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ANTHER TYPES OF THE MONOCOTS WITHIN FLORA OF KARACHI, PAKISTAN

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Abstract

Seventy-two monocot species distributed in 10 families were examined for their anther types based on mode of dehiscence by light and scanning electron microscopy. Latrorse anthers were found in 68 species, 3 species dehisce their anthers extrorsely while only one species showed poricidal dehiscence irrespective of primitive or advance taxa.

Introduction

Anther dehiscence is the opening of anther sacs to release the pollen grains. There are various schools of thought for the dehiscence of anthers such as Buchman (1983) opined that anther sacs open when the stomium of anther ruptures, the locule wall turns back and pollen grains are exposed. However, in many aquatic plants the development of stomium is absent and the anther wall ruptures regularly (Swamy & Krishnamurthy, 1980). Dehiscence may also be related to the mechanical forces of endothecium (D'Arcy, 1996; Saad *et al.*, 2007). Besides, this there are a number of features of the stamen such as open stomata, a weakly developed cuticle, a prominent intercellular space system and xylem lacunae some or all of these may also play a role in anther dehiscence (Schmid, 1976). Based on the mode of dehiscence of anthers there are four anther types such as longitudinal, transverse, poricidal and valvular. Longitudinal type is further divided into extrorse, introrse and latrorse subtypes (Radford *et al.,* 1974). Very few reports are available on anthers of monocots (Buchmann, 1983; Endress, 1996). Present study was carried out to provide the informations on anther types of monocots from Karachi region based on their mode of dehiscence.

Materials and Methods

Anthers of 72 species belonging to the 10 monocot families were studied. Mature flowers prior and after anther dehiscence were collected from different localities within the vicinity of Karachi such as Karachi University Campus, Malir, Manghopir and Clifton. However, in case of nonavailability of fresh material herbarium specimens were also studied (Table1).

Anthers were observed for their mode of dehiscence under stereo (Nikon XXI Model) and scanning electron microscopes (JSM-6380 A). For scanning electron microscopy, anthers were mounted on a metallic stub with the help of double adhesive tape and coated with gold for a period of 6 minutes in sputtering chamber and observed in SEM. In most of the cases 2 plants / species and 10 anthers / plant were studied.

Table 1. Anther types of the monocotyledonous taxa.

Name of taxa	Family	Anther types	Voucher specimen (collector, number, herbarium)
Asparagus dumosus Baker	Asparagaceae	Latrorse	S. Sharmeen 40 (KUH); R. Bano s.n. (KUH).
Aloe vera (L.) Burm.	Asphodelaceae	Latrorse	Tahir Ali 8840 (KUH); Rubina Saleem & Abrar Hussain s.n. (KUH).
Asphodelus tenuifolius Cav.	Asphodelaceae	Latrorse	S. Khatoon 566, 570 (KUH); S.M.H. Jafri 834 (KUH); Rizwan Yousuf 46 (KUH).
Commelina albescens Hassk.	Commelinaceae	Extrorse	R.Bano s.n. (KUH); M. Qaiser, A. Raza & Abrar Hussain 566 (KUH); S.Abedin 1408, 3768 (KUH); Tausif s.n. (KUH).
Cyperus arenarius Retz.	Cyperaceae	Latrorse	S.Abedin 5097 (KUH); Alavi s.n. (KUH); M.Qaiser, A.Ghafoor & Hussain 3848, 3890 (KUH).
C. atkinsoni C.B. Clarke	Cyperaceae	Latrorse	Gul s.n. (KUH); Jafri 2509 (KUH); M. Qaiser & A. Ghafoor 4161 (KUH); S.Abedin 3664, 3702 (KUH)
C. bulbosus Vahl	Cyperaceae	Latrorse	R. Bano 29 (KUH); Hussain s.n. (KUH); Ahmed s.n. (KUH).
C. conglomeratus Rottb.	Cyperaceae	Latrorse	Abedin 5682 (KUH); Ahmad s.n. (KUH); Mushtaq Hussain s.n. (KUH).
C. laevigatus L.	Cyperaceae	Latrorse	Ali s.n. (KUH); Gul s.n. (KUH); Khadija s.n. (KUH).
C. rotundus L.	Cyperaceae	Latrorse	R. Bano 4, (KUH); S. Abedin 2351, 5289 (KUH); Nargis s.n. (KUH); S. Khatoon 395 (KUH).
Eleocharis geniculata (L.) Roemer & Schult.	Cyperaceae	Latrorse	S.I. Ali s.n. (KUH); R. Bano s.n. (KUH).
Fimbristylis dichotoma (L.) Vahl	Cyperaceae	Latrorse	R. Bano 14 (KUH).
Schoenoplectus litoralis (Schrad.) Palla	Cyperaceae	Latrorse	Khatoon & Qadir 307 (KUH); S.I. Ali s.n. (KUH); Khan s.n. (KUH); S. Abedin 3797 (KUH); R. Bano s.n. (KUH).
Hydrilla verticillata (L.f) L.C. Rich	Hydrocharitaceae	Extrorse	R. Bano 27 (KUH); S. Omer & Abrar Hussain s.n. (KUH);Gul s.n.(KUH); Khadija s.n. (KUH).
Juncus maritimus Lam.	Juncaceae	Latrorse	R. Bano 46 (KUH); S.I. Ali s.n. (KUH); S.M.H. Jafri 2752(KUH).
Dipcadi erythraeum Webb. & Berth.	Liliaceae	Latrorse	R.Bano 42 (KUH).
Phoenix dactylifera L.	Palmae	Latrorse	Kamal Akhter Malik 837 (KUH); S. Sharmeen 108, 119 (KUH); R. Bano s.n. (KUH).
Aristida adscensionis L.	Poaceae	Latrorse	Abrar Hussain s.n. (KUH); M. Qaiser, A. Raza & Abrar Hussain 987 (KUH); S.I. Ali s.n. (KUH).

