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Studies on the taxonomic significance of leaf microhairs of subtribe Sporobolinae, Poaceae

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पोएसी कुल की सब ट्राइब स्पोराबोलिनाई में पत्तियों के माइक्रोहेयर की वर्गिकी महत्ता का अध्ययन

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सारांश

विभिन्न प्रकार की घासों की वर्गिकी में एवं कठिन समूहों की पहचान करने में एवं उपकुलों एवं ट्राइब में वर्गिकृत करने में पत्तियों की ऊपरी परत का बहुत बड़ा महत्व होता है। लेकिन अब तक सूक्ष्माकारिकी का अध्ययन बहुत कम हुआ है। अतएव भारत में सब ट्राइब स्पोरोबोलिनाई (पोऐसी) के 24 सदस्यों की फोलियर सूक्ष्माआकारिकी लक्षणों का स्कैनिंग इलैक्ट्रॉन माइक्रोस्कोप (एसईएम) का विस्तारपूर्वक वर्णन एवं सतही लक्षणों का दस्तावेजीकरण किया गया है। सभी अध्ययन की गई 24 जातियों में तीन प्रकार के पर्णसतह लक्षण देखे गये है, जो जातियों, वंशों को इस सब ट्राइब में वर्गिकृत करने के महत्वपूर्ण लक्षणों में से एक हैं। इसके अतिरिक्त माइक्रोहेयर, मैक्रोहेयर, आन्तरकोशीय सिलिका अंग, हुक एवं प्रिकल्स का भी अध्ययन किया गया है।

ABSTRACT

In grass systematics, leaf epidermal features are very significant for classifying the difficult groups, within subfamilies and tribes. But the micromorphological studies on grasses are very limited. Therefore, foliar micromorphological characters for 24 taxa of the subtribe Sporobolinae Benth. (Poaceae) from India have been studied by using Scanning Electron Microscope (SEM) in detail and the surface features were documented. All the 24 taxa studied were found to have three types of surface features, one of the most useful characters to delimit the species and genera in the subtribe. Besides microhairs, macrohairs, intercostal silica bodies, hooks and prickles were also studied.

Keywords: Poaceae, *Sporobolinae*, Microhairs, Silica Bodies, India

INTRODUCTION

Poaceae are the most diverse in their morphological features which are useful for describing various genera and species of this large family. In the recent years, vegetative characters are also used as valuable tools for identification and classification; among these, leaf characters are the most commonly used in plant taxonomy (Stebbins & Khush, 1961). Microscopic features such as epidermal cells, stomata, cuticle, surface contours and ornamentation (hairs, papillae and trichomes) are used to describe different taxa (Avdulov, 1931; Prat, 1932). Metcalfe (1960), pointed out that the epidermal characters are quite valuable in grass systematics. General anatomical and micromorphological features for monocots have earlier been described by Metcalfe (1953); later by Palmer & Tucker (1981, 1983); Palmer & al. (1985); Palmer & Gerbeth-Jones (1986, 1988) who made detailed studies on the microhair morphology of some East African grasses. Palmer and his team after studying the micromorphological features of the leaves of modern grasses have recorded the characteristic patterns based on

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SEM studies. Recently, Clayton & Renvoize (1986) used micromorphological features to resolve the taxonomic problems in Poaceae. Besides, Watson & Dallwitz (1992) used the data of abaxial leaf surfaces only at generic level, and have documented the structural diversity as well as measurements of few epidermal characters including cells, nature of the walls, stomata, microhairs, silica bodies and papillae for abaxial surface.

It is well recognised that foliar anatomy and epidermal features are very important in grass systematics for characterization of broad groups, within subfamilies and tribes (Palmer & Tucker, 1981, 1983; Palmer & al.,1985; Palmer & Gerbeth-Jones, 1986, 1988). Microhairs of diverse morphological types are of general occurrence in all the subfamilies of the Poaceae except the Pooideae (Johnston & Watson, 1977; Ellis, 1987) and are found on the epidermis of the leaf sheaths, leaf blades, glumes, lemmas, paleas, and lodicules (Metcalfe 1960; Ellis 1979, 1987; Amarasinghe & Watson 1990). Microhairs are usually classified as "Panicoid", "Chloridoid", or "Intermediate" types according to the shape and relative cell wall thickness of basal and apical cells (Tateoka & al., 1959; Johnston & Watson 1976; Amarasinghe & Watson 1990; Snow, 1996).

