

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Anatomical Study for The Leaf Epidermis of The Genus *Lepidium* L. in Iraq.

Thulfiqar Abbas Kadhem\*, and Ruqayah Manoon Alnomani.

University of Kufa, Faculty of Education for Girls, Department of Biology, Iraq.

### ABSTRACT

The aim of the study was to investigate the detail epidermal characteristics of the leaf for six species of the genus *Lepidium* in Iraq. The species investigated include *L. aucheri*, *L. latifolium*, *L. perfoliatum*, *L. persicum*, *L. ruderale* and *L. sativum*. The qualitative parameters, such as straight or sinuous, thin or thick anticlinal cell walls, types of stomata apparatus and trichomes types were studied by using light microscopy (LM). Also quantitative traits such as stomatal index, length, width, epidermal length and width was described in details. The results show high covariance in the leaf attributes which can be of great taxonomic significance.

**Keywords:** *L. latifolium*, stomatal, *Lepidium*.

\*Corresponding author

## INTRODUCTION

Brassicaceae is an economically important family which comprises many economical plants [1,2 and 3]. [4] reported more than 80 genera growing in different areas of Iraq. The epidermal characters of the leaves of the species of *Lepidium* were not fully investigated. [5] compared between summer and winter rosettes leaves of various herbs including *Lepidium virginicum* emphasized that the epidermal cell walls are more sinuous in upper surface than in lower surface. [6] mentioned that plants belong to the Brassicaceae contain nonglandular, unicellular, unbranched or branched, T-shape or stellate trichomes and their cell walls with calcium carbonate, glandular trichomes rare, stomata commonly anisocytic type and secretory cells represented by myrosin cells. [7] separated some members of Brassicaceae by their epidermal characters, such as epidermal cells with polygonal to nearly rounded and linear in *Lepidium apita* and polygonal to less undulating to clearly irregular at different areas of the organ epidermis in *Raphanus sativus* and in *Sisymbrium irio*. Also, [8] reported that the stomata are mainly anisocytic, rarely anomocytic in three species of *Isatis* and five single genera of Eulidieae, the shapes of leaf epidermal cells were usually polygonal or irregular. [9] reported the presence of stomata in both epidermises and their types mainly anisocytic, rarely anomocytic and occasionally paracytic. They concluded the taxonomic importance of leaf epidermal features which can employed as a criterion of distinguishing species in the genus *Lepidium*. In another study, [10] studied *Lepidium sativum* and reported that the type of stomatal apparatus is anisocytic, the epidermis have polygonal elongated cells with sinuous walls, trichomes branched with thick, warty cell walls. [11] designing a key for separating 82 species of Brassicaceae based on trichome morphology. The significance of leaf epidermal features in the systematic of many genera and species of Brassicaceae has been reported [12,13,14 and 15]. Leaf epidermal cells provided an identification key for determination of more species [16]. Our work aims to elucidate the taxonomic potential by using leaf epidermal features like stomata, epidermal cells and trichomes to delimit the species within the genus.

## MATERIALS AND METHODS

Herbarium materials collected from different parts of Iraq were used in this study in addition to freshly samples. The herbarium materials were first softened by boiling in distilled water. Both abaxial and adaxial surface from the middle portion of the leaf were prepared according to [17] with a fine needle and mounted on glass slides in glycerin and safranin (1:1), covered with cover slips and edges of cover-slip sealed with nail varnish to prevent dehydration. Both qualitative and quantitative micromorphological foliar characteristics were observed using light microscope. Next they were photographed using a digital microscopic camera.

