

APPEARANCE OF RUDIMENTARY CARPEL IN *BAUHINIA VARIEGATA* LINN.

by

Islam Mahmud Khan\* Shaukat Islam and Qaisar Ali\*.

**Abstract.** *Bauhinia variegata* growing in Peshawar exhibits bicarpellary and tricarpellary, apocarpous condition. This character has been noticed and reported for the first time. The appearance of a rudimentary carpel ranges from 31% to 0% in the plants growing in the similar environmental conditions. The point of attachment and the T.S. of the gynophores and ovary are given. The probable mode of inheritance is also discussed.

**Introduction.** *Bauhinia variegata* is an important ornamental tree. The leaves and roots have medicinal value. (Shah and Joshi, 1972). The buds are edible in the sub-continent.

Stebbins (1952) explained evolution in this plant. Rahman and S.J. Begum (1966) worked on the flower pigments. Sharma *et al* (1968) studied the chemical composition and nutritive value of the plant. Sharma and Raju (1969) studied cytology of various species of *Bauhinia*. Schmitz (1974) used pollen morphology as an aid in the classification of this genus. The present work deals with the appearance, position and frequency of the rudimentary carpel in *Bauhinia variegata*.

**Material and Methods.** The material was collected from the trees growing on the Peshawar University Campus and Pakistan Forest Institute, Peshawar. One hundred flowers (in different size i.e. small bud to full open flower) taken at random were examined. Plants growing near each other of the same size and age were regarded to be in the similar environments. Transverse sections were cut by hand and the drawings were made by camera lucida.

**Observations and Discussions.** All the taxonomists e.g. Hooker (1879), Parker (1924), Rendle (1971) and Chopra (1970) have described the carpel condition in *Bauhinia variegata* as monocarpellary, even in its family the bicarpellary condition is very rare. In *Bauhinia variegata*, apart from full sized mature carpel, a small carpel in a rudimentary condition has been noticed (Fig. 1).

This carpel is attached to the ovary wall of the main carpel with a small stalk i.e. the rudimentary carpel is not taking a separate origin from the common point, but appears as an out growth of the ovary base of the main carpel. The rudimentary carpel develops to different degree and sometimes attains full size. Where it attains full size it has a common origin with the main carpel (Fig. 2).

\*The authors are Associate Professor, Department of Botany, Assistant Professor, Quaid-e-Azam College for Women and Lecturer-in-Biology, Faculty of Agriculture respectively in the University of Peshawar.

In the transverse section (Fig. 3) the attachment of the stalk of rudimentary carpel with the main carpel shows discontinuous bundles and having a pith. Whereas the main ovary shows a continuous vascular bundle bearing a break at the point of attachment of the stalk of the small ovary and having a central cavity. The gynophore of the same (Fig. 3) bicarpellary gynoecium shows a continuous structure (Fig. 4). In a transverse section the large angular stalk bears the main carpel, the attached smaller one runs some distance and then separates as if springing from the main ovary and bears the rudimentary carpel. The size of the carpel depends upon the thickness of the gynophore.

In a number of cases the rudimentary carpel appears as full sized mature carpel showing true "bicarpellary condition" (Fig. 1B). The highest frequency of the bicarpellary condition was noticed in a tree growing in the Botanical garden of the Pakistan Forest Institute which happened to be 31%. In another plant growing near it, which was of the same size and age showed 8% flowers with a bicarpellary condition. In still another tree in the same environment no bicarpellary gynoecium was seen in 100 flowers observed.

In the lawn of Department of Botany 20%, 8%, 3% and 0% flower buds from different trees were found to have an attached rudimentary carpel. These four trees were of the same size and probably of the same age and were growing in the uniform environment near each other as shown in Table 1.