Subtribe Sporobolinae represented by four genera in India *viz*., *Crypsis, Muhlenbergia, Sporobolus* and *Urochondra* (Bor, 1960; Karthikeyan & al.,1989). Earlier only two species have been studied in the subtribe Sporobolinae. The micromorphology of microhairs of 24 taxa belonging to 4 genera are studied during the present study and the results are presented here.

MATERIALS AND METHODS

In the present study, the microhairs morphology of leaf surface of 24 species of Sporobolinae was observed by using of Scanning Electron Microscope (SEM). Materials for the study were collected from the herbarium or from live specimens. In each species, mature leaves were selected and soaked in to the water and cut in to the small pieces to the size about 0.5 cm^2. The leaves were cleaned with ethyl alcohol; cleaned leaf pieces were then mounted directly on stubs using double-sided adhesive tape and they were sputter-coated for 60 seconds with gold-palladium mixture in a SC7620 Sputter Coater (EMITECH). After coating, leaves were examined with the Scanning Electron Microscope (Evo M18, Carl Zeiss), using an accelerating voltage of 5 to 15 KV. Multiple micrographs and measurements were made using the Image Tool software.

RESULTS AND DISCUSSION

24 taxa were studied for the leaf microhair morphology of the subtribe Sporobolinae in India. Out of the 24 taxa, 10 were found to be of the chloridoid type and 6 taxa were found seen macrohairs, prickles but not any microhairs and 7 taxa were found with a layer of silica bodies. A total of 24 species were studied for their microhair morphology for the first time which includes 1 endemic species to Tamil Nadu, viz., *Sporobolus hajrae*.

Three types of surface conditions were observed: 1) Macrohairs and Prickles; 2) Microhairs Chloridoid-type present study shows that the subtribe Sporobolinae has Chloridoid-type of microhairs in all the species, where it could be observed absent; 3) Microhairs absent due to a thick layer of costal silica bodies, deposit in the coastal species.

1. Microhairs were present in the following species: *Crypsis schoenoides, Muhlenbergia duthieana, M. himalayensis, M. huegelii, Sporobolus capillaris, S. fimbriatus, S. helvolus, S. humilis* subsp. *minor, S. piliferus* and *S. tenuissimus*.
2. Macrohairs and prickles were found in the following species but microhairs were not seen in the following species: *Crypsisa culeata, Sporobolus africanus*, *S. diandrus*, *S. fertilis, S. festivus* and *S. wallichii*.
3. Microhairs were not found due to a layer of silica body deposits in the maximum number of coastal species like: *Sporobolus coromandelianus, S. hajrae, S. ioclados, S. maderaspatanus, S. spicatus, S. virginicus* and *Urochondra setulosa*. In a similar study on microhairs of *Eragrostis* species Vivek & al., (2016) pointed out that microhairs are caducous. This might be the reason for the absence of microhairs in subtribe Sporobolinae also.

The SEM images of microhairs of the subtribe Sporobolinae are given in Table 1, Plates I, II & III.

Table 1. Types of microhairs in the subtribe Sporobolinae of India:

