

STUDY OF FOLIAR EPIDERMAL COMPLEXES OF *PIPER BETLE* L. AND *PIPER LONGUM* L. (PIPERACEAE), MEDICINALES MENTIONED IN ATHARVAVEDA.**R.S Kaikade & S.N. Ingole***

Bar. R.D.I.K. And N.K.D. College, Badnera, Amravati (M.S.) India.

*Head of Botany Dept., Bar. R.D.I.K. & N.K.D. College, Badnera Amravati (M.S.) India.
shubhaingole@gmail.com**ABSTRACT**

Indian history of medicinal plants is dated back to 3500 B.C. The curative properties of plants have been mentioned in the 'Suktas of Rigveda' and 'Atharvaveda'. Ayurveda has also described good number of plants with their therapeutic properties. In the present work foliar epidermal studies as anatomical biomarkers of *P.betle* L. and *P.longum* L. belonging to family Piperaceae mentioned in Atharvaveda is undertaken because microscopic characters are one of the important criteria for the identification of organized drugs. Adulterant resembles the genuine drug with respect to its morphological appearance and organalistic characteristics. However, it is devoid of the active constituents which are present in genuine drugs. For such purpose correct identification of species is must and can be based on some microscopic and anatomical characters. The epidermal data, i.e. epidermal cell wall, number of epidermal cells, stomatal frequency, stomatal index were found to be useful in deciphering the individual species. In the present study, the evidences obtained from three epidermal complexes viz. the epidermal cell complex, the stomatal complex and the trichome complex are evaluated for their taxonomic importance. All these complexes show array of structural diversity.

Key Words: *P.betle*, *P.longum*, Epidermal complex, Atharvaveda, trichomes

Introduction

Comparative anatomical studies of angiosperms have achieved a remarkable record as anatomical characters have been employed with great success to the solution of difficult taxonomic problems. Anatomical structures are most likely to provide evidences concerning the inter-relationships of larger groups such as families and also helping to establish real affinities of their uncertain taxonomic status. The value of the character is measured for its constancy. The more constant the character, the greater is the reliability that can be placed upon it. Some important anatomical characters of well established taxonomic value are trichomes, stomata, epidermis, leaf architecture, histology of stem and petiole, sclerieds,

vessel elements etc. Hence in the present study, the epidermal cell complex, the stomatal complex and the trichome complex of *P.betle* L. and *P.longum* L. are evaluated for their taxonomic importance.

Materials and Method

The plant materials for the present study were collected from different habitats in Amravati district (Maharashtra). Herbarium specimens of collected plants were made and macro characters were studied in the field. The plants were identified with the help of the standard floras. The fresh as well as fixed material in F.A.A. was used for anatomical studies. Present study is based mostly on free hand

sections and peelings of fresh and preserved materials.

To study the epidermal complexes and stomatal complexes, epidermal peeling of leaves and other vegetative parts was directly done mechanically by forceps or by scraping with the help of razor blade. The prepared peels were stained with 1% aqueous saffranin followed by mounting in 50% glycerin. For each species, the qualitative analysis of stomatal complexes was made by calculating stomatal frequency, size of stomata and epidermal cells from random sampling of 5 different peels on either surface. The stomatal index for leaves was calculated according to the method of Salisbury (1927). Stomatal classification is based on the present morphological classification recorded by Baranova (1992).

To get the integrated picture of the trichome types and their organographic distribution, varied temporary micro preparations viz- epidermal peels, mount of cleared whole organs or their portions, scraping of trichomes and transections were used. The observation was made directly under compound microscope and camera lucida sketches were made.

Observations

Piper betle L.

Epidermal cell complex:

Adaxial surface: Intercostal cells comparatively bigger than those of abaxial surface, polygonal to roundish, $64 \times 44 \mu$; walls- slightly wavy; orientation- various to long axis of organ; costal cells distinct, uniform, hexagonal, elongated; walls- straight, parallel to plane of vein. Cells

surrounding hair bases elongated radially, straight walled in rosette. Cuticular striation- absent. Cells/ unit area- 45.

