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LEAF MORPHOLOGICAL AND EPIDERMAL FEATURES AS AN AID TO THE TAXONOMY OF DIFFERENT MORPHOTYPES OF MUGA SILKWORM HOST PLANT *Litsaea monopetala* PERS.

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ABSTRACT

Studies have been conducted on morphological and epidermal features of leaves of eight morphotypes of MV1- MV6 of *Litsaea monopetala* a host plant of muga silkworm *Antheraea assama* Ww. and used in cultivation in North Eastern India. The aim of the present study is to reveal the variations in respect of morphological and anatomical features like epidermal cells, stomata and trichomes etc. in morphotypes of the plant species, *Litsaea monopetala* prominently marked variations have been observed in the shape, size, outline of the different leaves and the epidermal cells. The leaves of most of the studied morphotypes are Oval to obovate in shape, leaf length, width and area were observed 138-205 mm, 75-1370 mm and 3220-21835 mm² ,upper epidermis possess undulated to feebly undulated epidermal cells with cell size 1.5 x 10^{-3} - 5.4x10^{-3} and The leaves in all morphotypes are hypostomatic and possess anomocytic, anisocytic and paracytic types of stomata. Stomatal frequency and index varies between 133-660 and 10.78- 36.14 , respectively. Trichomes occur abundantly on the abxial than that of adaxial surface of the leaves.

KEYWORDS : Morphotypes, lanceolate, anomocylic, anisocytic, paracylic

The family lauraceae comprised of 36 genera and 2000 species, a vast majority of which are trees or well formed shrubs. Its members are mostly restricted to the tropical and sub-tropical forests. As regards India the family occupies an important economic position since it's two species, *Persea bombycina* Kost. and *Litsaea polyantha*, Juss. Syn. *L monopetala* Pers. are used in cultivation in North-Eastern India i.e. especially in Assam and Meghalaya states for rearing the muga silkworm. Though, many of the variants of these species are available in nature of which few morphotypes have been collected and identified by Siddiqui et al., (2000). However important information in respect of plant leaf morphology and their epidermal characters are still lacking in studies.

The epidermis constitutes the outermost layer of cells which covers the whole outer surface of the plant body including the vegetative and the reproductive parts. In leaves, it forms a continuous layer except stomata and nector glands. The cells comprising the epidermis are generally irregular in out line varying in shape and size and are arranged very close to each other having no intercellular spaces. Apart from the ordinary cells they comprise many types of trichomes, stomatal guard cells and other specialized cells such as subsidiary cells and oil cells. According to Histogen theory the epidermis is derived from dermatogen of apical meristem. The trichomes are uni-multicellular appendages growing from epidermal layer, may be classified into different morphological categories Malpighi ,(1675). Coined the term stomata and regarded them as excretory vessels, Vesque ,(1889) emphasized the importance of stomata and alongwith other anantomical features in classification of plants.

The climatic conditions of Doon Valley as well as its adjoining areas of Garhwal and Kumaun regions is more or less similar to N-E region of India, being subtropical and varies according to the altitude all over the hills. The Doon Valley lies at the foot hills of N-W Himalayan at an altitude 900 AMSL and covers average rain-fall around 200mm / year. Furthermore, the high temperature is 38 degree Celsius whereas the lowest is 04 degree Celsius with range of relative humidity from 50% to 95% favouring luxuriant growth of *L. monoptela* Pers.

The present study is aimed to identify the different morphotypes of muga Silkworm host plant species L. monopetala available in state Uttarakhand on the basis of observations of the leaf pertaining to morphological and epidermal features.

MATERIALS AND METHODS

The plant material MV1 to MV6 employed for the

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present study were collected from the trees growing in the various localities like Doiwala, Lachiwala, Majra and Premnagar of Doon valley Uttarakhand, India in order to carry out the morphological studies of leaves and to obtain the microscopic preparation of semi-matures leaves these were fixed in F.A.A.

To analyse the epidermal features, upper and lower epidermal peels form middle portion of leaves were obtained by macerating the middle portion of the leaves in conc. HNO_3 and H_2O_2 (1:1). The peels were thoroughly washed. Later these peels stained were 50% safranine. The stained peels were mounted in glycerine. The prepared slides were examined under 200x magnification and different epidermal features were examined and recorded. The types of stomata, nos. of stomata and epidermal cells present in microscopic field at particular magnification have been counted. The size of stomata has also been measured. The frequency and no. of stomata per square mm has been calculated. The formula proposed by Salisbury, (1928) was employed to determine the stomatal indices. The recorded epidermal features were compared with the leaf size and total number of stomata as well as the total number of epidermal cells were also calculated.

