

Study of Wood Vessels in the Genus *Cassia*

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Vessels in the woods of 13 species of the genus *Cassia* show significant differences in their dimension and the nature of lateral wall pitting. Simple perforation plates occur in a wide variety of vessels.

Key Words - Origin Perforation Pitting Vessels Wall Wood

Origin and trends of specialization of vessels in different taxa of both monocotyledons and dicotyledons have now been well studied. A correlation between a variety of wood anatomical features and vessel specialization has also been established (Carlquist, 1961). Bailey (1957) emphasised the need to study variability and vessel elements in individual genera and species. Species of the genus *Cassia* show a wide range of variation from tree to herbaceous habit and hence study of wood vessels in this genus was undertaken to correlate between habitat and degree of specialization in vessel elements.

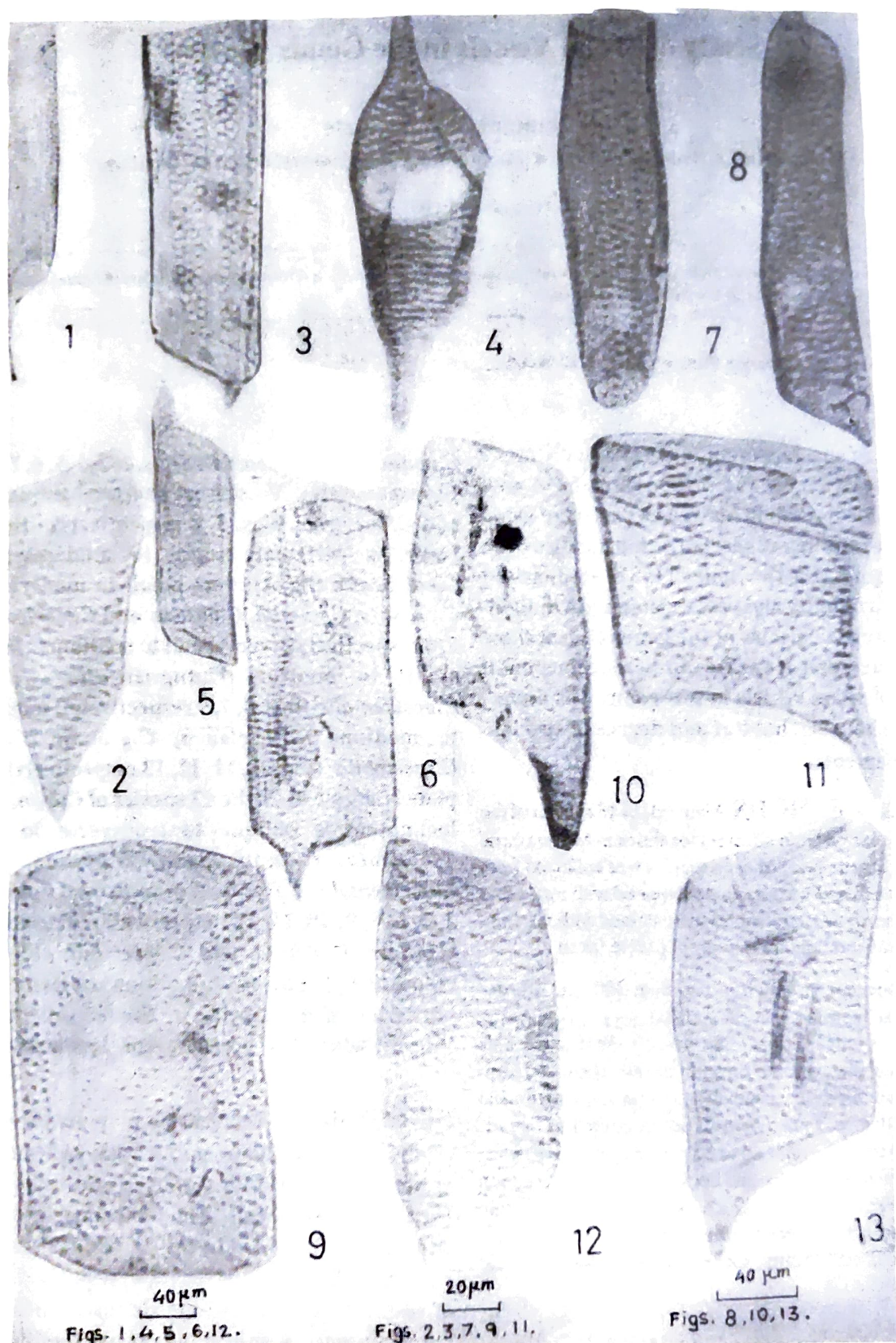
MATERIALS & METHODS Materials of 13 species of the genus *Cassia* were collected from different localities in Maharashtra. The wood sample of mature plant of each species was collected from the basal part of the stem and was macerated, treated with nitric acid and chromic acid. The macerated samples were stained with safranin, mounted in lactophenol and photomicrographs were taken.