Abaxial surface: Intercostal cells similar to those of adaxial surface; smaller, $54 \times 36 \mu$. Cuticular striation absent. Cells/ unit area- 47

Stomatal complex: Hypostomatic

Adaxial surface: Astomatic

Abaxial surface: Stomatal distribution- on intercostal area and near veins; orientation- longitudinal, oblique and transverse to long axis of organ; shape-elongate; guard cells almost equal, inner walls moderate thick. Distribution 2-3 cells apart. Type- predominantly cyclocytic, anomocytic, adjacent cells 3-5 in number. Size- $36 \times 16 \mu$. Frequency- 9/ unit area.

Trichome complex:

I. Non-glandular uniseriate filiform

1. Unicellular conical

Body tapering, $52 \times 16 \mu$ to shortly papillate $20 \times 12 \mu$; acutely pointed at apex; base flat; content- granulated; lumen- narrower; wall- moderately thick, smooth. Hair base seated upon ordinary single epidermal cell.

2. Multicellular conical

2.1 Body-2-celled; $64 \times 20 \mu$; lower cell shorter, squarish; content- finely granulated; lumen- broader; wall- moderately thick, smooth, straight; terminal cell longer, slightly bend at apex; base slightly concave; content- finely granulated; lumen- narrower; wall- moderately thick, smooth, concave. Hair base seated upon vertical division wall between 3-adjointing epidermal cells.

2.2 Body-2-celled; 68×20μ; similar as above; differing only in hair base seated upon ordinary single epidermal cell.

2.3 Body-2-celled; 72×20μ; seated upon vertical division wall between 2- adjoining epidermal cells.

2.4 Body-3-celled; 80×24μ; lower and middle cells are equal, elongated; content- granulated; lumen- narrower; wall- moderately thick, smooth, straight; terminal cell slightly longer; sub- acutely pointed at apex; base rounded. Hair base seated upon rosette of 4- epidermal cells.

I. Uniseriate glandular capitate

1. Capitate long stalked

1.1 Foot-1-celled, not sunken, cells rectangular; content- hyaline. Stalked- 1-celled, squarish, comparatively narrower than head; lateral wall concave, smooth, moderately thick; content- hyaline; head- globose, 2- celled, rounded, dense.

1.2 Foot-1-celled, sunken; head- globose, 1- celled, elongated, comparatively narrower; lateral wall straight, smooth, moderately thick; content- hyaline; head- triangular, 1-celled, dense.

Piper longum L.

Epidermal cell complex:

Adaxial surface: intercostal cells polygonal to rounded, 52×40μ; walls- straight to curve; orientation- various to long axis of organ; costal cells distinct, uniform, elongated; walls- straight, parallel to plane of veins; cells surrounding hair bases arranged in rosette having straight- curved walls. Cuticular striation absent. Cells/ unit area- 42.

Abaxial surface: intercostal cells similar to those of adaxial surface; 48×40μ.

Cuticular striation feebly present. Cells/ unit area- 48

Stomatal complex: Amphistomatic

Adaxial surface: Stomatal distribution- on intercostal area; orientation- longitudinal to long axis of organ; shape- rounded to elongated, guard cells almost equal, inner wall thin. Distribution- non specific. Type- cyclocytic; size- 24×20μ. Frequency- 1/ unit area.

Abaxial surface: Stomatal distribution- on intercostal area and near veins; orientation- various to long axis of organ; shape- rounded- elongate; guard cells almost equal, inner wall thin. Distribution- non specific. Type- cyclocytic, Size- 32×20μ. Frequency- 8/ unit area.

Trichome complex:

I. Non-glandular uniseriate filiform

1. Unicellular conical

1.1 Body- ovate- conical; 68×16μ, longer than broad, acutely pointed at apex; base- rounded; content- granulated, not obliterated; lumen- broad; wall- moderately thick, roughish. Hair bases seated upon single protruding distinguished epidermal cell.

1.2 Body- falcate- conical; 64×16μ, acutely pointed at apex; base- straight. Hair base seated upon single protruding distinguished epidermal cell.

