

VESSELS IN SOME APOCYNACEAE

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ABSTRACT: *In the present investigation vessels of 24 species of the family Apocynaceae have been studied. Lot of variation exist in the size and shape of vessels, number of perforation plates and intervacular thickening of walls in the taxa of Apocynaceae.*

INTRODUCTION

One function of the Pharmacognosis is to identify properly the crude drugs used as such in medicine or as sources for commercial exploitation by drug industries or for export. Anatomical structures are most likely to provide evidence concerning the inter relationships of larger groups such as families. Anatomy sometimes proves very much helpful for individual identification. Moreover for establishing the botanical identity of commercial samples of medicinal plants anatomy plays an important role, and also in checking adulteration, substitution and fraud. The vessel size characters in Apocynaceae can be used as a character of Pharmacognostic importance. Variation seen in vessel structure with in a taxon are always interesting since they are of evolutionary and systematic significance. Independent evolution of vessel in vascular plants has been traced and the two major trends of specialization in Gymnosperms as well as Angiosperms has been convincingly demonstrated with proper evidences (Thompson, 1918; Bailey and Thompson, 1918; Bailey, 1944). For example in the Gnetales vessels develop from the dissolution of reticulate perforations, whereas in angiosperms they develop from the breaking down of scalariform

perforation. The actual transformation of scalariform type of vessel to the vessel with single perforation is demonstrated both in primary and secondary xylem. Little attention has been given for the study of vessels in the members of the family Apocynaceae. In view of this lacuna present investigation is undertaken.

MATERIALS AND METHODS

Materials were collected from the different localities and fixed in F. A. A. Tissues were macerated following the method of Jane (1956). After thorough washing the macerated material was stained in safranin and mounted in glycerine jelly.

Camera lucida drawings were made using the same magnification to depict the variations in size, shape, location and number of perforation plates. Mean values of 10 observations showing the length and diameter of vessels in μm , number and position of perforation plates and nature of adjacent wall thickenings are given in table.

Observations

The vessels are classified on the basis of their length into three types viz. long, medium and short sized. Observation

regarding the size, shape, perforation plates and adjacent wall thickening of the vessels in 24 species of the family Apocynaceae given in Table 1 and Figure 1.

TABLE - I

Showing vessel characteristics in certain species of the family Apocynaceae

S. No.	Name of the Species	Size of Vessels								Perforation Plates						Adjacent Wall Thickening			
		Long		Medium		Short		Average		Number				Position		Sp	Bp.	R	Sc
		L	D	L	D	L	D	L	D	1	2	3	4	Med ium	Oblique Lateral				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	<i>Allamanda neriifolia</i>	400	16	92	40	40	16	191	24	c	c	r	-	c	r	c	c	-	-
2	<i>A. cathartica</i>	440	44	108	16	92	16	213	25	o	c	-	-	-	c	c	c	o	R
3	<i>Carissa congesta</i>	236	20	124	12	84	8	148	13	-	c	r	-	c	c	c	c	-	-
4	<i>C. spinarum</i>	450	42	150	42	-	-	300	42	-	c	r	-	-	c	c	c	-	-
5	<i>Rauvolfia serpentine</i>	282	30	140	24	92	28	171	27	o	c	o	-	o	c	c	c	-	-
6	<i>R. tetraphylla</i>	364	48	184	40	96	20	215	36	-	c	-	-	-	c	c	c	c	-
7	<i>Thevetia peruviana</i>	332	28	76	16	56	16	108	16	o	c	-	-	o	c	c	c	-	-
8	<i>Cerbera manghas</i>	304	20	172	8	100	16	192	15	-	c	r	c	c	o	c	o	-	-
9	<i>Alstonia scholaris</i>	-	-	128	16	68	16	98	16	-	c	o	-	c	r	c	o	-	-
10	<i>Catharanthus roseus</i>	1700	24	188	20	76	24	655	23	o	c	-	-	c	c	c	o	-	-