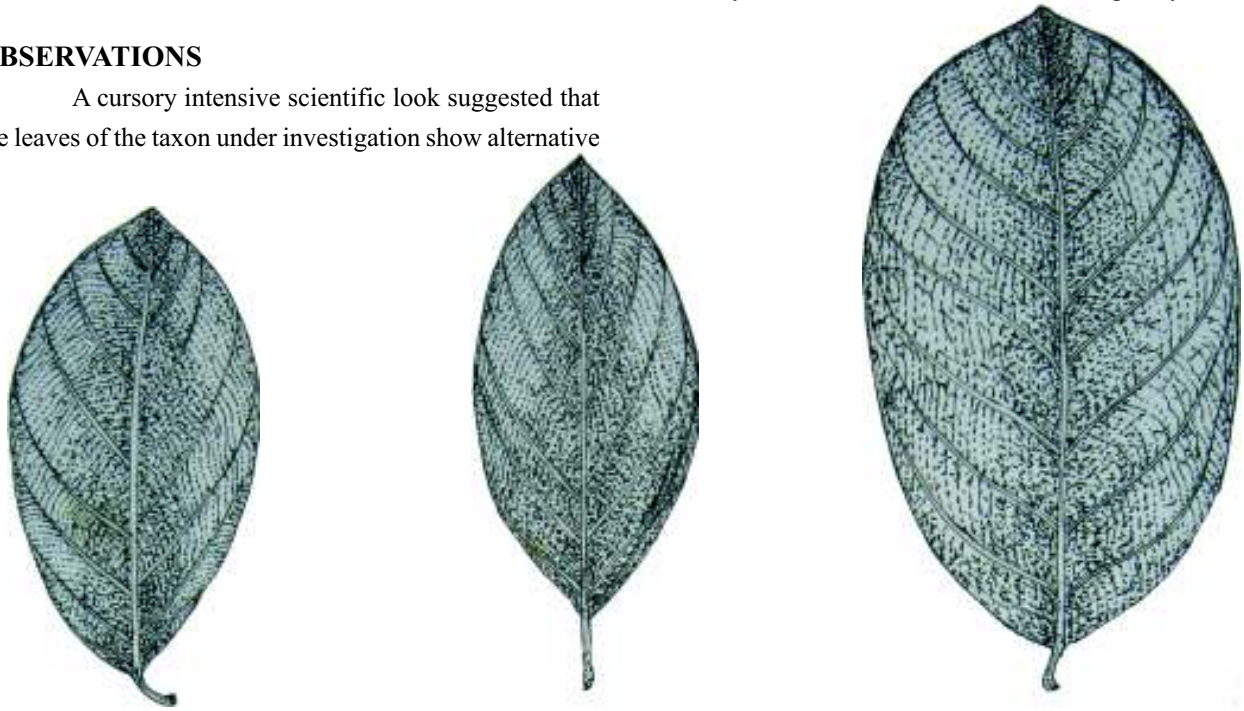
OBSERVATIONS

A cursory intensive scientific look suggested that the leaves of the taxon under investigation show alternative opposite phyllotaxy and the leaves bear entire margin, unilacunar node and single strand at the leaf base which forms the midrib in the lamina and the morphotypes have variable configurations pertaining to the leaf size, form, balance apex and shape etc. Table I to IV and Fig.1 to 3.

Morphological And Anatomical Features Of Morphotypes (MV1-MV6)