1.3 Body- straight- conical; 40×16μ, sub acutely pointed at apex; base- rounded; content- granulated, not obliterated; lumen- broad; wall- moderately thick, roughish. Hair base surrounded by four distinguished epidermal cells forming rosette like structure.

1.4 Body- tapering; 44×20μ, apex sharply pointed; base flat; content-granulated; lumen- broad; wall-moderately thick, slightly roughish. Hair base seated upon vertical division wall between two adjoining epidermal cells.

2. Multicellular conical

2.1 Body-2-celled; 64×16μ; lower and terminal cells equal; acutely pointed at apex; base flat; content- granulated; lumen- narrower; wall- moderately thick, rough. Hair base seated upon 3- epidermal cells.

2.2 Body-3-celled; 64×20μ; lower cell shorter than middle and terminal cell. Hair base seated upon vertical division wall between two adjoining epidermal cells.

II. Uniseriate glandular capitate

1. Capitate shortly stalked

1.1 Foot-1-celled, not sunken, cell squarish; content- hyaline; stalk- 1-celled, comparatively narrower than base of head; cell- squarish, lateral wall- convex, smooth; content- hyaline; head- globose, 2-celled; cells- oval; content- dense.

1.2 Foot-1-celled, same as above, head- globose, 1-celled; content- dense.

Table:1 Laminar epidermal cells characteristics features

Name of Taxa	Epidermal cells		Cell Wall		Size	
	Adaxial	Abaxial	Adaxial	Abaxial	Adaxial	Abaxial
<i>P.betle</i>	PA,RA, few elongated	PA,RA	Slightly wavy	S to C	64×44μ	54×36μ
<i>P.longum</i>	PA,RA	PA,RA	S to C	S to C	52×40μ	48×40μ

P-polygonal, R- Rounded, A- anisodiametric, S- straight, C- curved

Table:2 Laminar stomatal features

Name of Taxa	Type of stomata		Size (Average) Length × Breadth(μ)		No. of epidermal cells per unit area		Frequency (Average) per unit square		Stomatal Index (Average)	
	Ada	Aba	Ada.	Aba.	Ada.	Aba.	Ada.	Aba.	Ada.	Aba.
<i>P.betle</i>	-	C	-	36×16	45	57	-	9	-	13.63
<i>P.longum</i>	C	C	24×20	32×20	42	68	1	8	2.32	10.52

