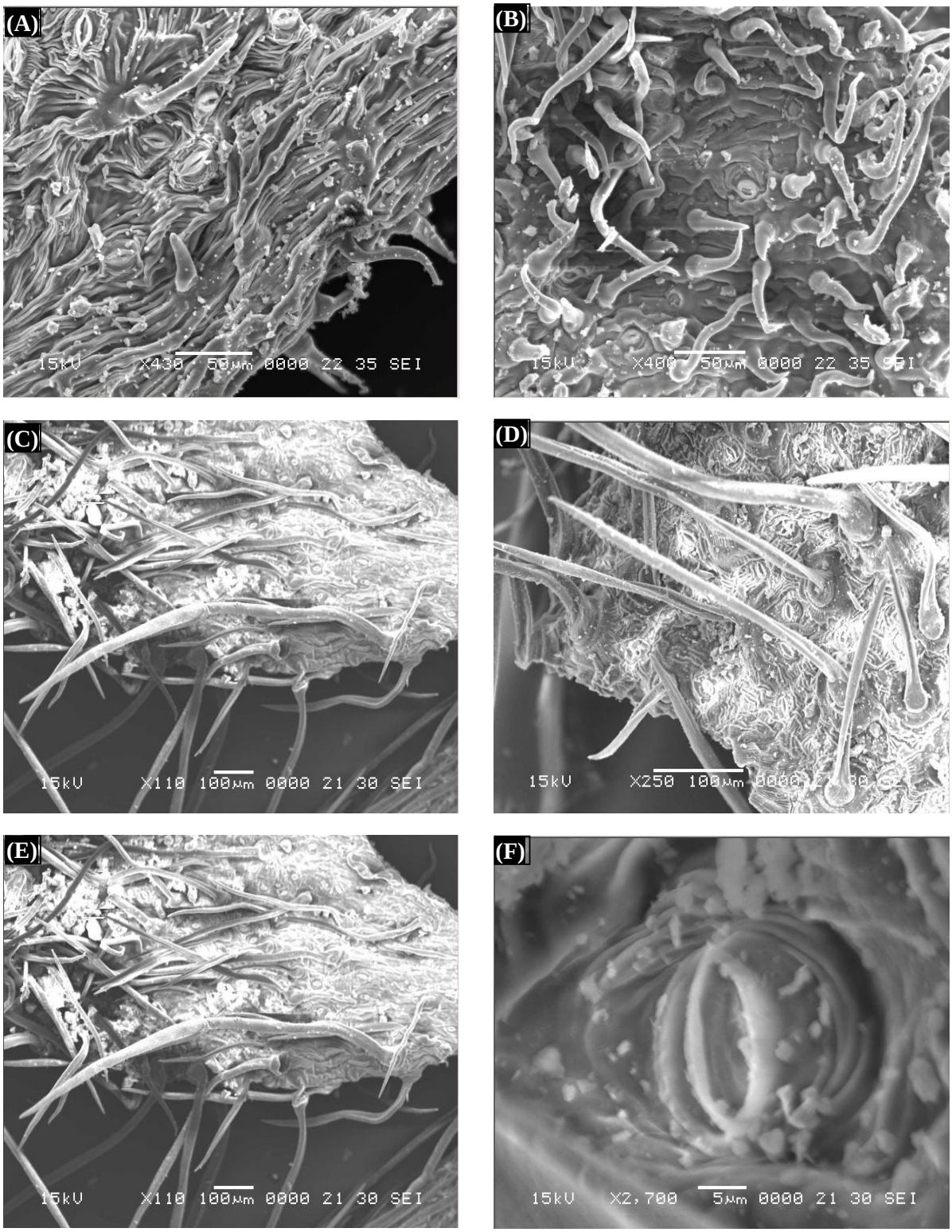

Fig. 1. Scanning Electron Micrographs of *Convolvulus arvensis* Linn.
A. Lower surface of Leaf showing the simple non-glandular trichomes and stomata.
B. Outer surface of sepal lobes showing stiff, slightly bended trichomes. Scanning Electron Micrographs of *Convolvulus prostratus* Forssk.
C. Upper leaf surface showing long unicellular trichomes.
D. Lower leaf surface showing unicellular trichomes with broad basal cell, splitting trichomes are also prominent.
E. Showing the long trichomes on the outer surface of the sepal lobe.
F. Stomata on the lower surface of the leaf.

