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Internodal Vessel Elements of Some Malvaceae

Inamdar, J. A., R. Balakrishna Bhat and T. V. Ramana Rao

(Department of Biosciences. Sardar Patel University, Vallabh Vidyanagar 388 120, Gujarat, India)

ABSTRACT

Internodal vessel elements are studied in 20 genera, 75 species and 33 cultivars of *Hibiscus rosa-sinensis* beloning to the Malvaceae. The minimum and maximum length and diameter range from 79~466 and 14~88 μm, respectively. The vessel elements are either cylindrical, fusiform, conical, clavate, oval, column-, drum-, fish and cup-like or erratic. Perforation plates are exclusively simple in all the species investigated, except occasionally scalariform in varieties of *Hibiscus rosa-sinensis*. In most of the species studied vessel elements have predominantly two perforation plates or occasionally one and three. Adjacent side wall thickening is commonly simple and border pitted, mixed, scalariform, helical and reticulate. The vessel elements vary in their size. shape, number and inclination of perforation plates and adjacent wall thickening.

INTRODUCTION

The vessel elements have been studied in different families of monocotyledons(Cheadle, 1943, 1944, 1953, 1955; Cheadle and Kosakai, 1972, 1973, 1974, 1975, 1978) and dicotyledons(Bailey and Tupper, 1918; Bailey, 1944; Abbe and Abbe, 1971; Inamdar and Murthy, 1977; Murthy *et al.*, 1978; Aleykutty and Inamdar, 1978; Shenoy and Inamdar, 1979; Avita and Inamdar, 1981; Rao and Inamdar, 1980). A review of literature reveals that the vessel elements of the Malvaceae have not been studied. Therefore, the present investigation has been undertaken on the internodal vessel elements in 20 genera, 75 species and 33 cultivars of *Hibiscus rosa-sinensis* belonging to the Malvaceae.

MATERIALS AND METHODS

For the present study plants were collected from the different parts of India and abroad. Seeds of a few species of the Malvaceae were obtained through the courtesy of Director, "Botanischer Garten und Botanischer Museum" Berlin-Dehlem, Berlin. These were grown in the University Botanical Garden under field conditions.

The internodes were macerated following the procedure of Jane(1956). The macerated internodes were washed thoroughly in distilled water, stained with Dalafield's hematoxylin

and mounted in glycerin jelly. Camera lucida drawings were made at the table level using the Carl Zeiss research trinocular microscope fitted with Carl Zeiss tube type drawing attachment. The list of the species investigated, size of vessel elements, disposition and number of perforation plates and type of side wall pitting are compiled in Table 1.

OBSERVATIONS

Vessel elements are studied in 20 genera, 75 species and 33 cultivars of *Hibiscus rosa-sinensis* belonging to the Malvaceae. There is a great range in the length of the vessel elements, therefore, for convenience, they are grouped into long(345 μm and above), medium(205~344 μm) and short(below 205 μm). The type, number and disposition of perforation plates and adjacent wall thickening are depicted in Figs. 1 and 2, and charted in Table 1.

Size. The longest vessel elements recorded are 466 μm in length in *Abelmoschus esculentus* and the shortest 79 μm in *Hibiscus caesius* and *H. rosa-sinensis* cv. Gnat. The maximum diameter is 88 μm in *Gossypium hirsutum* and minimum 14 μm in *Hibiscus rosa-sinensis* cv. Soyuz. The maximum and minimum average length is 451 μm and 102 μm observed in *Hibiscus rosa-sinensis* cv. Roosevelt and *Sida grewioides*, respectively. Similarly maximum and minimum diameter is 77 μm and 17 μm noticed in *Ceiba pentandra* and *Malva nicaunis*, respectively.