Table 1. (Cont'd.).

Name of taxa	Family	Anther types	Voucher specimen (collector, number, herbarium)
A. funiculata Trin. & Rupr.	Poaceae	Latrorse	M. Qasier, A. Ghafoor & Abrar Hussain 3830 (KUH); Khadija s.n. (KUH); Yasin Nasir s.n. (KUH).
A. hystricula Edgew.	Poaceae	Latrorse	Khush Gul s.n. (KUH); M. Qasier, A. Ghafoor & S. Abrar 4123 (KUH).
A. mutabilis Trin. & Rupr.	Poaceae	Latrorse	Tahmeena Siddiqui 49 (KUH); R.Bano 6 (KUH).
Aeluropus lagopoides (L.) Trin. ex Thw.	Poaceae	Latrorse	S.I. Ali s.n. (KUH); S.I. Ali, S.A. Farooqi & S. Abedin 4287 (KUH).
B. ramosa (L.) Stapf	Poaceae	Latrorse	S. Sharmeen 7 (KUH); Abrar Hussain 1007 (KUH); Abrar Husain s.n. (KUH).
Bothriochloa ischaemum (L.) Keng	Poaceae	Latrorse	S.I. Ali, S. Abedin & A. Ghafoor 1227 (KUH); M. Qasier & A. Ghafoor 4518 (KUH).
Cenchrus pennisetiformis Hochsts. & Steud. ex Steud.	Poaceae	Latrorse	S.I. Ali & S.A. Farooqi s.n. (KUH); S. Sharmeen 45 (KUH); M. Qasier, A. Raza & Abrar Husaain 1138 (KUH); Abrar Hussain s.n. (KUH).
C. biflorus Roxb.	Poaceae	Latrorse	S. Sharmeen 16 (KUH); Nadeem, Zeenat, Bushreen & Moin 44 (KUH).
C. setigerus Vahl	Poaceae	Latrorse	S.I. Ali & students 302, 359 (KUH); Y. Nasir s.n. (KUH).
Chloris barbata Sw.	Poaceae	Latrorse	S. Sharmeen 11 (KUH), R. Bano 41 (KUH); M. Salim Qureshi s.n. (KUH); S. Abedin 32 (KUH).
Cymbopogon martinii (Roxb.) Wats.	Poaceae	Latrorse	Moin & Nadeem 25 (KUH).
C. jwarancusa (Jones) Schult.	Poaceae	Latrorse	Shamim Akhtar s.n. (KUH); Sadaruddin *et al*., 73 (KUH); Bushreen & Nadeem 55 (KUH).
Cymbopogon commutatus (Steud.) Stapf	Poaceae	Latrorse	S. Abedin 677 (KUH); M Qasier, A. Raza & Abrar Hussain 537 (KUH); Abrar Hussain s.n. (KUH); R.Bano 18 (KUH).
Cynodon dactylon (L.) Pers.	Poaceae	Latrorse	R. Bano 28 (KUH); Moin, Zeenat & Bushreen 12 (KUH); S.I.Ali s.n. (KUH).
Dactyloctenium aegyptium (L.) Willd.	Poaceae	Latrorse	S. Sharmeen 67 (KUH); R. Bano 24 (KUH); T.Siddiqui 43 (KUH); Abrar Hussain s.n. (KUH).
D. scindicum Boiss.	Poaceae	Latrorse	R. Bano 7 (KUH); Abrar Hussain s.n. (KUH); S.I. Ali & S.A. Farooqi s.n. (KUH); Y.Nasir s.n. (KUH).