Table 1

*The percentage of the rudimentary carpels, locality and age of the trees of B. variegata var. Purple. (Date of counting: 1-3-77 to 1-4-77)*

S.No.	Percentage of rudimentary carpels present	Condition of the tree	Place where the tree is growing.
1.	16	Young tree	Surroundings of Pakistan Forest Institute.
2.	31	Fully mature tree full bloom.	—do—
3.	8	—do—	—do—
4.	0	Young tree	—do—
5.	8	Fully mature tree full bloom	Lawn of Deptt. of Botany.
6.	20	—do—	—do—
7.	0	—do—	—do—
8.	3	—do—	—do—
9.	2	Fully mature tree	Road sides of University of Peshawar.
10.	1	—do—	—do—
11.	0	—do—	—do—
12.	0	—do—	—do—
13.	0	—do—	—do—



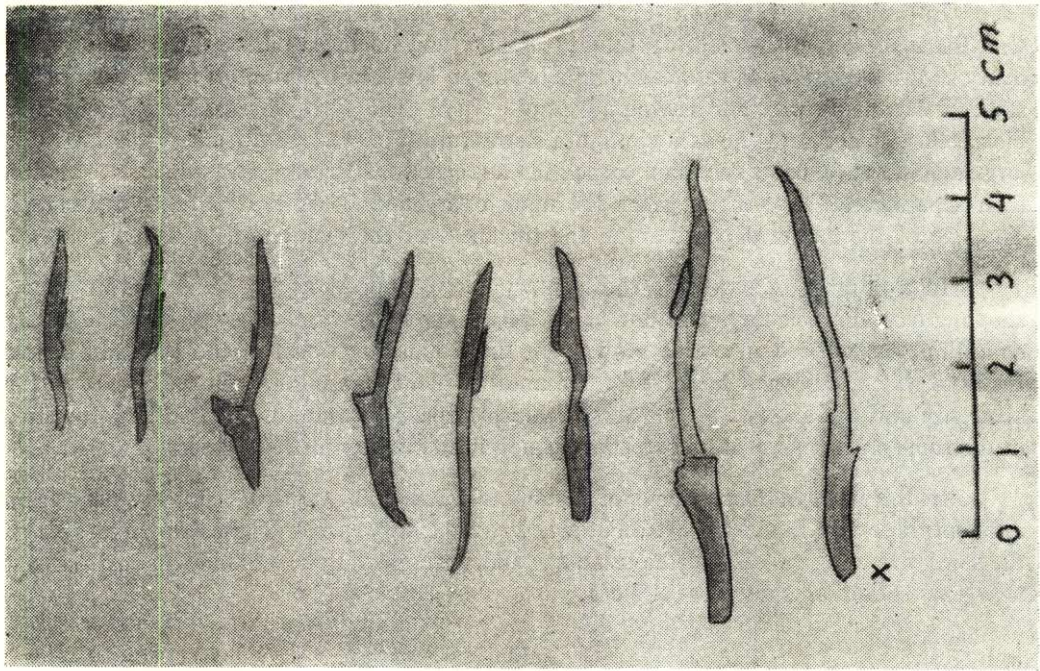
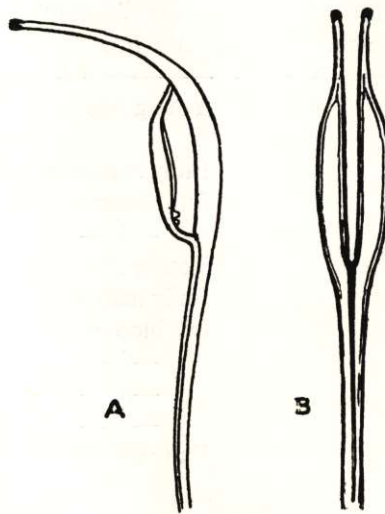


Fig. 1 Rudimentary carpel attached with the main carpel ovary (X Normal carpel without any outgrowth).



- A. Rudimentary carpel stalk attached to the main carpels ovary base.
- B. Two equally developed carpel with stalk joined with each other and the ovary separated.

