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ANATOMICAL STUDIES IN THE GENUS *ARGEMONE*

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ABSTRACT

The comparative data on the anatomy of two species of *Argemone*, *A. mexicana* and *A. ochroleuca* have been found to be statistically significant.

INTRODUCTION

Argemone mexicana introduced from America is now widely distributed throughout India. *A. ochroleuca* is a recently discovered weed (Venkatesh, 1960, 1962) and is not so widely dispersed as *A. mexicana*. Cytologically, *A. ochroleuca* has been shown to be a distinct species (Malhotra, 1960).

MATERIAL AND METHODS

The material of *A. mexicana* was collected from Jaipur and of *A. ochroleuca* from Mount Abu. The leaves were fixed in F.A.A. and cleared by warming in lactic acid. Transverse sections were cut at thickness ranging from 10-15 μ The data were statistically analysed to determine the interspecific differences between the two species.

OBSERVATIONS AND CONCLUSIONS

Certain anatomical characters of the two species of *Argemone*, namely *A. mexicana* and *A. ochroleuca* have been investigated. The midrib in *A. mexicana* contains a single, but in *A. ochroleuca* 3-4 vascular bundles. In *A. mexicana*, the midrib region contains palisade tissue below the upper epidermis and collenchyma below the lower epidermis. On the contrary, in *A. ochroleuca*, in the midrib region palisade is absent and only collenchyma is present both inside the upper and lower epidermis. The remaining portion of the mesophyll in the midrib region is parenchymatous. In both the species, beside the vascular bundles the mesophyll in the lamina consists of a layer of palisade tissue on the adaxial side and loosely arranged spongy parenchyma beneath it.

The epidermal cells are tetra to hexagonal with straight anticlinal walls. The coastal regions of the leaf possess single-celled straight spine with multicellular bases. The stomata are of the anomocytic type. Palisade tissue is present only on the adaxial side. The vein-islets are tri-to pentangular with straight or curved and once to thrice branched vein-endings.

Data on anatomical characters along with the relevant statistical analysis are given in Tables 1-3.

Qualitatively, the anatomical characters of the leaf in both the species of *Argemone* are similar. But the two species differ significantly in respect of number of vein-islets and free-vein endings per unit area (Table 1). Moreover other characters also show statistically significant differences (Table 3). The coefficient of variation percent is least for free vein-endings per square mm in *A. ochroleuca* while in *A. mexicana* the same is true for the stomatal index of the lower epidermis (Table 2). Besides the size of the leaf, epidermal cells, stomata and vein-islets are also different in the two species *vide* p. 166.

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Table 1. Basic data with statistical analysis on the anatomy of two species of *Argemone*

S. No. Microanatomical characters	Arithmatic Mean		Standard deviation		Variance		Coefficient of variation percent	
	Am.	Ao.	Am.	Ao.	Am.	Ao.	Am.	Ao.
1. Stomatal frequency								
(*a*) Upper	92.03 ±22.01	94.23 ±22.01	13.31	12.80	177.19	163.95	14.46	13.58
(*b*) Lower	161.17 ±16.96	193.53 ±44.03	15.20	27.07	231.22	733.18	9.43	13.99
2. Stomatal index								
(*a*) Upper	27.08 ±8.53	20.66 ±3.61	2.80	1.88	14.50	3.53	14.05	9.09
(*b*) Lower	32.56 ±4.91	27.49 ±5.37	1.87	2.89	3.53	8.38	5.77	10.52
3. No of vein-islets per sq. mm	9.41 ±1.42	14.35 ±2.14	0.93	1.38	0.87	1.92	9.91	9.66
4. No. of free vein ending per sq. mm	17.89 ±2.50	26.29 ±3.21	1.55	1.69	2.41	2.87	8.67	6.45
5. Palisade ratio (Upper only)	5.08 ±1.94	6.94 ±2.00	0.94	0.96	0.90	0.92	18.69	13.86

Am = *Argemone mexicana* ; Ao = *Argemone ochroleuca*. All observations are mean of 50 readings

Table 2. Degree of variability of anatomical characters of the two species of *Argemone*

Species	Anatomical characters						
	Free vein-endings per sq. mm	Vein-islets per sq. mm	Stomatal index U	Stomatal index L	Stomatal frequency U	Stomatal frequency L	Palisade ratio (upper)
A. mexicana							
Coefficient of variation percent	8.67	9.91	14.05	5.77	14.46	9.43	18.69
Variability grade	II	IV	V	I	VI	III	VII
A. ochroleuca							
Coefficient of variation percent	6.45	9.66	9.09	10.52	13.58	13.99	13.86
Variability grade	I	III	II	IV	V	VII	VI

U=Upper, L=Lower, I=Most stable, II=Stable, III=Less stable, IV=Less variable than V, V=Variable, VI=More variable than V, VII=Most variable

Table 3. Statistical analysis of anatomical characters in *Argemone*

Macro/Microanatomical	Difference of means (a)	Standard error of difference (b)	t=a/b
1. Stomatal frequency			
(*a*) Upper	2.20	2.61	0.84 Insig.
(*b*) Lower	32.36	4.39	7.37***
2. Stomatal index			
(*a*) Upper	6.42	0.60	10.70***
(*b*) Lower	5.06	0.48	10.40***
3. No. of vein-islets per sq. mm	4.94	0.23	21.47***
4. No. of free vein-endings per sq.mm	8.40	0.32	26.25***
6. Palisade ratio (Upper only)	1.86	0.19	9.76***

(98 degrees of freedom) Insig. = Insignificant ***=Very highly significant

Distribution of t for
0.050 P = 1.9828 0.010 P = 2.6338 0.001 P = 3.3876

Characters	*A. ochroleuca*	*A. mexicana*
Leaf size	7.70× 2.32 cm	10.62×6.42 cm
Size of epidermal cells	40.80μ×26.80μ	46.40×34.30μ
Size of upper stomata	33.20μ×29.00μ	34.40μ×30.60μ
Size of lower stomata	29.00μ×25.30μ	31.40μ×26.80μ
Size of vein islets	33.40μ×24.60μ	56.70μ×47.10μ

Further, the lack of palisade tissue inside the adaxial epidermis in the midrib region in *A. ochroleuca* too can be used to distinguish it from *A. mexicana* even in the pre-flowering vegetative stage. Morphologically *A. mexicana* and *A. ochroleuca* can be distinguished only by their flowers. *A. ochroleuca* has lemon-yellow or whitish petals which are up to 3.5×2 cm in size ; buds are oblong ; stigma narrow spreading widely ; in *A. mexicana* petals are bright yellow up to 2×1 cm in size, buds are subspherical ; stigma is broad ; the lobes closely crowded together and appressed to style (Raizada, 1976).

Thus besides morphology, characters of anatomy (also known as quantitative microscopy or analytical microscopy *viz.* Wallis, 1957, 1967) can also be usefully employed for distinguishing the species of this genus.

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