Table 1. (Cont'd.).

Name of taxa	Family	Anther types	Voucher specimen (collector, number, herbarium)
Desmostachya bipinnata (L.) Stapf	Poaceae	Latrorse	Khadija s.n. (KUH); S. Sharmeen 38 (KUH); M.Imran 44 (KUH).
Dichanthium annulatum (Forssk.) Stapf	Poaceae	Poricidal	S. Sharmeen 62 (KUH); R. Bano 3, 17 (KUH); M. Qaiser & A. Ghafoor 3626 (KUH).
Digitaria nodosa Parl.	Poaceae	Latrorse	S. Sharmeen 88 (KUH); S.M.H.Jafri 1512 (KUH).
Echinochloa colona (L.) Link	Poaceae	Latrorse	Abrar Hussain s.n. (KUH); Gul s.n. (KUH); M. Nazimuddin s.n. (KUH).
Eleusine indica (L.) Gaertn.	Poaceae	Latrorse	Abrar Hussain 1000 (KUH); Gul s.n. (KUH).
Elionurus royleanus Nees ex A. Rich.	Poaceae	Latrorse	Khadija s.n. (KUH); Coll. ignot s.n. (KUH); Moin, Rizwan, Bushreen & Zeenat 65 (KUH).
Eragrostis ciliaris (L.) R.Br.	Poaceae	Latrorse	Y. Nasir s.n. (KUH); M. Qaiser, A. Ghafoor & Abrar Hussain 3672, 3750 (KUH); Abrar Hussain s.n. (KUH).
E. pilosa (L.) P.Beauv.	Poaceae	Latrorse	R. Bano 23 (KUH); Khadija s.n. (KUH); S. Abedin 5303 (KUH); Abrar Hussain s.n. (KUH).
E. tenella (L.) P. Beauv.	Poaceae	Latrorse	S. Sharmeen 84 (KUH); Khadija s.n. (KUH); Bushreen, Nadeem & Moin 77 (KUH).
Eriochloa procera (Retz.) C.E. Hubb.	Poaceae	Latrorse	S. Omer 151 (KUH); S.Abedin 3880 (KUH); Moin & Nadeem 27 (KUH); R.Bano s.n.(KUH).
Halopyrum mucronatum (L.) Stapf	Poaceae	Latrorse	T. Siddiqui 58 (KUH); S.I. Ali 229 (KUH); S.M.H. Jafri 1540 (KUH).
Laptothrium senegalense (Kunth) W.D.Clayton	Poaceae	Latrorse	S. Abedin & A. Ghafoor 1275 (KUH); Abrar Hussain s.n. (KUH) S.I. Ali & S.A. Farooqi s.n. (KUH).
Lolium temulentum L.	Poaceae	Latrorse	R. Bano 12 (KUH).
Melanocenchris abyssinica (R.Br.) Hochst.	Poaceae	Latrorse	Abrar Hussain s.n. (KUH); Khadija s.n. (KUH); Gul s.n. (KUH).
Ochthochloa compressa (Forssk.) Hilu	Poaceae	Latrorse	Nadeem, Moin, Zeenat & Bushreen 38 (KUH); T. Siddiqui 72 (KUH).
Panicum antidotale Retz.	Poaceae	Latrorse	S. Sharmeen 126 (KUH); Y. Nasir s.n. (KUH); Ansar Ahmed s.n. (KUH).
P. turgidum Forssk.	Poaceae	Latrorse	S. Sharmeen 117 (KUH); R. Bano 36 (KUH).
Paspalum paspalodes (Michx.) Scribner	Poaceae	Latrorse	S. Sharmeen 136 (KUH); R. Bano 22 (KUH); Y. Nasir. s.n.(KUH); M. Qaiser & A. Ghafoor 4457 (KUH); Abrar Hussain s.n. (KUH).

Table 1. (Cont'd.).