11	<i>Plumeria acuminata</i>	272	60	68	28	80	16	140	35	-	c	-	-	c	r	c	c	-	-
12	<i>Holarrhena antidysenterica</i>	316	32	116	14	36	16	165	21	o	c	-	-	c	r	c	c	o	-
13	<i>Tabernaemontana divaricata</i> (Single flower)	172	36	108	16	92	12	124	21	o	c	-	-	c	r	c	c	r	-
14	<i>T. divaricata</i> (double flower)	392	34	128	16	80	12	200	21	-	c	-	-	c	r	c	c	-	-
15	<i>Chonemorpha fragrans</i>	360	30	198	36	-	-	297	33	-	c	-	-	o	c	c	c	-	-
16	<i>Vallaris solanacea</i>	240	24	136	48	72	20	149	31	-	c	o	-	c	r	c	-	-	-
17	<i>Wrightia tinctoria</i>	440	24	132	20	64	12	212	19	-	c	c	-	c	o	c	c	-	r
18	<i>Nerium indicum</i> (Pink- single flower)	412	24	132	16	64	12	203	17	-	c	-	-	-	c	c	c	-	-
19	<i>Nerium indicum</i> (Pink- double flower)	366	54	258	42	150	42	258	46	-	c	-	-	-	c	c	-	r	o
20	<i>N. indicum</i> (Red flower)	612	42	306	54	-	-	459	48	-	c	-	-	-	c	c	-	-	-
21	<i>N. indicum</i> (White flower)	432	60	-	-	-	-	432	60	-	c	-	-	-	c	c	-	-	o
22	<i>Ichnocarpus frutescens</i>	324	32	144	20	-	-	234	26	o	c	-	-	c	r	c	c	-	-
23	<i>Trachelospermum divaricatum</i>	192	16	76	16	56	16	108	16	r	c	-	-	c	r	c	o	o	-

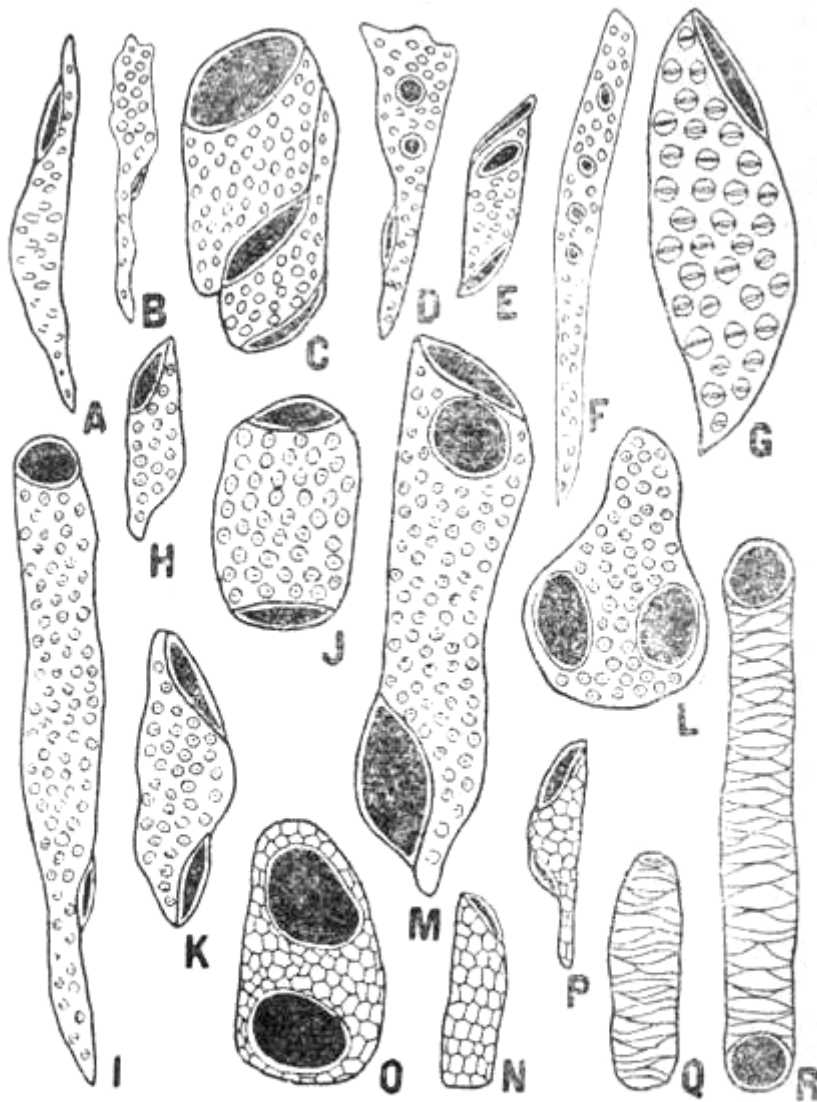
24	<i>Beaumontia grandiflora</i>	296	28	104	20	60	12	153	20	-	c	-	-	c	r	c	c	-	-
	AVERAGE	406	33.39	142.09	25.22	76.74	17.37	225.29	27.12										