Vessel members whose mean length is less than 350 μm are described as short, those between 350 μm and 800 μm as medium and those over 800 μm as long. Further, the vessels are described as 'small' if their mean diameter or breadth is less than 100 μm , 'medium' if their mean diameter is between 100 μm and 200 μm and 'large' if it is more than 200 μm . Vessels are described as 'small' further detailed as extremely small up to 25 μm , very small between 25 μm and 50 μm and moderately small between 50 μm and 100 μm as per the standard given by Metcalfe & Chalk (1950). The minimum and maximum values are reported for each species. Their dimensions, nature of lateral wall-pitting, inclination of perforation plate are given.

RESULTS The wood vessels are cylindrical, fusiform, columnar or drum like. The length and the breadth ranges from 37 - 408 μm . and 17 - 200 μm . respectively. Vessels are short in *C.kolabensis*, *C.obovata*, *C.angustifolia*, *C.biflora*, *C.glauca*, *C.hirsuta*, *C.occidentalis*, *C.fistula*, *C.grandis*,

C.nodosa and *C.spectabilis* (figs. 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 13 respectively). Vessels are short to medium in *C.pumila* and *C.laevigata* (figs. 3, 8 respectively). Breadth of the vessel is extremely small to moderately small in *C.kolabensis* (fig. 1); very small to moderately small in *C.obovata*, *C.pumila*, *C.biflora* and *C.laevigata* (figs. 2, 3, 5, 8 respectively); very small to medium *C.fistula* (fig.10); small to medium *C.angustifolia*, *C.hirsuta* and *C.occidentalis* (figs. 4, 7, 9 respectively); moderately small to medium in *C.glauca*, *C.grandis*, *C.nodosa* and *C.spectabilis* (figs. 6, 11, 12, 13 respectively). Perforation plate is simple in all the 13 species of *Cassia*. The end wall inclination is oblique to transverse in *C.kolabensis*, *C.obovata*, *C.angustifolia*, *C.glauca*, *C.laevigata*, *C.occidentalis*, *C.fistula*, *C.grandis* and *C.nodosa* (figs. 1, 2, 4, 6, 8, 9, 10, 11, 12 respectively); oblique in *C.pumila*, *C.biflora*, *C.hirsuta*, and *C.spectabilis* (figs. 3, 5, 7, 13 respectively). Lateral wall pitting is alternate, contiguous, bordered in all species of *Cassia* except in *C.nodosa* (fig.12) where it is opposite, contiguous bordered.

DISCUSSION Perforation plate involves two features (1) the loss of border on perforation plate and (2) decrease of bars on perforation plate and end wall - are advanced features (Frost, 1930). The final stage in the evolution of end wall not included in the survey of Frost and Cheadle appears to be loss of perforation, resulting in degeneration of vessel element, called the vascular tracheid. This phenomenon occurs only in advanced families (Metcalfe & Chalk, 1950; Carlquist, 1958, 1961). Anomalous perforations (Metcalfe & Chalk, 1950) are regarded as highly specialized conditions; other types including reticulate perforations or irregular network.