Name of taxa	Family	Anther types	Voucher specimen (collector, number, herbarium)
Paspalidium geminatum (Forssk.) Stapf	Poaceae	Latrorse	S. Sharmeen 142 (KUH); R. Bano 32 (KUH); M. Qaiser & A. Ghafoor 3640 (KUH); S.I. Ali s.n. (KUH).
P. punctatum (Burm.)A. Camus	Poaceae	Latrorse	S. Sharmeen 135, 139 (KUH).
Pennisetum divisum (Gmel.) Henr.	Poaceae	Latrorse	R. Bano 46 (KUH); S.I. Ali 417 (KUH); S.M.H. Jafri s.n. (KUH).
P. glaucum (L.) R.Br.	Poaceae	Latrorse	S. Sharmeen 112, 113 (KUH); Moin & Nadeem 30 (KUH).
Phragmites karka (Retz.) Trin. ex Steud.	Poaceae	Latrorse	S. Sharmeen 104 (KUH); Syed Afzal Ahmed Hyderi s.n. (KUH); Khadija s.n. (KUH).
Saccharum griffithii Munro ex Boiss.	Poaceae	Latrorse	Shamim Akhtar s.n. (KUH).
S. spontaneum L.	Poaceae	Latrorse	R. Bano 43 (KUH); S.A. Farooqi *et al*. s.n. (KUH); S.A. Malik s.n. (KUH).
Setaria intermedia Roem. & Schult.	Poaceae	Latrorse	S.A. Farooqi & M. Qaiser 2790 (KUH); R.R. Stewart 17100 (KUH); S.M.H.Jafri 4054 (KUH).
S. verticillata (L.) P. Beauv.	Poaceae	Latrorse	R. Bano 47 (KUH); S. Sharmeen 169 (KUH); S. Abedin 30 (KUH); Shamim Akhter s.n. (KUH); Y. Nasir s.n. (KUH).
Sporobolus arabicus Boiss.	Poaceae	Latrorse	R. Bano 45 (KUH); Y. Nasir s.n. (KUH); Gul s.n. (KUH); Khadija s.n. (KUH).
S. coromandelianus (Retz.) Kunth	Poaceae	Latrorse	S. Sharmeen 176 (KUH); Gul s.n. (KUH); Abrar Hussain s.n. (KUH).
S. helvolus (Trin.) Dur. & Schinz	Poaceae	Latrorse	Abrar Hussain s.n. (KUH); S.I. Ali s.n. (KUH); S. Omer s.n. (KUH).
Stipagrostis hirtigluma (Steud. ex Trin. & Rupr.) Dewinter	Poaceae	Latrorse	S. Sharmeen 21, 31 (KUH).
Tetrapogon tenellus (Koen. ex Roxb.) Chiov.	Poaceae	Latrorse	Abrar Hussain & M. Saleem s.n. (KUH); Moin, Bushreen & Zeenat 53,37 (KUH).
T. villosus Desf.	Poaceae	Latrorse	J.R. Kazmi s.n. (KUH); Coll.ignot s.n. (KUH).
Urochondra setulosa (Trin.) C.E. Hubb.	Poaceae	Latrorse	S.I. Ali s.n. (KUH); Abrar Hussain s.n. (KUH); T. Siddiqui 75 (KUH); Rizwan Yousuf 12 (KUH).
Polypogon monspeliensis (L.) Desf.	Poaceae	Latrorse	Abrar Hussain s.n. (KUH); M. Qaiser & A. Raza 491 (KUH); S.R.B. Rizvi s.n. (KUH).
Potamogeton pectinatus L.	Potamogetonaceae	Latrorse	R. Bano s.n. (KUH).
P. perfoliatus L.	Potamogetonaceae	Latrorse	Gul s.n.(KUH); S.I.Ali s.n. (KUH).
Typha domingensis Pers.	Typhaceae	Extrorse	A.Wahid s.n. (KUH); S. Omer & Rizwan Yousuf s.n. (KUH); Abrar Hussain s.n. (KUH); R. Bano 34 (KUH).

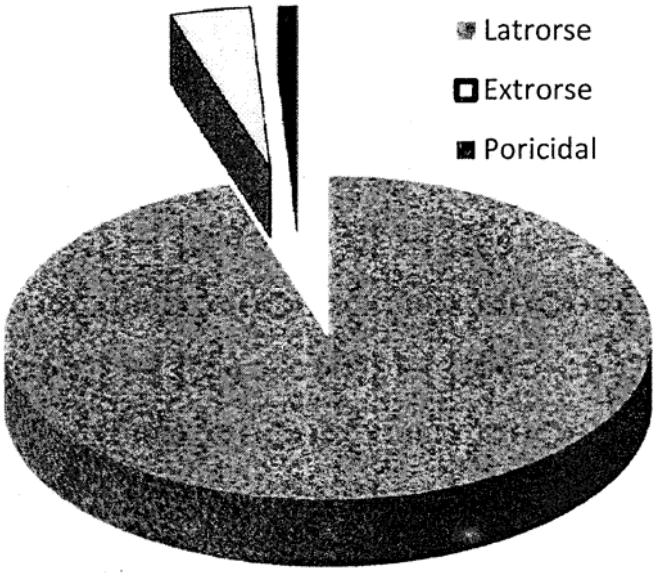

Fig. 1. Pie Chart showing the percentage of anther types of the monocotyledonous taxa.