S.No.	Species name	Type of micro hairs	Specimen studied
1.	*Crypsis aculeata* (L.)Ait.	Microhairs absent	*coll.ign.* 105(CAL).
2.	*C. schoenoides* (L.) Lam.	Chloridoid type	*G.P. Roy* 2493(BSIJ).
3.	*Muhlenbergia duthieana* Hack.	Chloridoid type	*P.K. Hajra* 87523(BSD); *U.C. Bhattacharyya* 13029 (BSD).
4.	*Muhlenbergia himalayensis* Hack. ex Hook.f.	Chloridoid type	*U.C. Bhattacharyya,* 44778 (BSD); *S.K. Murti* & *R. Prasad,* 61950(BSD).
5.	*M. huegelii* Trin.	Chloridoid type	*T.A. Rao,* 8579 (BSD); *G.K. Deka,* 1706 (ASSAM).
6.	*Sporobolus africanus* (Poir.) Robyns & Tournay	Microhairs absent	*Kabeer,* 117178 (MH); *Arumugam,*153103(MH).
7.	*S. capillaris* Miq.	Chloridoid type	*Kabeer,* 116148(MH).
8.	*S. coromandelianus* (Retz.) Kunth	Microhairs absent	*Arumugam,*135101(MH); *Kabeer,*183628(MH).
9.	*S. diandrus* (Retz.) P. Beauv.	Microhairs absent	*Arumugam,* 135102(MH).
10.	*S. fertilis* (Steud.) Clayton	Microhairs absent	*Kabeer,*116244(MH).
11.	*S. festivus* Hochst. ex A. Rich.	Microhairs absent	*E. Chiovenda,* 3956(CAL).
12.	*S. fimbriatus* (Trin.) Nees	Chloridoid type	*J.M. Wood,*1798(CAL).
13.	*S. hajrae* P. Umam. & P. Daniel	Microhairs absent	*P. Daniel* & *P.Umamaheswari,* 106554(MH).
14.	*S. helvolus* (Trin.) T. Durand & Schinz	Chloridoid type	*R.S. Raghavan,* 114572(BSI); *V.J. Nair,* 21557(BSD).
15.	*S. humilis* sub sp. *Minor* Veldkamp	Chloridod type	*Kabeer,*183597(MH).
16.	*S. ioclados* (Trin.) Nees	Microhairs absent	*Kabeer,*116351(MH); *U. C. Bhattacharyya,* 39246 (BSD).
17.	*S. maderaspatanus* Bor	Microhairs absent	*P. Daniel,* 101105(MH)
18.	*S. piliferus* (Trin.) Kunth	Chloridod type	*Kabeer,* 118766(MH)
19.	*S.spicatus* (Vahl) Kunth	Microhairs absent	*Kabeer,*119609(MH)
20.	*S. tenuissimus* (Schrank) Kuntze	Chloridod type	*Kabeer,*116242 (MH)
21.	*S. tetragonus* Bor	Microhairs absent	*P.C. Pant,* 43141(BSD)
22.	*S. virginicus* (L.) Kunth	Microhairs absent	*P. Daniel* & *P. Umamaheswari,*106597(MH)
23.	*S. wallichii* Munro ex Thwaites	Microhairs absent	*Kabeer,* 117218(MH)
24.	*Urochondra setulosa* C.E. Hubb.	Microhairs absent	*G. L. Tiwary,* 987(BSIJ)

CONCLUSION

Some species of *Sporobolinae* were characterized by chloridoid-type of microhairs. However, microhairs were not be observed in some taxa such as *Sporobolus coromandelianus, S. hajrae, S. ioclados, S. maderaspatanus, S. spicatus, S. virginicus* and *Urochondra setulosa* due to the presence of layer containing silica bodies and some species were found to have macro hairs and prickels such as *Crypsisa culeata, Sporobolus africanus*, *S. diandrus*, *S. fertilis, S. festivus, S. tetragonus* and *S. wallichii,* rarely some species do not have any type of hairs. This may be due to caducous nature is the reason. Thus the microhair micromorphological characters can be helpful when used along with other morphological characters for the restriction and delimitation of species of subtribe Sporobolinae in India.