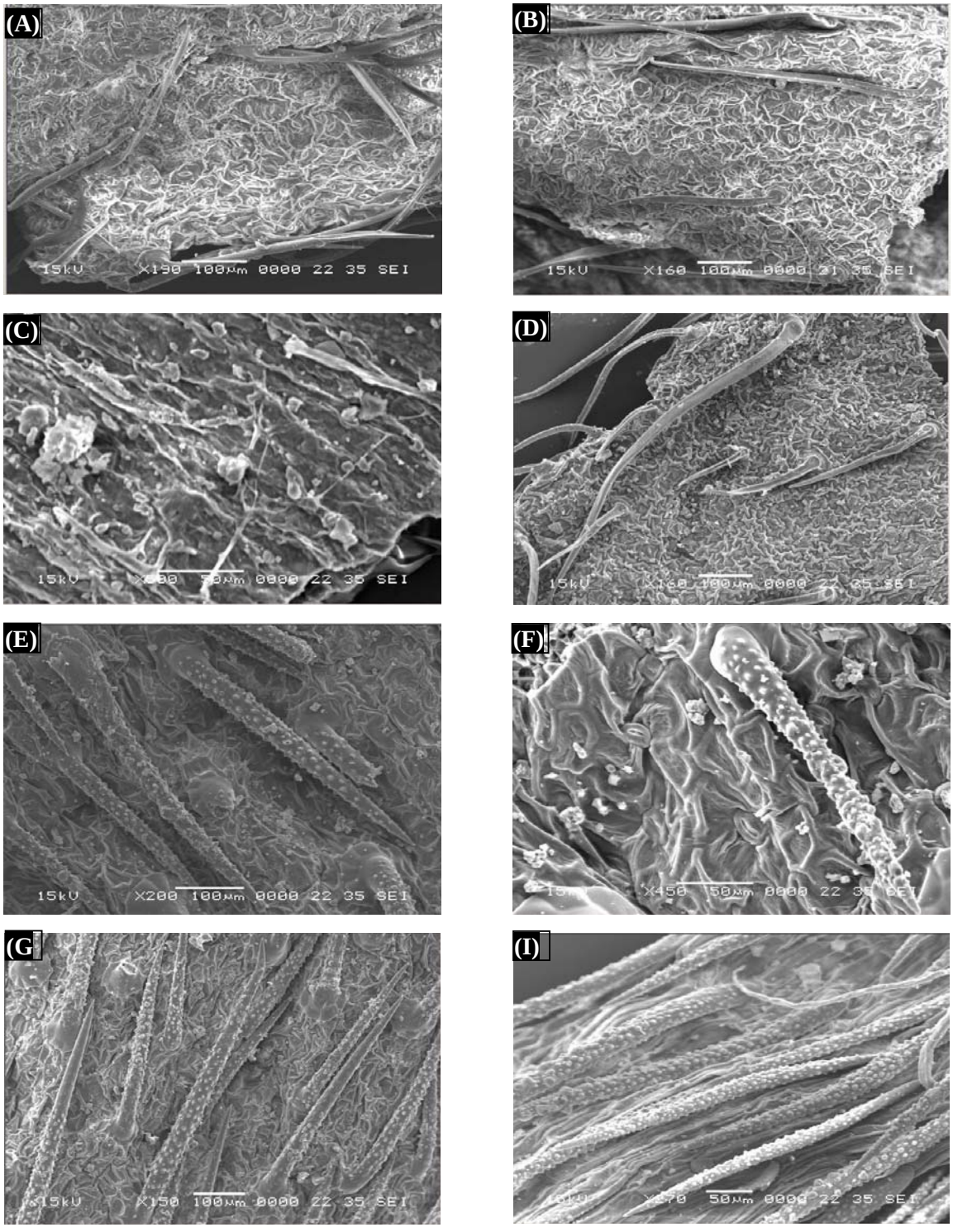

Fig. 2. Scanning Electron Micrographs of *Convolvulus rhinospermus* Hochst. ex Choisy

A. Lower surface of Leaf showing a few long appressed trichomes and stomata.

B. Upper leaf surface having few spilited trichomes small stomata are also present

C. Pedicel having a few trichomes.

D. Outer surface of sepal lobes showing ±reticulate-pattern with few stiff appressed trichomes. Scanning Electron Micrographs of *Convolvulus pseudocantabricus* Schrenk.