Results and Discussion

Monocotyledonous flora of Karachi exhibits latrorse, extrorse and poricidal types of anther dehiscence (Table 1; Figs. 2-5). Amongst all of the studied taxa 95% taxa have latrorse type and 4% taxa show extrorse dehiscence while only 1% taxa dehisced their anthers by apical pores (Fig. 1). Out of 10 families, Commelinaceae, Hydrocharitaceae and Typhaceae have extrorse type of anthers while in the families Asparagaceae, Asphodelaceae, Cyperaceae, Juncaceae, Palmae and Potamogetonaceae latrorse anthers were observed. Poaceae is the only family where all taxa having latrorse dehiscence except in the *Dichanthium annulatum* (Forssk.) Stapf (Fig. 2A) which has poricidal anthers. Similarly Buchmann (1983) also observed some monocot families with atleast one taxon in which anther dehiscing by pores or apical slits. For the anther types generally it is believed that extrorse anthers are more common in primitive monocots and rare in advanced groups but present findings do not support this contention as the extrorse anthers are observed in Commelinaceae and Typhaceae from which Commelinaceae is most basal family and Typhaceae is advanced one. These findings are also in agreement to those of Endress (1993) where on one side extrorse condition was found in advanced groups like Alismatids and Araceae while introrse anthers were observed in *Acorus* which is considered to be the most primitive monocot. Therefore, from the foregoing discussion one can conclude that latrorse type of dehiscence is most common within monocots of Karachi and secondly anther types are scattered irrespective of advance and primitive taxa.

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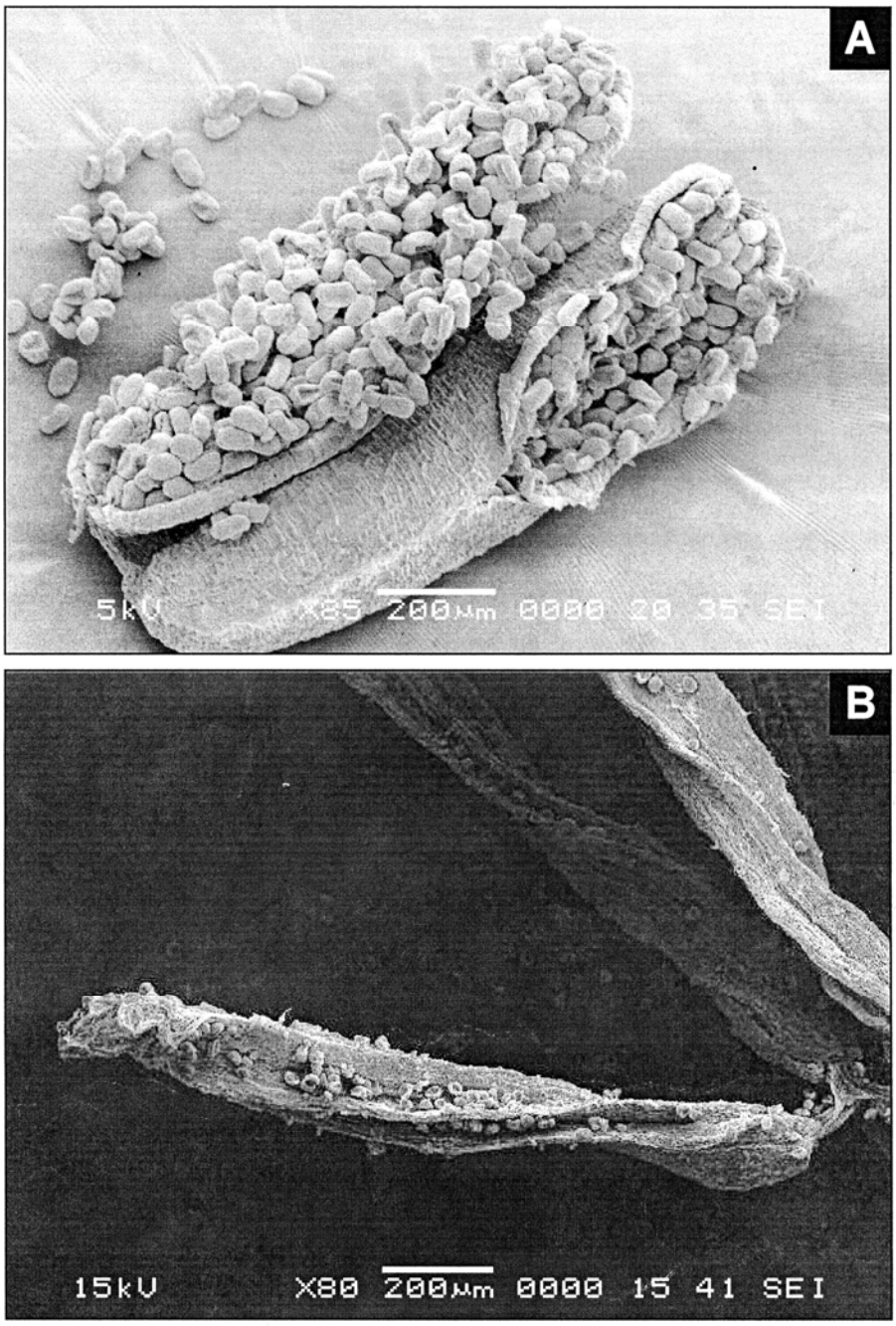