## RESULTS AND DISCUSSION

### Epidermal cells

The epidermal cells of upper and lower epidermis of leaves are rectangular, or elongated in all species under investigation. Cells in upper surface with slightly undulating anticlinal cell walls in *L. latifolium* and *L. persicum*, moderately undulating in *L. aucheri*, *L. ruderale* and *L. sativum*, heavy undulating in *L. perfoliatum* were recorded (Tables 1, 2 and Figs. 1, 2). While in lower leaf surface the cell walls appeared as slightly undulating in *L. sativum* and *L. perfoliatum*, moderately undulating in recent species. These observations are in general agreements with the results of other studies [9 and 10]. Regarding the dimensions of the cells on both surfaces the cells appeared more larger in abaxial surface compared with adaxial surface in *L. sativum*, *L. latifolium* and *L. persicum*. In upper epidermis the highest length and width mean (420.18  $\mu\text{m}$  X 136.75  $\mu\text{m}$ ) recorded in *L. aucheri* whilst the lowest length mean recorded in (173.62  $\mu\text{m}$ ) in *L. persicum* and lowest width mean (62.5  $\mu\text{m}$ ) in *L. ruderale*. In lower epidermis the highest length and width mean (310.00  $\mu\text{m}$  X 115.9  $\mu\text{m}$ ) recorded in *L. aucheri* and the lowest length and width mean (175.00  $\mu\text{m}$  X 69.73  $\mu\text{m}$ ) in *L. perfoliatum*.

### Stomata

The stomata are commonly anisocytic type in the leaf epidermises of all species which that the leaf is amphistomatic (Tables 1, 2 and Figs. 1, 2). These results are in agreement with the findings of [8] and [9] except anomocytic and paracytic stomata were not observed in all the studied species. Stomatal density is increased in lower epidermis and reduced in upper epidermis, so the highest stomatal index for both surfaces

is (66.44) and (62.97) in *L. aucheri*, whilst the lowest stomatal index in lower and upper epidermis is (30.18) in *L. persicum* and (31.46) in *L. ruderale* respectively. Regarding stomatal dimensions they appeared overlapped between all species studied with lowest length and width mean in upper epidermis (36.13  $\mu\text{m}$  X 31.93  $\mu\text{m}$ ) in *L. perfoliatum* and highest length mean (53.75  $\mu\text{m}$ ) in *L. aucheri* and highest width (40.25  $\mu\text{m}$ ) in *L. latifolium*, whilst in lower epidermis the length and width mean range from (38.95  $\mu\text{m}$  X 30.83  $\mu\text{m}$ ) in *L. perfoliatum* and (54.77  $\mu\text{m}$  X 44.65) in *L. latifolium*.

### Trichomes

Among the six species, only two species showed glabrous abaxial leaf surface in *L. aucheri* and *L. latifolium* and hairy surface in the remained species. Whilst the adaxial leaf surface observed glabrous in all species except *L. sativum* and *L. ruderale* which appeared with hairy indumentum. The trichomes are nonglandular unicellular, uniseriate and unbranched (fig. 3). However, these results are in different with [10] who reported T-shaped branched trichomes in *L. sativum*, and with Abdel [11] who recorded the presence of simple trichomes in *L. aucheri*.

### CONCLUSION

The species of the genus *Lepidium* could be separated on the basis of epidermal characters, such as anticlinal cell walls undulating, cells dimensions, stomatal index and dimensions.

**Table 1: variations in mean of epidermal cells dimensions**

species	Width of epidermal cells		Length of epidermal cells	
	Lower epidermis	Upper epidermis	Lower epidermis	Upper epidermis
<i>L. aucheri</i>	115.9	136.75	310.1	420.18
<i>L. latifolium</i>	91.60	92.5	245.98	219.19
<i>L. perfoliatum</i>	69.73	81.4	175.44	195.09
<i>L. persicum</i>	96.16	88.70	192.76	173.62
<i>L. ruderale</i>	98.57	62.5	220.71	204.37
<i>L. sativum</i>	111.87	108.75	296.51	223.57

**Table2: variations in mean of stomatal apparatus dimensions**

species	Stomatal length		Stomatal width		Stomatal index	
	Upper epidermis	Lower epidermis	Upper epidermis	Lower epidermis	Upper epidermis	Lower epidermis
<i>L. aucheri</i>	53.75	54.20	37.95	40.22	62.97	66.44
<i>L. sativum</i>	48.04	48.42	39.56	39.60	46.85	49.83
<i>L. ruderale</i>	47.60	48.36	37.28	36.84	31.46	41.20
<i>L. perfoliatum</i>	36.13	38.95	31.93	30.38	44.62	46.41
<i>L. latifolium</i>	53.12	54.77	40.25	44.65	59.63	52.04
<i>L. persicum</i>	44.52	47.12	35.59	36.25	36.44	30.18