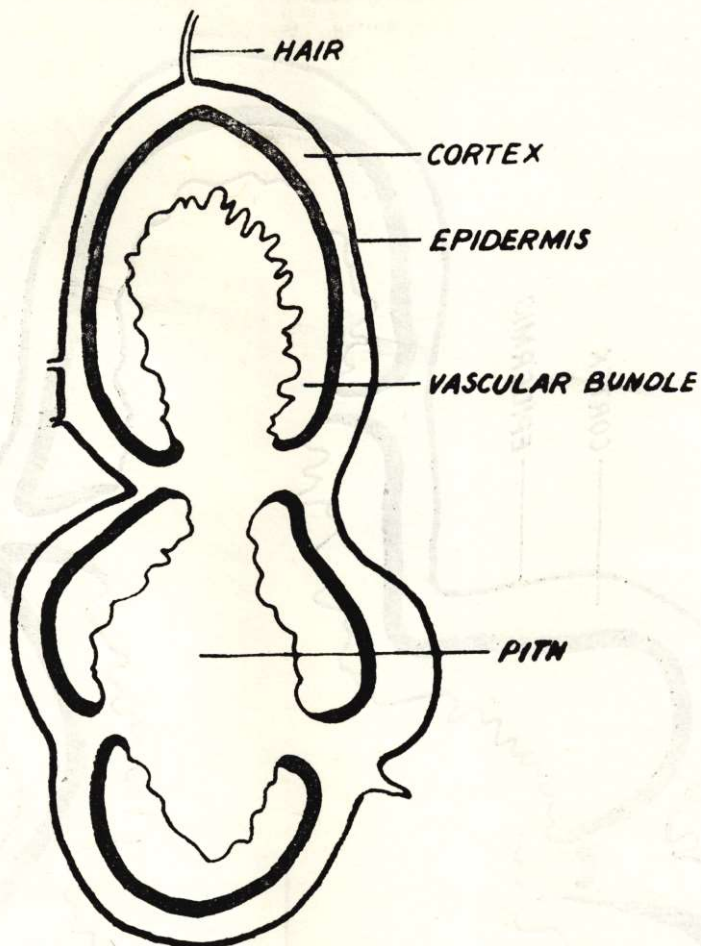


Fig. 2 T.S. of gynophore of two almost equally developed carpels. X 40.

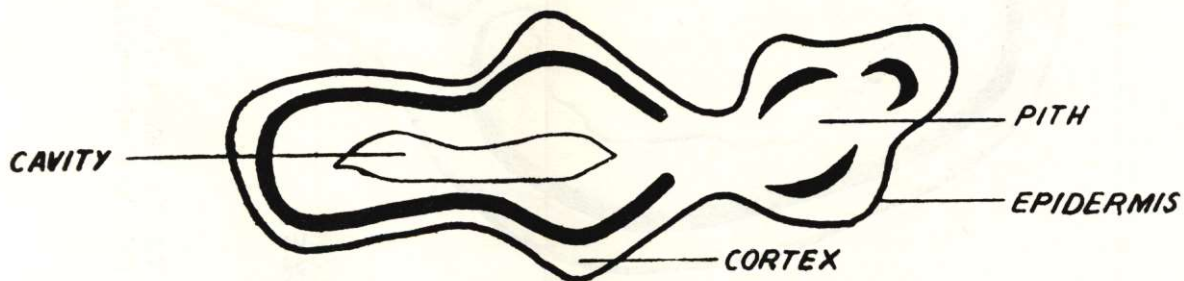


Fig. 3. T.S. showing the stalk of the rudimentary carpel attached with the wall of developed ovary. X 20