Fig. 2. Scanning electron micrographs of anther types. Extrorse: A. *Commelina albescens*; B. *Typha domingensis* (Scale bar: A, B = 200 µm).

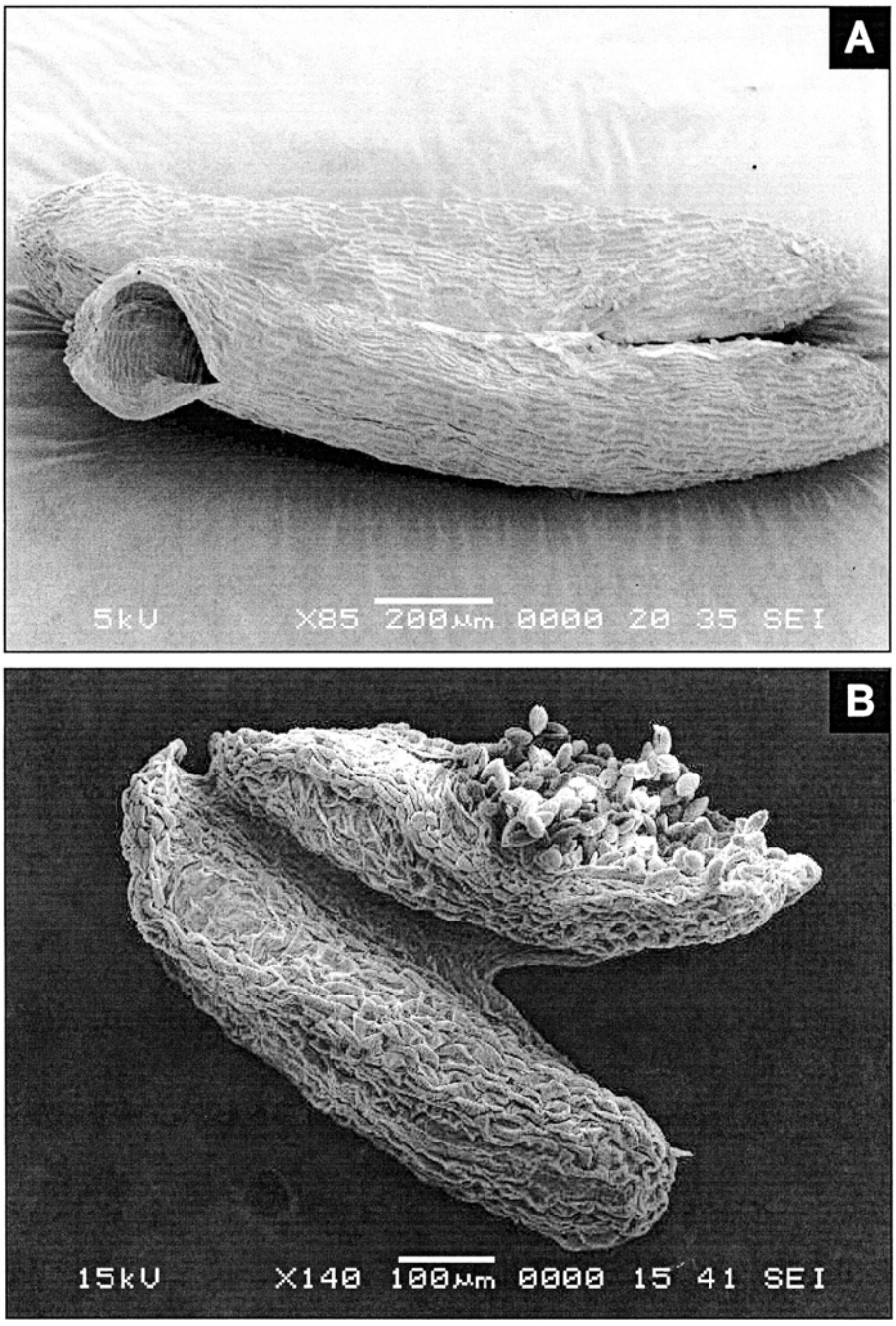

Fig. 3. Scanning electron micrographs of anther types. Poricidal: A. *Dichanthium