Explanation of letters :

C: common, R: rare, O : Occasional.

L : length, D : diameter, Sp. : Simple pitted, Bp. : Border pitted, R : reticulare, Sc. : Sculari - form

FIGURE 1



A = *Carissa congesta*; B = *Holarrhena antidysenterica*; C = *Wrightia tinctoria*; D = *Beaumontia grandiflora*; E = *Carissa spinarum*; F = *Cerbera manghas*; G = *Alstonia scholaris*; H = *Rauvolfia serpentina*; I = *Carissa congesta*; J = *Chonemorpha fragrans*; K = *Nerium indicum* Pink-single flower; L = *Wrightia tinctoria*; M = *Allamanda nerifolia*; N = *Rauvolfia tetraphylla*; O = *Allamanda cathartica*; P = *Trachelospermum divaricatum*; Q = *Tabernaemontana divaricata* single flower; R = *Allamanda cathartica*. All x 400.

DISCUSSION

(1) Size of Vessels :

(A) Long Vessels: The length and diameter of the vessels varies from 1700 – 192 μm and 60 – 16 μm respectively. The maximum length is observed in *Catharanthus roseus* and minimum in *Trachelospermum divaricatum* likewise, longest diameter is seen in *Nerium indicum* (White flowered variety) and *Plumeria acuminata* and smallest in *Allamanda neriifolia* and *Trachelospermum divaricatum*. The average length and diameter of vessel measure 406 μm and 33 μm respectively.

(B) Medium Vessels: The length and diameter of the vessels ranges from 306 – 68 μm and 54 – 8 μm respectively. The maximum length and diameter is observed in *Nerium indicum* (red flowered variety) and minimum length in *Plumeria acuminata* and smallest diameter in *Cerbera manghas*. Average length and diameter of vessels measure 142 μm and 25 μm respectively.

(C) Short Vessels: The length and diameter of vessels vary from 150 – 36 μm and 42 – 8 μm respectively. *Nerium indicum* (Pink single flowered) exhibit the maximum length and diameter and *Holarrhena antidysenterica* the minimum length and *Carissa congesta* the smallest diameter. The average length and diameter measure 77 μm and 18 μm respectively.

(D) The average length and diameter of long, medium and short sized vessels ranges from 655 – 108 μm and 60 – 13 μm respectively. The maximum

average length of vessel is noticed in *Catharanthus roseus* and minimum in *Thevetia peruviana* and *Trachelospermum divaricatum* largest average diameter is seen in *Nerium indicum* (white flowered variety) and smallest in *Carissa congesta*.

(2) Shape of Vessels: - The shaped of vessels is highly variable. Tubular, cylindrical and conical vessels are of common occurrence. In addition to these types, drum like vessels are found in *Plumeria acuminata*, *Chonemorpha fragrans* (Fig. J), *Wrightia tinctoria* (Fig. C), *Ichnocarpus frutescens*, *Beaumontia grandiflora* and spindle shaped in *Alstonia scholaris* (Fig.G). Besides, this, most of the vessels show no definite shape and it may be intermediate between tubular, cylindrical, conical, drum like and spindle – shaped.