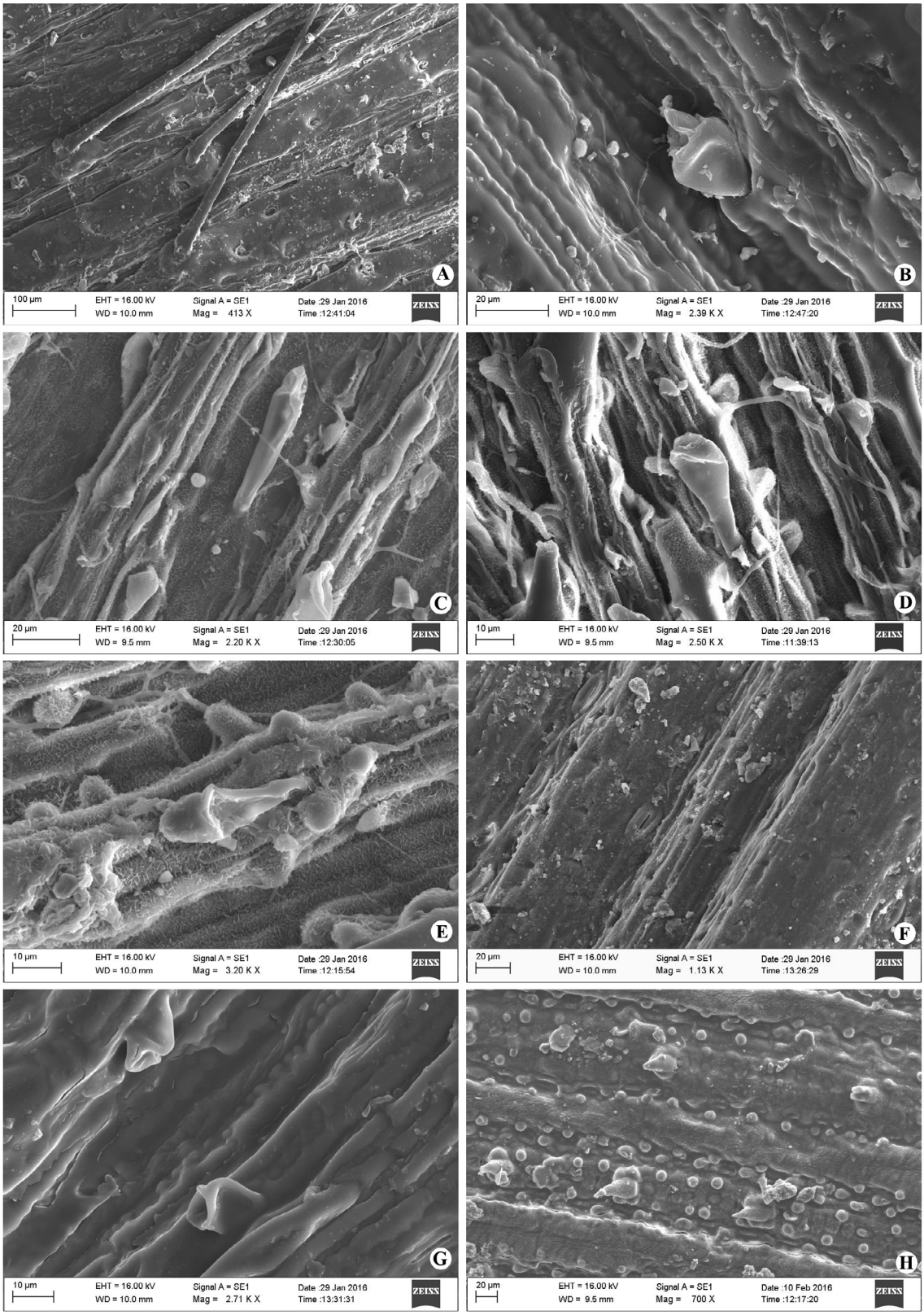

Plate. I. SEM image of microhaires: A. *Crypsis aculeata* (L.) Aiton; B. *C. schoenoides* (L.) Lam.; C. *Muhlenbergia duthieana* Hack.: D. *M. himalayensis* Hack. ex Hook. f.; E. *M. huegelii* Trin.; F. *S. africanus* (Poir.) Robyns & Tournay; G. *S. capillaris* Miq. H. *S. coromandelianus* (Retz.) Kunth;