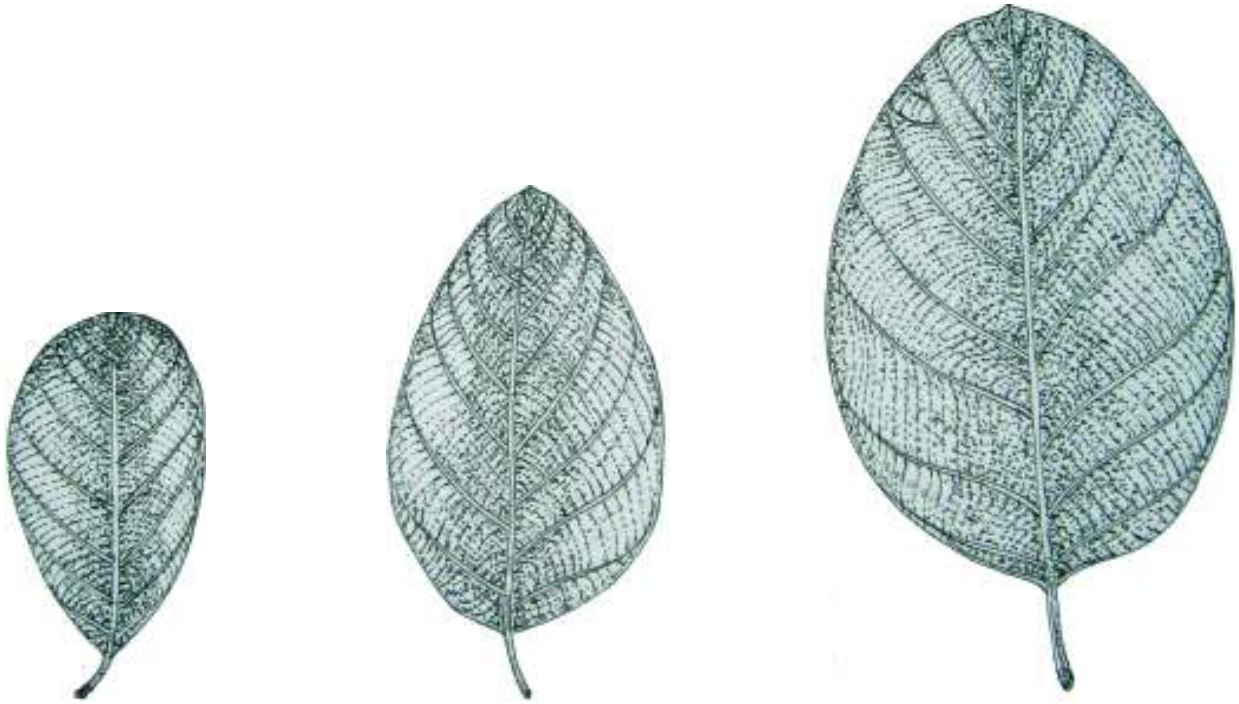
MV1: Leaf simple, deciduous, ramal, alternate, petiolate, exstipulate, attenuate, oval entire accuminate, acuminate glabrous, coriaceous (Fig.,1) length x width 138x75 mm, area 6525mm^2, upper epidemis feebly undulated, cell size 2.5 x 10^{-3} , frequency 6.60/ mm^2, lower epidermis (Fig..2) highly undulated, frequency 8.33/ mm^2, stomatal anomocytic & paracytic, size 1.6 x 10^{-4}, frequency 225 and stomatal index 21.27 (Fig., 3).

MV2: Leaf simple deciduous, ramal alternate, petiolate exstipulate, attenuate, lanceolate, entire reticulate, cuspidate, glabrous-sub glaucous, coriaceous-sub coriaceous, length x width 160x82 mm, area 3220 mm^2 (Fig.,1), upper epidermis undulated, cell size 1.5 x 10^{-3} mm^2, cell frequency 6.00/ mm^2 (Fig.,2) lower epidermies feebly undulated ,frequency 11.66 mm^2, stomata anomocytic size 1.8 x 10^{-4} mm^2 stomatal frequency 660 and



MV1 MV2 MV3

Fig. 1 : Leaves of morpho - variants of muga silkworms host plant *L. monopetala* Ww. (MV1 - MV3)



MV6 **MV5** **MV4**

Fig. 1 : Leaves of morpho - variants of muga silkworms host plant *L. monopetala* Ww. (MV4 - MV6)

stomatal index 36.4 (Fig. ,3).

MV3: Leaf simple deciduous, ramal, alternate, petiolote, exstipulate, attenuate, Obovate, entire, reticulate, cuspidate, glabrous-subglaucocus, sub-coriaceous, length x width 172x88 mm, area 11300 mm^2 (Fig.,2) upper epidermis feebly undulated cell size $4.75x10^{-3}$ mm^2, frequency 6.00/ mm^2 (Fig.,2) lower epidermis highly undulated, frequency 8.00/ mm^2, stomata anisocytic paracytic size 2.5×10^{-4} mm^2, stomatal frequency 266 and stomatal index 24.95 (Fig.,3).