Shape. The vessel elements may be cylindrical(Figs. 1 : 1, 2, 4, 6, 7, 9, 12, 19, 20, 23, 24, 27, 28, 29, 31, 32, 34, 37, 38, 40; 2 : 5, 7, 9, 13~16, 18~21, 23, 25, 26, 28~34, 36~38, 45, 46), fusiform(Figs. 1 : 5, 8, 11, 14, 18, 35; 2 : 1, 4, 8, 11, 22, 24, 43), column-like(Fig. 1:22, 26), drum-like(Figs. 1 : 10, 15~17, 30, 33, 36, 39; 2 : 12, 17, 27, 41, 42), conical(Figs. 1 : 21, 26; 2: 3, 10, 35, 39, 40), fish-like(Fig. 2 : 44), cup-like(Fig. 2: 6), clavate(Fig. 1: 3), oval (Fig. 2: 2) or erratic(Fig. 1: 13).

Perforation plates. Perforation plates are simple(Figs. 1: 1~40; 2: 1~20, 22~29, 32~46), in most of the species investigated, while the scalariform perforation plates are common in varieties of *Hibiscus rosa-sinensis*. The same vessel element shows at one end simple and at the other end scalariform perforation plate in *Hibiscus rosa-sinensis* cv. Hidayatullah(Fig. 2: 31). The shapes of the perforation plates are circular and as wide as the diameter of the vessel elements in most of the cases. In some members, they are rectangular(Fig. 1: 22, 26), lenticular(Fig. 1: 38), oval(Fig. 1: 39), triangular(Fig. 2: 45), V-shaped(Fig. 2: 13), napiform(Fig. 2: 35), dumb-bell shaped(Fig. 1: 19) or semilunar(Fig. 2: 36). Sometimes perforatien plates are very small as compared to the width of the vessel element(Figs. 1: 13, 14; 2: 22, 29). The disposition may be median and transverse(Figs. 1: 1, 16, 28, 30, 36; 2: 3, 10, 39), oblique(Figs. 1: 9, 10, 16, 20, 22, 32, 35; 2: 11, 12, 13, 23, 38, 40, 46) or lateral(Figs. 1: 1, 2, 5~8, 11~15, 27, 29, 38; 2: 1, 2, 4, 5, 8, 9, 15, 17, 20~25, 29, 30, 32, 34, 35, 37, 43). Oblique and lateral disposition of perforation

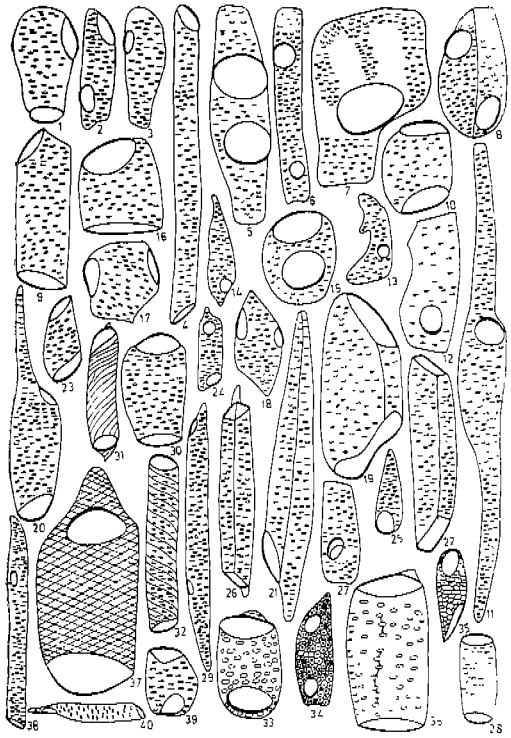

Fig 1

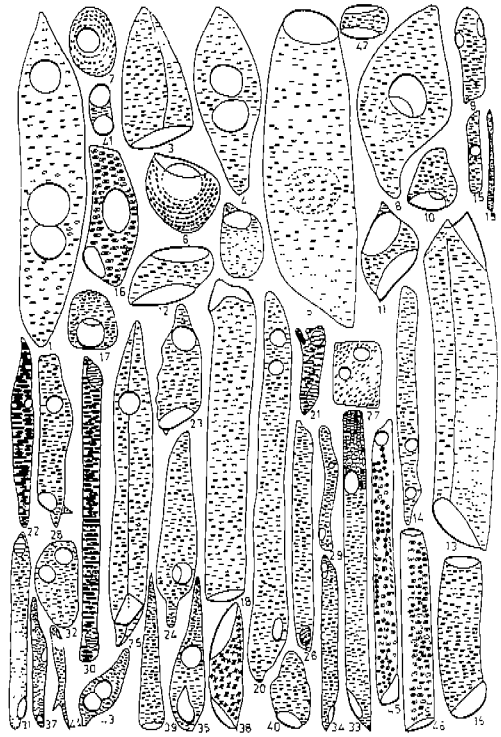

Fig. 2

Explanation to text figures 1 (1~40) showing the different features of vessels of Malvaceae.