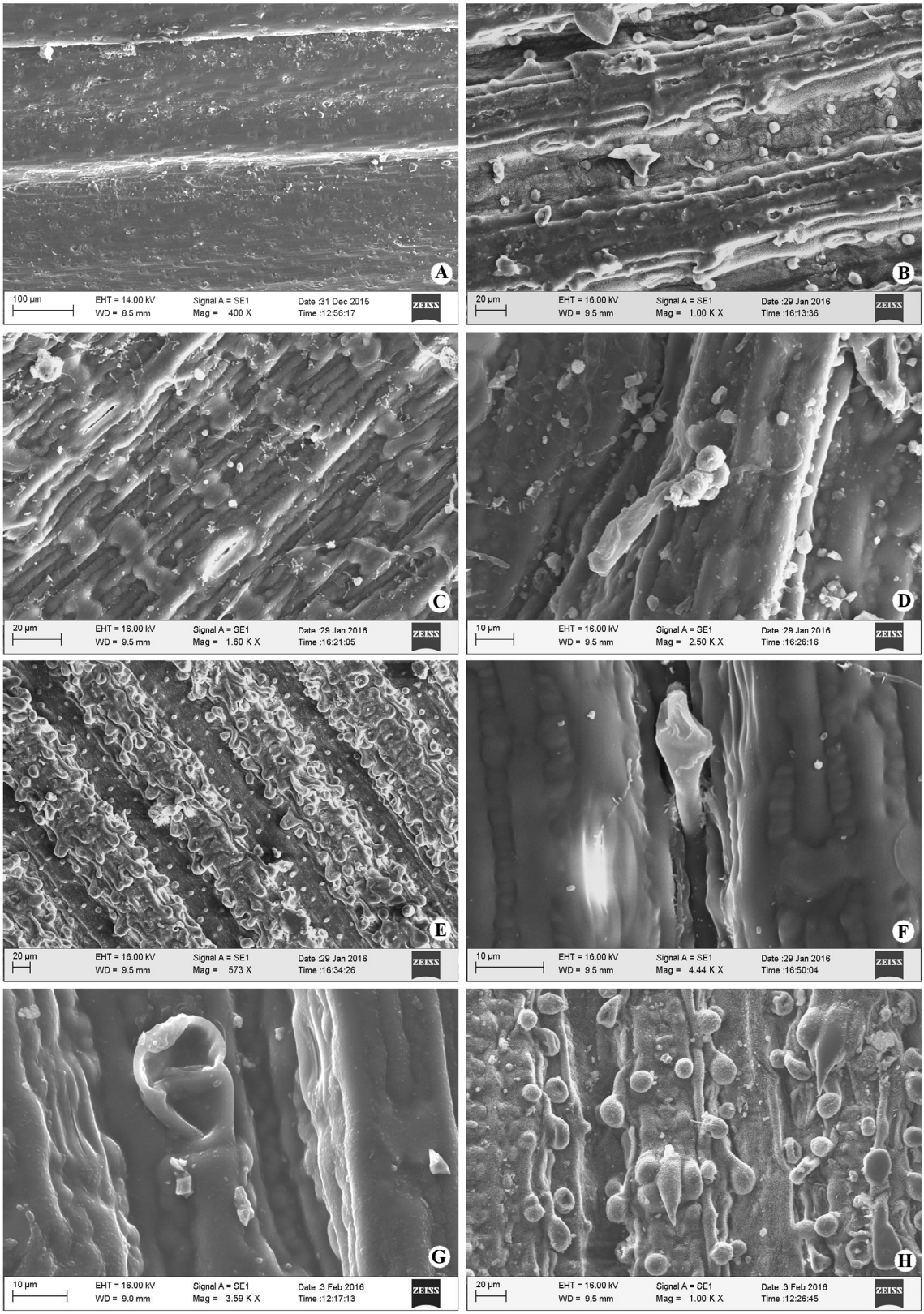

Plate. II. SEM image of microhaires: A. *S. diandrus* (Retz.) P. Beauv.; B. *S. fertilis* (Steud.) Calyton; C. *S. festivus* Hochst. ex A. Rich.; D. *S. fimbriatus* (Trin.) Nees; E. *S. hajrae* P. Umam. & P. Daniel; F. *S. helvolus* T. Durand & Schinz; G. *S. humilis* subsp. *minor* Veldkamp; H. *S. ioclados* (Trin.) Nees