annulatum*; Latrorse: B. *Asparagus dumosus* (Scale bar: A = 200 um; B =100 µm).

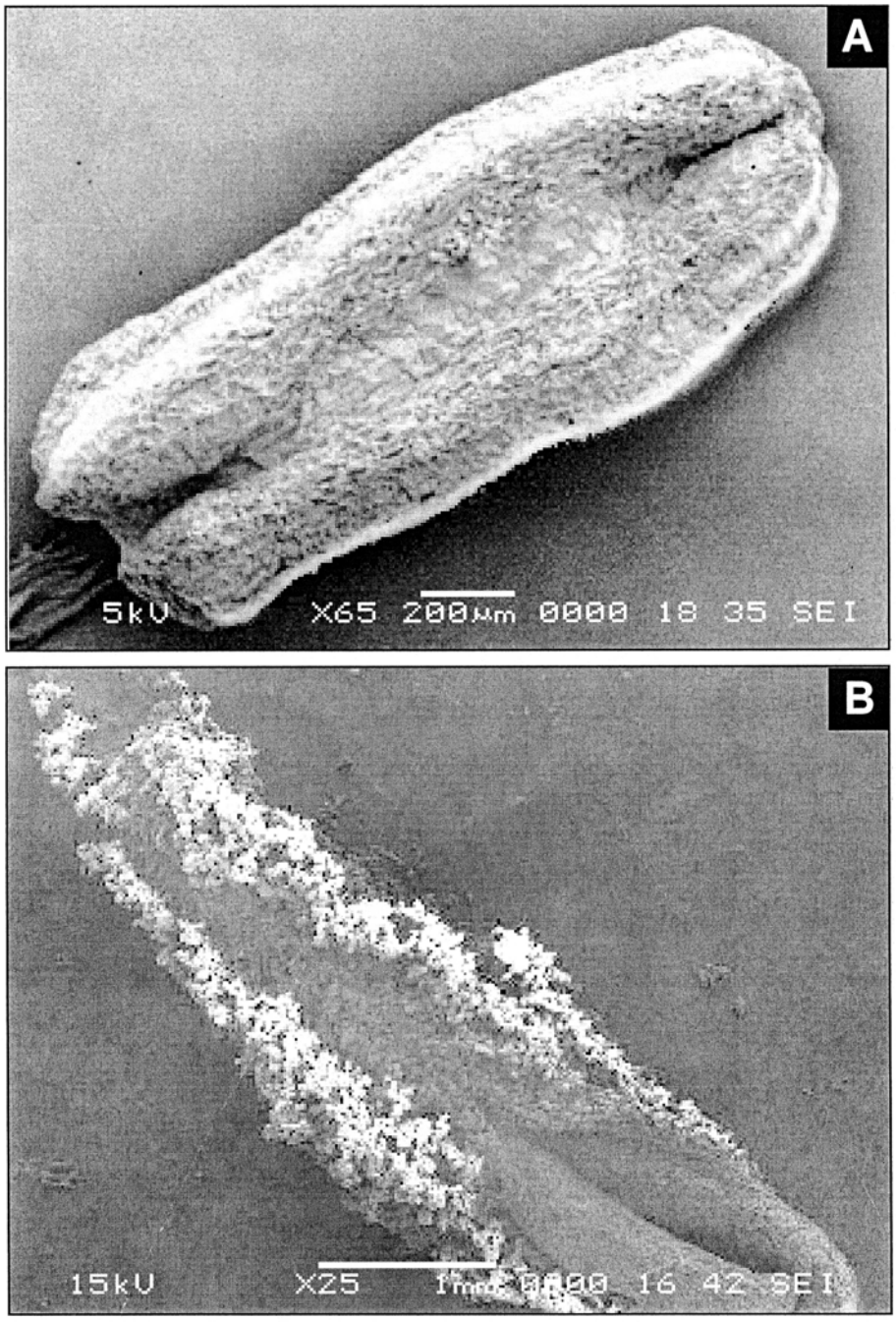

Fig. 4. Scanning electron micrographs of anther types. Latrorse: A. *Aloe vera*; B. *Phoenix dactylifera* (Scale bar: A = 200 µm; B = 1mm).