(3) Perforation Plates:- The presence of two perforation plates at each end is the commonest feature exhibited by most of the vessels. However, there are vessels with 1,3 and 4 perforation plates. In the genus *Thevetia peruviana*, *Allamanda*, *Rauwolfia* (Fig. H. N), *Catharanthus roseus*, *Alstonia scholaris* (Fig. G), *Ichnocarpus frutescence*, *Holarrhena antidysenterica* (Fig.B), *Trachela spermum divariceatum* and *Tabernaemontana divaricata* (Fig. O) have only one perforation plates. The perforation plate is either present on the side wall at one end or at the centre of the side wall. Three perforation plates are observed in *Allamanda neriifolia* (Fig. M), *Rauwolfia serpentine*, *Carissa* (Fig.E), *Cerbera manghas*, *Beaumontia*

grandiflora (Fig. D), *Vallisneria spiralis* and *Wrightia tinctoria* (Fig. C). All the three perforation plates may or may not be in the same plane. Two perforation plates are situated at the two ends and the third somewhere in the middle, but in some cases two are located near each other at one end and the third far away from these two. In *Cerbera manghas* (Fig. F) there are four perforation plates. As regards the shape of perforation plates it may be oval, lenticular, squarish, circular and semicircular. The disposition of perforation plates may be median or oblique or lateral.

- (4) End-walls of Vessels:- In all the studied species the blunt end wall of the vessels is a common feature. In addition to this, forked end wall is observed in *Holarrhena antidysenterica* (Fig. B), *Trachelospermum divaricatum*, *Beaumontia grandiflora* (Fig. D), pointed, short or long end walls are seen in *Vallisneria spiralis*, *Wrightia tinctoria*, *Trachelospermum divaricatum* (Fig. P) *Beaumontia grandiflora* (Fig. D), *Cerbera manghas*, *Carissa congesta* (Fig. I), *Rauvolfia serpentina* (Fig. 4) and *Allamanda neriiifolia* (Fig. M).
- (5) Thickening of vessel wall:- All the species studied exhibited simple pits on adjacent walls. The orientation of simple pits is either alternate or scattered regularly. The orientation of pits is mostly transverse or oblique. The simple pits are mostly spherical but rarely elongated. Reticulate pitting is observed in *Allamanda cathartica* (Fig. O),

Rauvolfia tetraphylla (Fig. N), *Trachelospermum divaricatum* (Fig. P), *Tabernaemontana divaricata* (Single flower), *Holarrhena antidysenterica*, *Nerium indicum*. The scalariform pitting exhibited by *Allamanda cathartica* (Fig. R), *Tabernaemontana divaricata* single flowered variety (Fig. Q), *Nerium indicum* (Pink double flower and white flower variety) and *Wrightia tinctoria*. Bordered pits are present in most of the species except *Nerium indicum* (Single pink, red and white flower variety) and *Vallisneria spiralis*. Sharma and Kapoor (1970) observed that the size of vessels in the stem of *Nerium indicum* (red flower) ranges from 440 – 620 μm in length and 20 – 25 μm in diameter, whereas, in the present work it is 306 – 612 μm in length and 54 – 42 μm in diameter in the same species. Tracheids possess annular, spiral or reticulate thickening which is similar to the present work. Singh, Madan and Kundu (1963) made a comparison on the roots of *Carissa carandus* and *Carissa spinarum*.

From the above discussion it is clear that there is lot of variation in size and shape of vessels, number of perforation plates and intervascular thickening of wall in the Apocynaceae. Several workers (Shah *et al.* 1966; Chaedle and Kosakai, 1975, 1976; Abbe and Abbe, 1971; Bailey, 1944; Inamdar and Murthy, 1977) have reported variations in vessel characters in different taxa of Angiosperms. The vessels in Apocynaceae are highly specialized in having simple perforation plates.

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