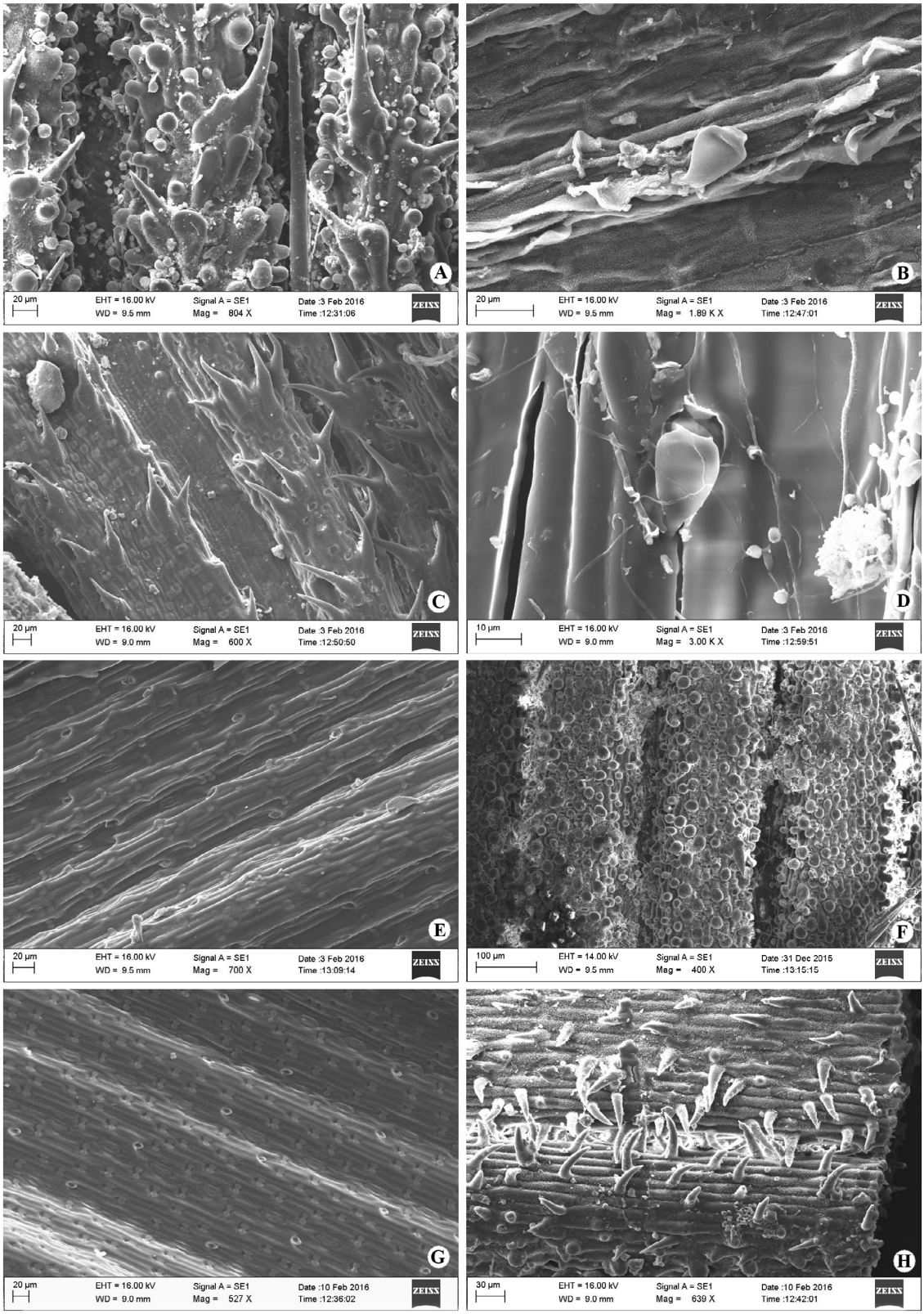

Plate. III. SEM image of microhairs: A. *Sporobolus maderaspatanus* Bor; B. S. *piliferus* (Trin.) Kunth; C. S. *spicatus* (Vahl) Kunth; D. S. *tenussimus* (Schrank) Kuntze; E. S. *virginicus* (L.) Kunth; F. S. *wallichii* Munro ex Thwaites; G. Urochondra setulosa (Trin.) C.E. Hubb.

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