1~21 : *Abelmoschus esculentus*
22~24 : *Abutilon alba*
25~27 : *A. hybridum* cv. Golden Fleece
28~30 : *A. indicum*
31~32 : *A. milleri*
33 : *Adansonia digitata*
34 : *Althea rosea*
35~36 : *Bombax malabaricum*
37~38 : *Ceiba pentandra*
39~40 : *Gossypium barbadense*
(Fig. 1: 1~40, ×60)

Explanation to text figures 2 (1~46) showing the different features of vessels of Malvaceae.

1~12 : *Gossypium hirsutum*
13~14 : *Hibiscus arnottianus*
15 : *H. cannabinus*
16 : *H. fieulneus*
17~18 : *H. ovalifolius*
19 : *H. punctatus*
20 : *Hibiscus rosa-sinensis* cv. Akula Subba Rao
21~24 : *H. rosa-sinensis* cv. Aurobindo
25~26 : *H. rosa-sinensis* cv. Commet
27~29 : *H. rosa-sinensis* cv. Florence Nightingale
30 : *H. rosa-sinensis* cv. Gnat
31 : *H. rosa-sinensis* cv. Hidayatullah
32 : *H. rosa-sinensis* cv. Lahlana
33 : *H. rosa-sinensis* cv. Liberace
34 : *H. rosa-sinensis* cv. Pushpa Hidayatullah
35 : *H. rosa-sinensis* cv. Nirmala
36 : *H. rosa-sinensis* cv. Viktor
37 : *H. solandra*
38 : *Kydia calycina*
39~40 : *Sida acuta*
41~43 : *S. grewioides*
44 : *S. rhombifolia* var. *rhomboidea*
45~46 : *S. rhombifolia*
(Fig. 2: 1~46, ×60)

plates are common. while the median and transverse are rare. The number of perforation plates are commonly two in majority of the members studied, but one and three perforation plates have also been observed(Figs. 1: 3, 7, 11~14, 21, 25; 2: 1, 2, 3, 7, 15, 20, 22, 39, 40, 44).

Adjacent wall thickening. Side wall thickening in majority of the cases is simple or border pitted(Figs. 1: 34; 2: 16, 38, 45, 46), bordered and simple mixed(Fig. 2: 33), scalariform(Fig. 2: 19, 21, 22, 30), single or double spiral(helical) (Figs. 1: 31, 37; 2: 37), spiral and simple mixed(Fig. 1: 32) or reticulate(Fig. 1: 35). Simple pits are commonly circular, lenticular, oval or elongated(Fig. 2: 7, 9) in outline. The arrangement may be opposite, alternate or at random. Border pits vary in shape and arrangement (Figs. 1: 34; 2: 16, 45, 46). They may be elongated in ladder-like fashion(scalariform), circular, slightly elongated and in horizontal lines(opposite) or in diagonal rows or lines (alternate) (Figs. 1: 34; 2: 16, 22, 30, 45, 46).

End wall. Vessels may be with or without tails. In *Hibiscus arnottianus* the end wall is 'V' shaped. Branched tails have been observed in *Hibiscus rosa-sinensis* cv. Aurobindo, *H. rosa-sinensis* cv. Florence Nightingale and *Sida rhombifolia* var. *rhomboidea*(Fig. 1: 21, 28, 44). The species-wise details of the vessels are given in Table 1. The apex of the tail or end wall may be acute, obtuse, mucronate, orbiculate or truncate(Figs. 1: 1~40; 2: 1~46).