MV4: Leaf simple, deciduous, ramal, alternate, petiotate, exstipulate, atenuate, Obovate, entire, reticulate, cuspidate, glabrous sub glaucocus, sub- coriaceous, length x width 157 x 90 mm, area 10405 mm^2 (Fig.,1) upper epidermis undulated, cell size $3.75x10^{-3}$ mm^2 cell frequency 6.00/ mm^2 (Fig.,2) lower epidermis highly undulated, frequency 10.00/ mm^2, stomata paracytic size 1.2×10^{-4} mm^2, frequency 167, index 15.65 (Fig.,3).

MV5: Leaf simple, deciduous, ramal, alternate, petiolate, exstipulate, attenuate, obovate, entire, cuspidate, glabroussubglabrous, coriaceous-subcoriaceous, length x width 138 x 87 mm, size 8865 mm^2 (Fig.,1) upper epidermis highly undulated, cell size $4.5x10^{-3}$ mm, cell frequency 8.00/ mm^2, (Fig.,2), lower epidermis undulated, frequency 11.00/ mm^2, stomata paracytic size 3.0×10^{-4} mm^2, frequency 133 , stomatal index 10.78 (Fig., 3).

MV6: Leaf simple, deciduduous, ramal, alternate, petiolate, exstipulate, attenuate Obovate , entire, acute- mucronate, glabrous-subglaucocus coriaceous-subcoriaceous, length x width 205 x 137 mm, size 21835 mm^2 (Fig., 1), upper epidermis undulated, cell size $5.4x10^{-3}$ mm^2 , cell frequency 7.60/ mm^2 (Fig. 2), lower epidermis feebly undulated, frequency 11.50/ mm^2, stomata paracytic, size 1.2×10^{-4} mm^2, frequency 300 , stomatal index 20.68 (Fig.,3).

DISCUSSION

A survey of the literature on leaf morphology and anatomy reveals that the data obtained from it have been amply employed for elucidation of the taxonomic and phylogenetic relationship in various plant groups and species at different levels of plant classification (Hayes et al., 1951) that the leaf morphology varies greatly is very well recognized. The leaf shape in the morphotypes MV1-

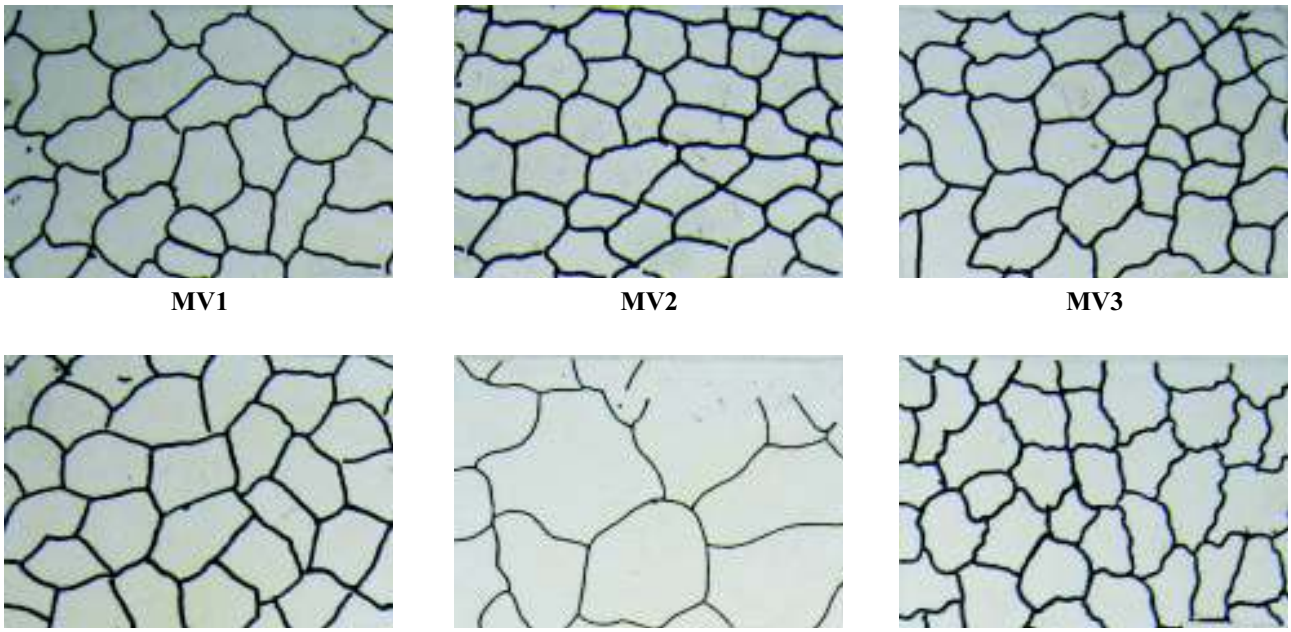


Fig. 2 :Figures of upper epidermis in some morpho-variants of muga silkworms host plant, *L. monopetala* (MV1-MV6) Variations in the organization of the upper epidermis in morpho-variants. (All x 200)