Ada- adaxial; Aba- abaxial; C- cyclocytic

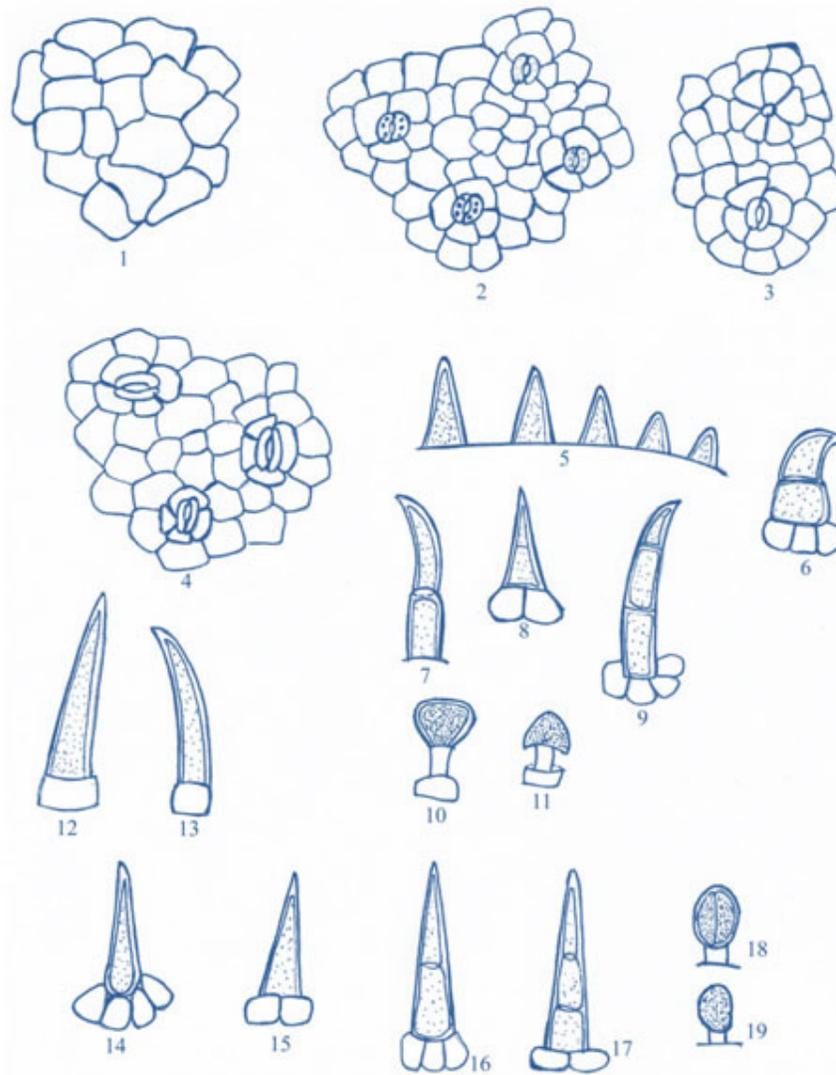


Fig. 1- adaxial surface of *P. betle*; 2- abaxial surface of *P. betle*; 3- Adaxial surface of *P. longum*; 4- abaxial surface of *P. longum*; 5-11- trichomes of *P. betle*; 12-19- trichomes of *P. longum*

Discussion

Herbs have always been the principal form of medicine in India and presently they are becoming popular throughout the world. There are widespread beliefs that green medicines are healthier and more harmless or safer than the synthetic ones. Hence identification and determination of a crude drug is necessary for its purity and quality.

For such purpose correct identification of species is must.

The shape of epidermal cells, thickness and characteristics of their wall, nature of sculpturing on their wall as seen in surface view, importance of papillate cells provide useful taxonomic criteria. Butterfass (1987), discussed the value of study of orientation of stomata. Trichomes

have been employed very frequently for systematic comparisons because of their diversity, their universal presence in the angiosperm and their ease of preparation. Metcalfe and Chalk (1950), Ramayya (1972), Parveen *et al.* (2000), Combrinck *et al.* (2007) and several others have provided useful information on the

structure, function and classification of trichomes with their significance in comparative anatomical studies.

The present study of anatomical biomarkers of the leaf epidermis states that these characters are useful for the identification of these investigated taxa.

References

- Baranova, M. (1992).** Principles of comparative stomatographic studies of flowering plants. *Bot. Rev.*, 58(1): 49-99.
- Bentham, G., Hooker, J.D. (1862-1883).** *Genera plantarum*. Volume 3. Reeve & Co., Williams and Norgate, London.
- Butterfass, T.H. (1987).** The trasverse orientation of stomata. *Bot.Rev.*, 53(4): 415-441.
- Combrinck, S., DU Plooy, G.W., Mc Crindle, R.I., Botha, B.M. (2007).** Morphology and Histochemistry of glandular trichomes of *Lippia scaverrima* (Verbenaceae). *Annals of Botany*, 99:1111-1119.
- Metcalfe, C.R., Chalk, L. (1950).** *Anatomy of dicotyledons*. Vol. I and II. Clarendon Press, Oxford.
- Parveen, N.S., Murthy, K.S.R., Pullaiah, T. (2000).** *Phytomorphology*, 50: 204
- Ramayya, N. (1972).** Classification and phlogeny of the trichomes of angiosperms In: *Research trends in plant anatomy*. Tata Mc Graw Hill, Bombay, 91-102.
- Salisbury, E.J. (1927).** On the causes and ecological significance of stomatal frequency with special reference to the wooland flora. *Phil. Trans. R. Soc.*, 216: 1-65.