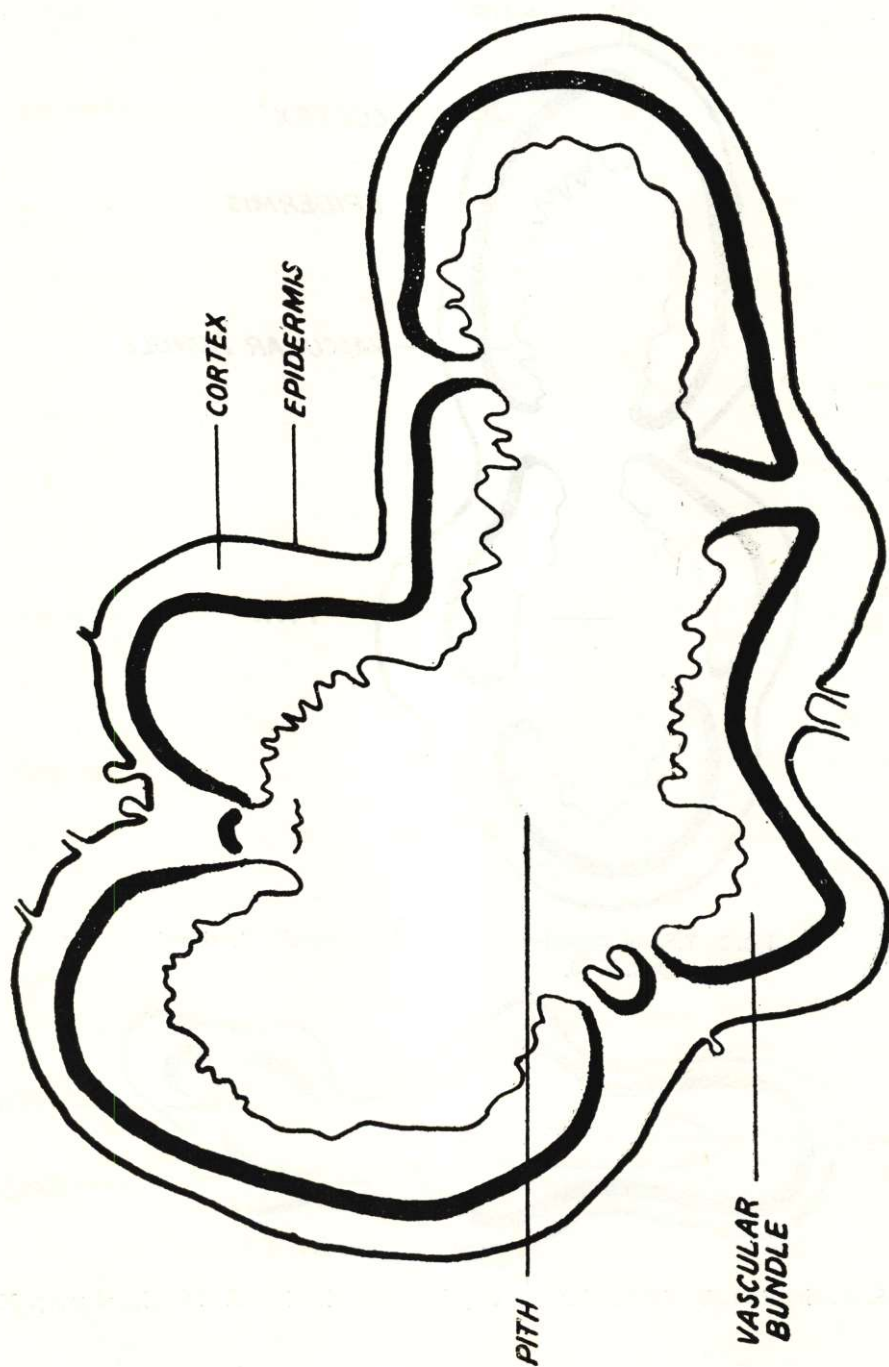


Fig. 4. T.S. of gynophores of the two carpels i.e. a rudimentary and a normal "bigger one" showing a continuous structure of the Pericycle and endodermis (represented by thick line) X 25.



Other plants observed, growing on the road sides have shown a range of 16 to zero percent rudimentary carpels. In all the observations only one case of fused ovary i.e. bicarpellary syncarpous condition with equally developed carpels was noticed but the stigma and style in that case was free. Whereas in all the other flower buds observed the rudimentary carpel was free i.e., apocarpus, even when the carpel was equally developed the condition was apocarpus.

In a very few cases with two almost equally developed carpels, one more rudimentary ovary attached to one of the carpels was noticed i.e. a tricarpellary apocarpus condition. This third rudimentary carpel was attached at the side of one of the ovary from almost two equally developed carpels of the same flower. In case the two carpels were slightly different in size the rudimentary carpel was attached to the larger one (Fig. 5).

In the family Leguminosea the bicarpellary condition is very rare. In the genus *Bauhinia* no bicarpellary condition was reported. The bicarpellary gynoecium in *B. variegata* with a frequency of 31% to 0% in the plants under study is a remarkable phenomenon.

The age, size, soil and other environmental factors seems to play no role in this respect. However, it was noticed that all the above indicated factors being constant a variation in frequency from 31% to 0% and 20% to 0% was observed in the plants growing in two different places. The plants growing on the road sides also show as high as 16% frequency of the extra rudimentary carpels.

Environmental factors have been noticed to alter the vegetative character of plants but reproductive organs i.e. carpels and stamens do not show much plasticity. So the morphological characters of the reproductive organs are considered as good characters in the classification (stable characters are more reliable from the taxonomic point of view).

It has been further noticed that whenever changes are produced by environment these are usually variation in shape and size and not in number.