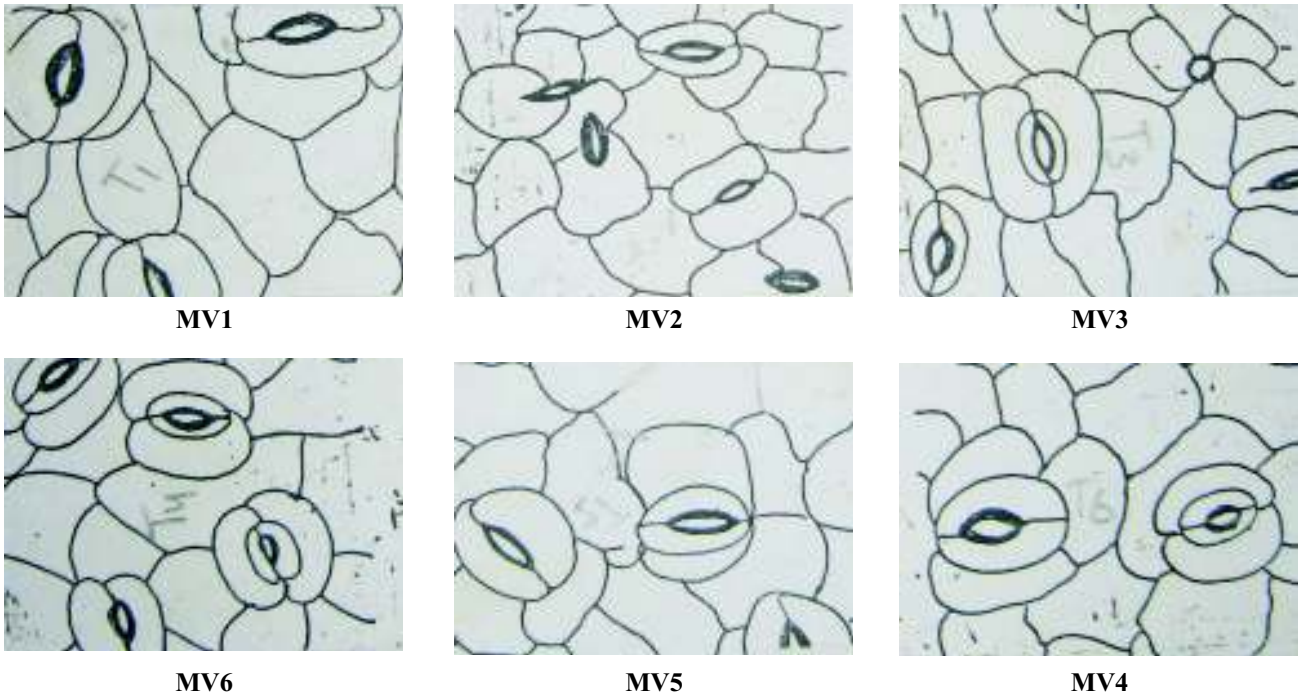


Fig. 3 :Figures of lower epidermis in some morpho-variants of muga silkworms host plant, *L. monopetala* (MV1-MV6) Variations in the organization of the upper epidermis in morpho-variants. (All x 200)

Table I: Foliar Features of the plant species *Litsaea monopetala* Pers.

Sl.No.	Morphotypes	Phyllotaxy	Shape/ Oultine	Base	Apex	Margin	Texture	Surface
1.	MV1	Alternate Opposite	Oval	Attenuate	Acute	Entire	Pubescent	Coriaceous
2.	MV2	-do-	Lanceolate	-do-	Acute	-do-	-do-	Coriaceous Subcoriaceous
3.	MV3	-do-	Obovate	-do-	-do-	-do-	-do-	-do-
4.	MV4	-do-	-do-	-do-	Obtuse	-do-	-do-	-do-
5.	MV5	-do-	Ovate	-do-	-do-	-do-	-do-	-do-
6.	MV6	-do-	Obovate	-do-	Acute	-do-	-do-	-do-

Table II: Features of upper epidermis of the plant species *L. monopetala* Pers.