E. Lower leaf surface showing appressed, broad stiff unicellular trichomes.

F. Lower leaf surface showing single trichome with granulate pattern on it and a few stomata are present.

G. Upper leaf surface having stiff unicellular trichomes, with prominent base.

H. Outer surface of sepal showing many appressed trichomes.

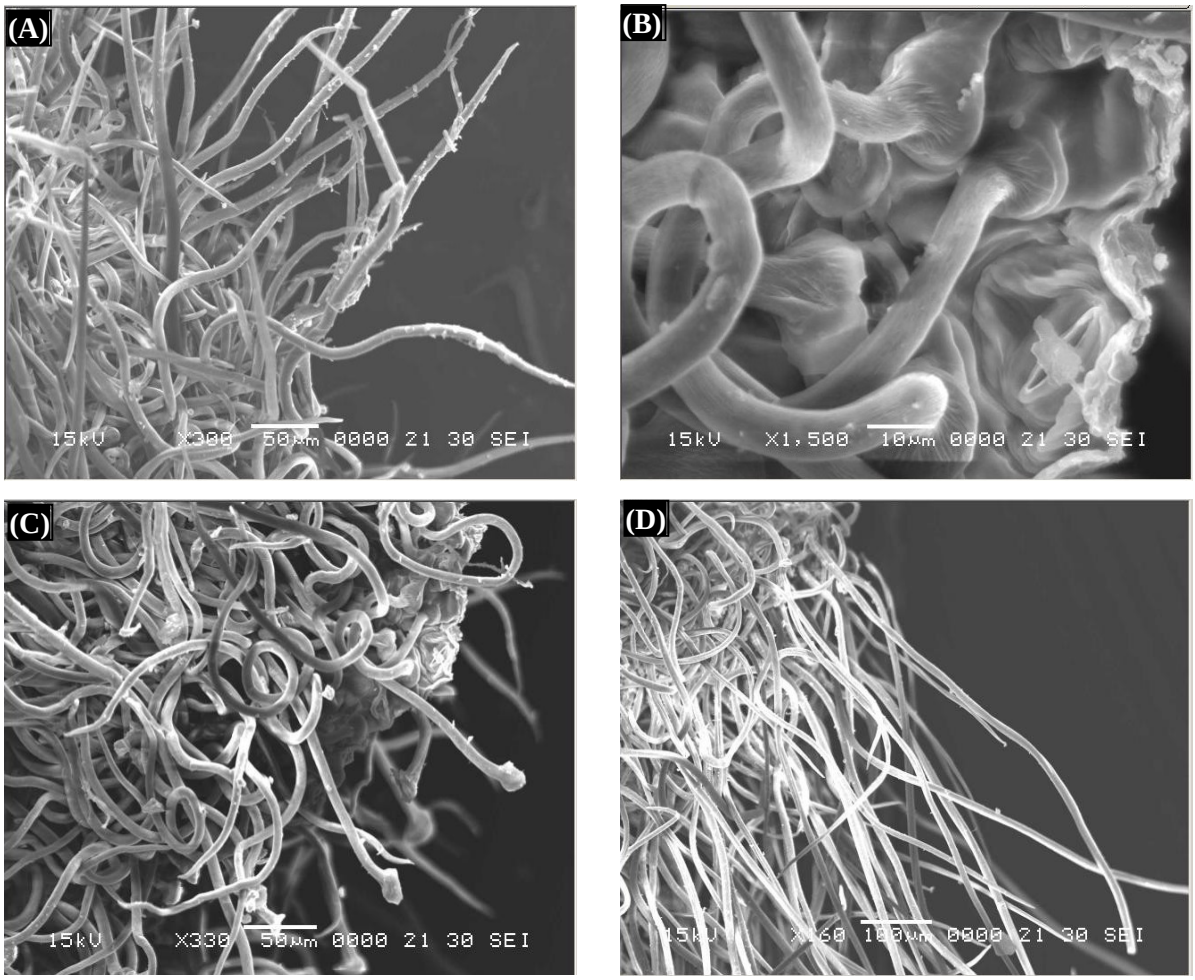

Fig. 3. Scanning Electron Micrographs of *Convolvulus scindicus* Stocks.
A. Upper leaf surface showing densely arranged trichomes.
B. Upper leaf surface enlarged curly trichomes with well developed base
C. Lower leaf surface showing curly nature of trichomes which are intermingled.
D. Outer surface of the sepal lobe showing long unicellular trichomes.

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