Figs. 1-13. Wood vessel elements – 1. *C. kolabensis*; 2. *C. obovata*; 3. *C. pumila*; 4. *C. angustifolia*; 5. *C. biflora*; 6. *C. glauca*; 7. *C. hirsuta*; 8. *C. laeyigata*; 9. *C. occidentalis*; 10. *fistula*; 11. *C. grandis*; 12. *C. nodosa*; 13. *C. spectabilis*.

Table 1 Vessel Elements in the Genus *Cassia*

Species	Length of Vessel (µm)		Breadth of Vessel (µm)		End wall inclination	Lateral wall pitting	Angularity in t.s.
	min.	max.	min.	max.			
<i>Cassia kolabensis</i>	102	255	17	68	Oblique to transverse	Alternate, contiguous, bordered	Circular to oval.
<i>C. obovata</i>	37	174	30	59	- do -	- do -	- do -
<i>C. pumila</i>	170	408	34	77	Oblique	- do -	Angular
<i>C. angustifolia</i>	94	204	51	102	Oblique to transverse	- do -	Circular to oval.
<i>C. biflora</i>	85	255	26	68	Oblique	- do -	- do -
<i>C. glauca</i>	85	289	43	119	Oblique to transverse	- do -	- do -
<i>C. hirsuta</i>	51	306	26	102	- do -	- do -	- do -
<i>C. laevigata</i>	81	377	33	85	- do -	- do -	- do -
<i>C. occidentalis</i>	67	204	30	104	- do -	- do -	- do -
<i>C. fistula</i>	170	315	26	119	- do -	- do -	- do -
<i>C. grandis</i>	162	332	68	200	- do -	- do -	Circular
<i>C. nodosa</i>	128	323	43	170	- do -	Opposite, bordered	Circular to oval
<i>C. spectabilis</i>	74	222	41	130	Oblique	Alternate, contiguous, bordered.	- do -

Lateral wall pitting of vessels exhibit a series in specialization showing the following evolutionary sequences scalariform - transitional - opposite - alternate. This trend of data of Frost (1931) is applied to intervessel pitting.

Considering the important feature of the vessels, the length with corresponding breadth, we tried the evolutionary sequence in the species of *Cassia*. Greater the length and comparatively narrow breadth represent a primitive character observed in *C. pumila* a herb and *C. laevigata*, a shrub. Short vessels with a narrow breadth, a comparatively advanced character is observed in the herbaceous plants *C. kolabensis* and *C. obovata* and *C. biflora* a shrub. Short vessels with wide breadth, an advanced character is observed in *C. angustifolia*, *C. glauca*, *C. hirsuta*, *C. occidentalis* which are shrubs and *C. fistula*, *C. grandis*, *C. nodosa* and *C. spectabilis* which have tree habitats.

The end wall oblique to transverse is a more advanced feature of vessels observed in *C. kolabensis*, *C. obovata*, *C. angustifolia*, *C. glauca*, *C. laevigata*, *C. occidentalis*, *C. fistula*, *C. grandis*, *C. nodosa* and oblique, less advanced in *C. pumila*, *C. biflora*, *C. hirsuta* and *C. spectabilis*.

Perforation plate is simple in all the species of *Cassia* which is an advanced character. Vessels have circular to oval transitional outline in all the species of *Cassia* studied except *C. pumila* where it is angular.

We conclude that shrubs show more advanced characters of vessels than herbs and trees.

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REFERENCES

- BAILEY I W 1957 The potentialities and limitations of wood anatomy in the study of phylogeny and classification of angiosperms *J Arnold Arbor* 38 243-254.
- CARLQUIST S 1958 Wood anatomy of Helianthaceae (Compositae) *Trop Woods* 108 1-30.
- CARLQUIST S 1961 Comparative plant anatomy. A guide to taxonomic and evolutionary application of anatomical data in angiosperms. Holt, Rinehart & Winston, New York.
- FROST F H 1930 Specialization in secondary xylem in dicotyledons, II. Evolution of end wall of vessel segment *Bot Gaz* 90 198-212.
- FROST F H 1931 Specialization in secondary xylem in dicotyledons, III. Specialization of lateral wall of vessel segment *Bot Gaz* 91 88-96.
- METCALFE C R & CHALK L 1950 *Anatomy of dicotyledons* Vol I Clarendon, Oxford.