Sl. No.	Morphotypes of *P. bombycina*	Topography of the cells wall	No. of epidermal cells/mm^2	Size of epidermal cells/mm^2
1.	MV1	Feebly undulated	660	$2.5x10^{-3}$
2.	MV2	Undulated	600	$1.5x10^{-3}$
3.	MV3	Feebly undulated	475	$3.75x10^{-3}$
4.	MV4	Undulated	600	$3.75x10^{-3}$
5.	MV5	Highly undulated	800	$4.50x10^{-3}$
6.	MV6	Undulated	660	$5.40x10^{-3}$

Table III: Features of lower epidermis the plant species *L. monopetala* Pers.

Sl. No.	Morph otypes	Topography of the cells walls	Epidermal cells/mm^2	Types of stomata	Stomata mm2 (Stomated frequency)	Size of stomata (mm^2)	Stomatal indices
1.	MV1	Highly undulated	833	Paracytic	225	$1.6x10^4$	21.27
2.	MV2	Feebly undulate	1166	Anomocytic	660	$1.8x10^4$	36.14
3.	MV3	Highly undulated	800	Anisicytic &paracytic	266	$2.5x10^4$	24.95
4.	MV4	Highly undulated	1000	Paracytic	167	$1.2x10^4$	15.65
5.	MV5	undulated	1100	Paracytic	133	$3.0x10^4$	10.78
6.	MV6	Feebly undulated	1150	Paracytic	300	$1.2x10^4$	20.68

MV6 examined varies from oval to oval-lanceolate . All the forms studied show single-stranded condition and presence of fine branches in the petiole is not a regular feature and the leaf base is attenuate. The leaf apex is mostly cuspidate and varies in MV6 showing tendency towards acute-mucronate respectively. The leaf margin is entire, texture is mostly glabrous to glabrous-subglaucocus and leaf surface varies from, subcoriaceous to coriaceous usually.

The upper epidermal cells are mostly irregular with feebly undulated or arched wall, where as in some morphotypes, polygonal with either undulated or highly undulated.

The studies of dermal appendages are based on

Table IV : Correlations between leaf size, total no. of stomata and epidermal cells/mm^2 of the plant species *Litsaea monopetala* Pers.

Sl. No.	Morphotypes of *P. bombycina*	Leaf			Total No. of epidermal cells/mm^2	Total no. of stomata/mm^2
		Length mm	Width mm	Area mm^2		
1.	MV1	138	75	6525	833/543x10^4	225/146x10^4
2.	MV2	160	82	3220	1166/375X10^4	660/212X10^4
3.	MV3	172	88	11300	800/904X10^4	266/300X10^4
4.	MV4	157	90	10405	1000/1040X10^4	167/1040X10^4
5.	MV5	138	87	8865	1100/675X10^4	133/117X10^4
6.	MV6	205	137	21835	1150/2511X10^4	300/655X10^4

observations made from both abaxial as well as adaxial surface of the leaf. Structurally the trichomes are highly undulated.

The frequency of epidermal cells/mm², upper epidermis exhibited marked variations. Amongst the morphotypes it varies 4.75 in MV3 and 8.00 in MV5. The total number of epidermal cells in lower epidermis of a leaf of morphotypes also varies greatly. highest number (1040x10^4 in MV4 while lowest (117x10^4) in MV5.

All the morphotypes studied are hypostomatic and majority of them possess paracytic type of stomata. Simultaneously, several anomocytic and anisocytic are also seen in some morphotypes (Table,III). The number of stomata per unit area (mm^2) ranges 13.3 in MV5 to 66.0 in MV2. The sized the stomata varies from in S3 to 1.2 x 10^{-4} 3.0 x 10^{-4} mm^2 and stomatal index shows a range from 10.78 in MV5 to 36.14 in MV2(Table ,III).

The total number of stomata in the leaf of morphotypes also express marked variation. It is highest (1040x10^4 in MV4 while lowest (117x10^4) in MV5., usually the larger leaves posses higher number of stomata with few exceptions (Table, III).

The structure, distribution and type trichomes have also been found to serve as an aid in establishing the position of a taxon in plant kingdom. The studies of Netolitzkay (1932) comprehensive survey of trichomes, their structure and functions.

Present study reveal, that the various morphological features of leaves and their anatomical features like epidermal cells stomata and trichomes can prove an important character in the systematic of the species *L. monopetala.*

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