It appears that this change is due to some heritable factor which does not behave in the typical mendelian way. This could be due to some unstable gene which is not expressing itself uniformly. The other possibility is that a number of genes are collectively

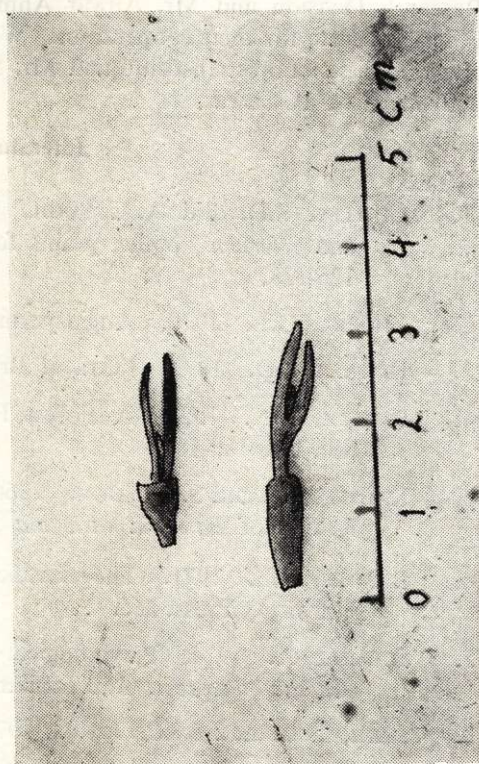


Fig. 5. Tricarpellary apocarpus conditions with a small rudimentary carpel attached to the bigger carpel.



playing a role in the development of the *rudimentary carpels* and the degree of development of the carpel depends upon the number of genes contributing to it but again in this case the genes must be of unstable nature which is not so probable.

Thirdly some cytoplasmic factor could also be a reason or there could be a suppressor factor which suppresses the formation and development of this rudimentary carpel and where this suppressor happens to become slightly loose the carpel appears. However, these points are open for further cytological and genetical studies.

**Acknowledgements.** We are deeply indebted to Dr. G.M. Khattak, Director General, Pakistan Forest Institute, Peshawar for his encouragement and providing us the laboratory facilities. We are thankful to Mr. M.A. Quraishi, Director, Biological Sciences Research Division and Mr. Anwar Ahmad Khan, Medicinal Plants Botanist, Pakistan Forest Institute for their cooperation. We are also thankful to Mr. Zamir Ahmad Azad, artist, Pakistan Forest Institute and Mr. Saadat Khan, typist, Botany Department in the University of Peshawar.

#### Literature Cited

1. CHITLEY, S.D. and A.A. SUOJI. 1973. Screening of *Datura*, *Ricinus*, *Bauhinia* and *Nerium* pollen grains for free amino acids. *Botanique (Nagpur)* 3(2): 125-128.
2. CHOPRA, G.L. 1970. Angiosperms. Unique Publishers Lahore 9th. Ed. 168-188.
3. HOOKER, J.D. 1879. Flora of British India. Sec. Ed. 275-285.
4. PARKER, R.N. 1924. A Forest Flora for the Punjab with Hazara and Delhi, Sec. Ed., 180-184.
5. RAHMAN, W. and S.J. BEGUM. 1966. Flower pigments: Flavonoids from the white flowers of *Bauhinia variegata* Linn. *Naturwissen-Schaften* 53(15): 385.
6. RENDLE, A.E. 1971. The classification of Flowering plants. Vol. 2. Cambridge University Press. 366.
7. SCHMITZ, A. 1974. Palynological contribution to the taxonomy of the *Bauhineae* (*Caesalpiniaceae*). *Bull Jardian Bot. Natl Bely* 43(3/4): 369-423.
8. SHAH, N.C. and M.C. JOSHI. 1972. An ethnobotanical study of the Kumaon region of India. *Econ. Bot.* 25(4): 414-422.
9. SHARMA, D.D., M.S. CHAWLA and S.S. NEGI. 1968. Chemical composition and nutritive value of bamboo (*Bambusa arundinaceae*) and Kachnar (*Bauhinia variegata*) trees.
10. SHARMA, A.K. and D.T. RAJU. 1969. Structure and behaviour of Chromosomes in *Bauhinia* and allied genera. *Cytologia (Tokyo)* 33(3/4): 411-426.
11. STEBBINS, G.L. Jr. 1952. Aridity as a stimulus to plant evolution, *Sci. and Culture*. 17(10): 438-439.