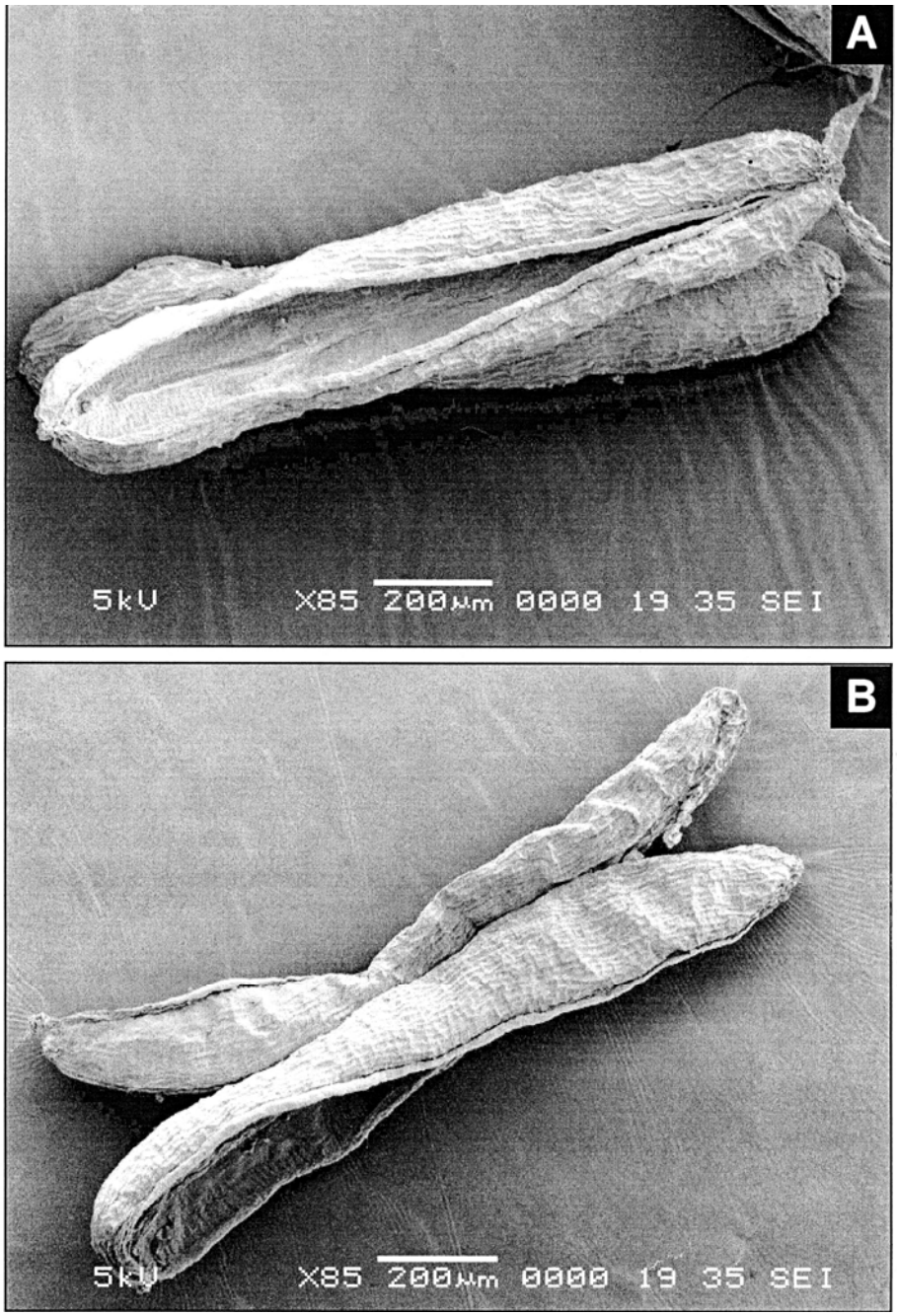

Fig. 5. Scanning electron micrographs of anther types. Latrorse: A. *Cynodon dactylon*; B. *Eleusine indica* (Scale bar: A, B = 200 µm).

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