DISCUSSION

The internodal vessel elements in 20 genera, 75 species and 33 cultivars of *Hibiscus rosa-sinensis* belonging to family Malvaceae is subject for present discussion. According to Metcalfe and Chalk(1950) vessel elements are small to medium sized, semi-ring porous with simple perforations and spiral thickening in some genera. The longest vessel elements recorded are 466 μm in *Abelmoschus esculentus*, while the shortest 79 μm in *Hibiscus caesius* and *H. rosa-sinensis* cv. Gnat. Radford *et al.*(1974) classified the vessel elements into 7 categories taking length as a criterion. During the present investigation the vessel elements fall under the categories extremely short (less than 175 μm) to medium sized (350~850 μm). The minimum and maximum diameter ranges from 14~88 μm. *Hibiscus rosa-sinensis* cv. Soyuz and *Gossypium hirsutum* exhibiting minimum and maximum diameter respectively. The diameter of the vessel element also fall under the category of extremely small (less than 25 μm) to moderately small (50~100 μm) of Radford *et al.*(1974). Therefore, the present observations agree with those of Metcalfe and Chalk (1950). Perforation plates are exclusively simple in all the investigated species except in the varieties of *Hibiscus rosa-sinensis*, where scalariform perforation plates with one to many bars are occasionally observed. The disposition of perforation plate is commonly oblique or lateral and rarely median and transverse. The number of perforation plates are mostly two, but there are vessel elements with one or three perforation plates which

Table 1. Showing average size of vessel elements, type, number and position of perforation plates and adjacent wall thickening in the Malvaceae

Species No.	Name of species	Average size in μm		Perforation plates							Adjacent wall thickening				
				Type	Number			Disposition			Sp	Bp	Rp	Sclp	Sprp
		L	D/B		1	2	3	Med	Obl	Lat					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	*Abelmoschus esculentus* W. & A.	283	65	SP	o	c	—	r	o	c	c	—	—	—	—
2	*A. manihot* L.	299	33	SP	—	c	—	r	c	o	c	—	—	—	—
3	*Abutilon album* Hort. ex Gentil	171	48	SP	—	c	—	r	c	o	c	—	—	—	—
4	*A. crispum* G. Don	186	31	SP	—	c	—	r	c	c	c	—	—	—	—
5	*A. glaucum* G. Don	289	30	SP	r	c	—	o	c	r	c	—	—	—	—
6	*A. hybridum* Voss. cv. Golden Fleece	201	34	SP	r	c	—	r	c	o	c	—	—	—	—
7	*A. indicum* G. Don	271	47	SP	—	c	—	o	c	o	c	—	—	—	—
8	*A. megapotamicum* St. Hil & Naud.	160	31	SP	r	c	—	o	c	c	—	—	—	—	—
9	*A. milleri* Hort. ex Wien	194	34	SP	—	c	—	r	c	c	c	—	—	—	o
10	*A. muticum* G. Don	199	41	SP	—	c	—	r	c	o	c	—	—	—	—
11	*A. pictum* Walp.	182	32	SP	—	c	—	r	c	c	c	—	—	—	—
12	*A. polyandrum* Schlecht.	287	30	SP	—	c	—	r	c	c	c	—	—	—	—
13	*Adansonia digitata* L.	261	56	SP	—	c	—	r	c	c	c	o	r	—	—
14	*Althea rosea*(L.) Cav,	259	49	SP	—	c	—	r	c	c	c	r	—	—	—
15	*Bombax malabaricum* DC.	282	50	SP	—	c	—	r	c	c	c	—	o	—	—
16	*Ceiba pentandra* Goertn.	269	77	SP	—	c	—	r	c	o	c	—	r	—	—
17	*Decaschistia crotonifolia* W. & A.	280	44	SP	—	c	—	r	c	c	c	—	—	—	—
18	*Gossypium barbadense* L.	265	63	SP	—	c	—	r	c	c	c	—	—	—	—
19	*G. herbaceum* var. *hirutum* L.	248	76	SP	r	c	r	r	c	c	c	—	—	r	—
20	*Hibiscus abelmoschus* L.	252	38	SP	—	c	—	r	c	c	c	—	—	—	—
21	*H. angulosus* Stud.	209	21	SP	—	c	—	r	c	c	c	—	—	—	—
22	*H. arnottianus* Gray	276	44	SP	r	c	—	r	c	c	c	—	—	—	—
23	*H. caesius* Gareke	246	37	SP	—	c	—	r	o	c	c	—	—	—	—
24	*H. canescens* Heyne	243	44	SP	—	c	—	o	o	c	c	—	—	—	—
25	*H. cannabinus* L.	268	31	SP	r	c	—	r	c	c	c	—	—	—	—
26	*H. ficulneus* L.	276	33	SP	—	c	—	o	c	c	c	—	—	—	—
27	*H. furcatus* Roxb.	278	30	SP	—	c	—	r	o	c	c	—	—	—	—
28	*H. lampas* Cav.	263	28	SP	—	c	r	r	c	c	c	—	r	r	—

(continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
29	*Hibiscus lunariifolius* Gray.	448	45	SP	—	c	—	o	o	1	c	—	—	—	r
30	*H. micranthus* L.	155	43	SP	—	c	—	1	c	o	c	—	—	—	—
31	*H. mutabilis* L.	276	38	SP	—	c	—	r	c	o	c	—	—	—	—
32	*H. palmatus* Forsk.	203	29	SP	—	c	—	o	o	c	c	—	—	—	—
33	*H. panduraeformis* Burm.	305	40	SP	—	c	—	r	c	c	c	—	—	—	r
34	*H. platanifolius* Sweet	293	40	SP	—	c	—	1	c	c	c	—	—	—	—
35	*H. punctatus* Delz.	266	25	SP	—	c	—	r	c	c	c	—	—	r	—
36	*H. radiatus* Willd.	258	62	SP	—	c	—	1	o	c	c	—	—	—	—
37	*H. rosa-sinensis* L.	294	43	SP	r	c	—	1	c	c	c	—	—	r	—
i)	*H. rosa-sinensis* cv. Akula Subba Rao	364	36	SP, SclP	—	c	r	1	r	c	c	—	—	—	1
ii)	*H. rosa-sinensis* cv. Apollo	210	26	SP	—	c	—	r	o	c	c	—	—	o	—
iii)	*H. rosa-sinensis* cv. Aurobindo	194	36	SP, SclP	1	c	—	1	r	c	c	—	—	o	—
iv)	*H. rosa-sinensis* cv. Bengaladesh	280	30	SP, SclP	—	c	—	r	r	c	c	—	—	r	—
v)	*H. rosa-sinensis* cv. Bhagyavati Devi	337	35	SP. SclP	—	c	—	r	1	c	c	—	—	1	—
vi)	*H. rosa-sinensis* cv. Commet	356	32	SP, SclP	1	c	—	r	r	c	c	—	—	—	—
vii)	*H. rosa-sinensis* cv. Dibbyan	344	22	SP. SclP	—	c	—	r	r	c	c	—	—	—	—
viii)	*H. rosa-sinensis* cv. Equisite	257	30	SP	—	c	—	r	1	c	c	—	—	r	—
ix)	*H. rosa-sinensis* cv. Florence Nightingale	178	32	SP, SclP	—	c	—	r	r	c	c	—	—	1	—
x)	*H. rosa-sinensis* cv. Ganapathy	169	29	SP	—	c	—	1	o	c	c	—	—	—	r
xi)	*H. rosa-sinensis* cv. George	302	31	SP, SclP	1	c	—	1	o	c	c	—	—	—	—
xii)	*H. rosa-sinensis* cv. Gnat	249	25	SP, SclP	—	c	—	1	o	c	c	—	—	r	—
xiii)	*H. rosa-sinensis* cv. Homilie Gowda	269	23	SP, SclP	r	c	—	r	1	c	c	—	—	—	—
xiv)	*H. rosa-sinensis* cv. Huba Huba	138	41	SP	—	c	—	r	1	c	c	—	—	—	—
xv)	*H. rosa-sinensis* cv. Lahlana	269	41	SP, SclP	r	c	—	1	o	c	c	—	—	r	—
xvi)	*H. rosa-sinensis* cv. Lee	304	41	SP	—	c	—	r	c	c	c	—	—	—	—
xvii)	*H. rosa-sinensis* cv. Liberace	413	24	SP, SclP	—	c	—	r	1	c	c	r	—	—	—
xviii)	*H. rosa-sinensis* cv. Martia	438	21	SP, SclP	—	c	—	1	r	c	c	—	—	—	—
xix)	*H. rosa-sinensis* cv. Nijalingappa	381	35	SP, SclP	—	c	—	1	o	c	c	—	—	—	—
xx)	*H. rosa-sinensis* cv. Nirmala	290	30	SP	—	c	—	1	r	c	c	—	—	1	—
xxi)	*H. rosa-sinensis* cv. Oxylinda	243	30	SP	—	c	—	r	1	c	c	—	—	—	—
xxii)	*H. rosa-sinensis* cv. Pushpa Hidayayatullah	266	27	SP	—	c	—	r	o	c	c	—	—	—	—
xxiii)	*H. rosa-sinensis* cv. Kanaka Nair	295	31	SP	—	c	—	r	o	c	c	—	—	—	—
xxiv)	*H. rosa-sinensis* cv. Kuvempu	270	31	SP, SclP	—	c	—	r	o	c	c	—	—	—	—
xxv)	*H. rosa-sinensis* cv. Rachaiah	273	39	SP	1	c	—	r	o	c	c	—	—	—	—

(continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
xxvi)	*Hibiscus rosa-sinensis* cv. Rashtrapathy	255	35	SP, SclP	r	c	—	r	o	c	c	—	—	—	—
xxvii)	*H. rosa-sinensis* cv. Roosevelt	451	31	SP	—	c	—	r	o	c	c	—	—	r	—
xxvii)	*H. rosa-sinensis* cv. Sebactani	309	41	SP	—	c	—	r	o	c	c	—	—	—	—
xxix)	*H. rosa-sinensis* cv. Soyuz	297	18	SP	—	c	—	r	r	c	c	r	—	—	—
xxx)	*H. rosa-sinensis* cv. Vladislav	258	36	SP, SclP	—	c	—	r	r	c	c	—	—	—	—
xxxi)	*H. rosa-sinensis* cv. Viktor	275	38	SP	—	c	—	r	o	c	c	—	—	—	r
xxxii)	*H. rosa-sinensis* cv. Weynat	254	25	SP, SclP	—	c	—	r	o	c	c	—	—	—	—
xxxiii)	*H. rosa-sinensis* cv. Cooperi	266	35	SP	—	c	—	r	o	c	c	—	—	—	—
38	*H. sabdariffa* L. Nichols.	261	28	SP	—	c	—	r	o	c	c	—	—	—	—
39	*H. schizopetalus* Hook. F.	266	31	SP	—	c	—	r	c	c	c	—	—	—	—
40	*H. solandra* L. Her.	274	36	SP	r	c	—	r	o	c	c	—	—	—	r
41	*H. suratlensis* L.	364	53	SP	—	c	—	r	o	c	c	—	—	—	—
42	*H. syriacus* L. var. *variegata*	280	41	SP	—	c	—	r	c	c	c	—	—	—	—
43	*H. trionum* L.	440	33	SP	—	c	—	r	o	c	c	—	—	—	—
44	*H. vitifolius* L.	264	46	SP	—	c	—	r	c	o	c	—	—	—	—
45	*Kydia calycina* Roxb.	252	55	SP	—	c	r	o	c	o	c	—	—	—	—
46	*Malachra capitata* L.	194	54	SP	—	c	—	r	c	o	c	—	—	—	—
47	*Malva alcea* L.	214	30	SP	—	c	—	r	c	o	c	—	—	—	—
48	*M. neglecta* Wallr.	276	28	SP	—	c	—	r	o	c	c	—	—	—	—
49	*M. nicaeensis* All.	176	17	SP	—	c	—	r	c	c	c	—	—	—	—
50	*M. parviflora* L.	193	29	SP	—	c	—	r	c	c	c	—	—	—	—
51	*M. parviflora* var. *oxyloba* (Boiss) H. Krist.	194	21	SP	—	c	—	r	o	c	c	—	—	—	—
52	*M. verticillata* var. *chinensis* (Mill.) Danert	195	44	SP	—	c	—	r	c	c	c	—	—	—	—
53	*M. verticillata* var. *crispa* L.	219	35	SP	—	c	—	r	o	c	c	—	—	—	—
54	*M. vericillata* var. *neurolona* Schlechtd.	255	33	SP	r	c	—	r	o	c	c	—	—	—	—
55	*Malvastrum coramandelianum* (L.) Gorcke	284	38	SP	—	c	—	r	c	c	c	—	—	—	—
56	*Malvaviscus arboreus* Cav.	242	49	SP	—	c	—	r	c	c	c	—	—	—	—
57	*Modiola caroliniana*(L.) G. Don	332	—	SP	—	c	—	r	c	c	c	—	—	—	—
58	*Pavonia coxii* Tad & Jack	282	46	SP	—	c	—	r	c	c	c	—	—	—	—
59	*P. odorata* Willd.	278	38	SP	—	c	—	r	c	c	c	—	—	—	—
60	*P. procumbens* Boiss.	258	33	SP	—	c	—	r	c	c	c	—	—	—	—
61	*P. zeylanica* Cav.	282	35	SP	—	c	—	r	c	c	c	—	—	—	—
62	*Senra incana* Cav.	189	31	SP	—	c	—	r	o	c	c	—	—	—	—
63	*Sida acuta* Burm.	204	42	SP	r	c	—	r	c	c	c	—	—	—	—

(continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
64	*Sida. cordata*(Burm.) Bross	252	35	SP	1	c	—	r	c	c	c	—	—	—	—
65	*S. cordifolia* L.	267	35	SP	—	c	—	1	o	c	c	—	—	—	—
66	*S. glutinosa* Cav.	277	36	SP	—	c	—	o	o	c	c	—	—	—	—
67	*S. grewioides* Guill. & Perr.	102	35	SP	—	c	—	o	c	c	c	—	—	—	—
68	*S. hermaphrodita*(L.) Rusby	176	41	SP	—	c	—	o	o	c	c	—	—	—	—
69	*S. rhombifolia* L.	247	36	SP	—	c	1	r	o	c	c	o	—	—	—
i)	*S. rhombifolia* var. *rhomboidea*	247	26	SP	r	c	—	r	c	c	c	—	—	—	—
70	*S. schimperiana* Hochst.	252	30	SP	—	c	—	o	o	c	c	—	—	—	—
71	*S. spinosa* L.	288	37	SP	—	c	—	r	o	c	c	—	—	—	—
72	*S. triloba* Cav.	200	23	SP	1	c	—	1	c	c	c	—	—	—	—
73	*S. veronicaefolia* Lam.	259	34	SP	—	c	—	r	c	c	c	—	o	—	—
74	*Thespesia populnea* Corr.	266	64	SP	—	c	—	r	c	c	c	—	—	—	—
75	*Urina sinuata* L.	252	36	SP	1	c	—	1	c	c	c	—	—	—	—

L=length; D/B=diameter/breadth; Med=median; Obl=oblique; Lat=lateral; Sp=Simple pitted; Bp=border pitted; Rp=reticulate; Sclp=scalariform; Sprp=spiral; SP=simple perforation plate; SclP=scalariform perforation plate; c=common; o=occasional; r=rare; —=not observed.

are similar to those of *Anarthria scabra*(rhizome and root) of Anarthriaceae(Cheadle and Kosakai, 1975). Side wall thickening in majority of the cases is simple pitted. But bordered, bordered and simple pitted mixed, scalariform, simple and helical are also observed. In *Hibiscus rosa-sinensis* cv. Aurobindo, *H. rosa-sinensis* cv. Rhombaidea the end wall is branched. This has also been reported by Shah *et al.* (1966) in *Dioscorea alata*.

The present investigation reveals that the vessel elements in the Malvaceae show advanced characters except in the *Hibiscus rosa-sinensis* varieties where scalariform perforation plates are occasionally noticed. It seems these varieties have primitive type of vessel elements.

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