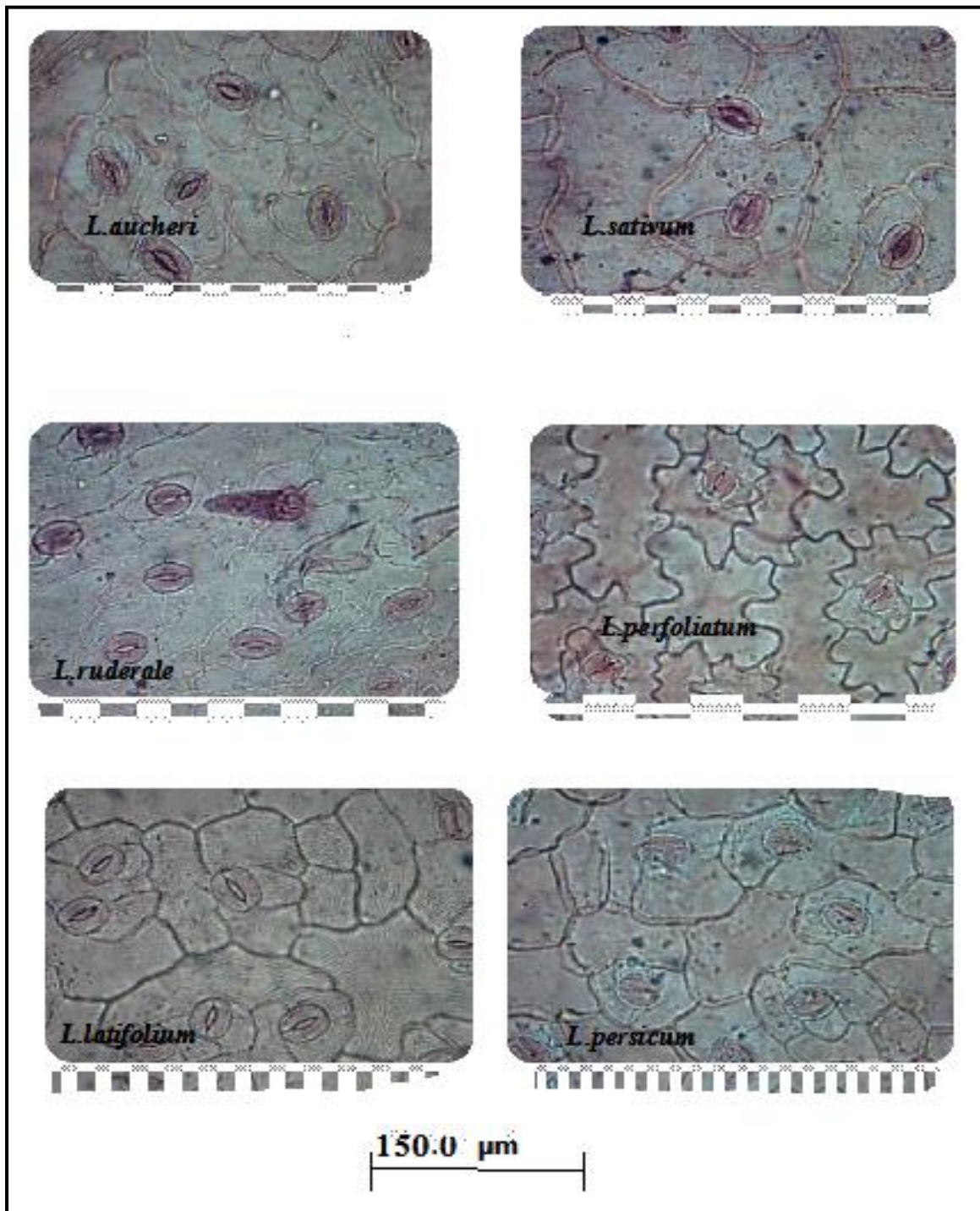


Fig. 1: variations in adaxial epidermis



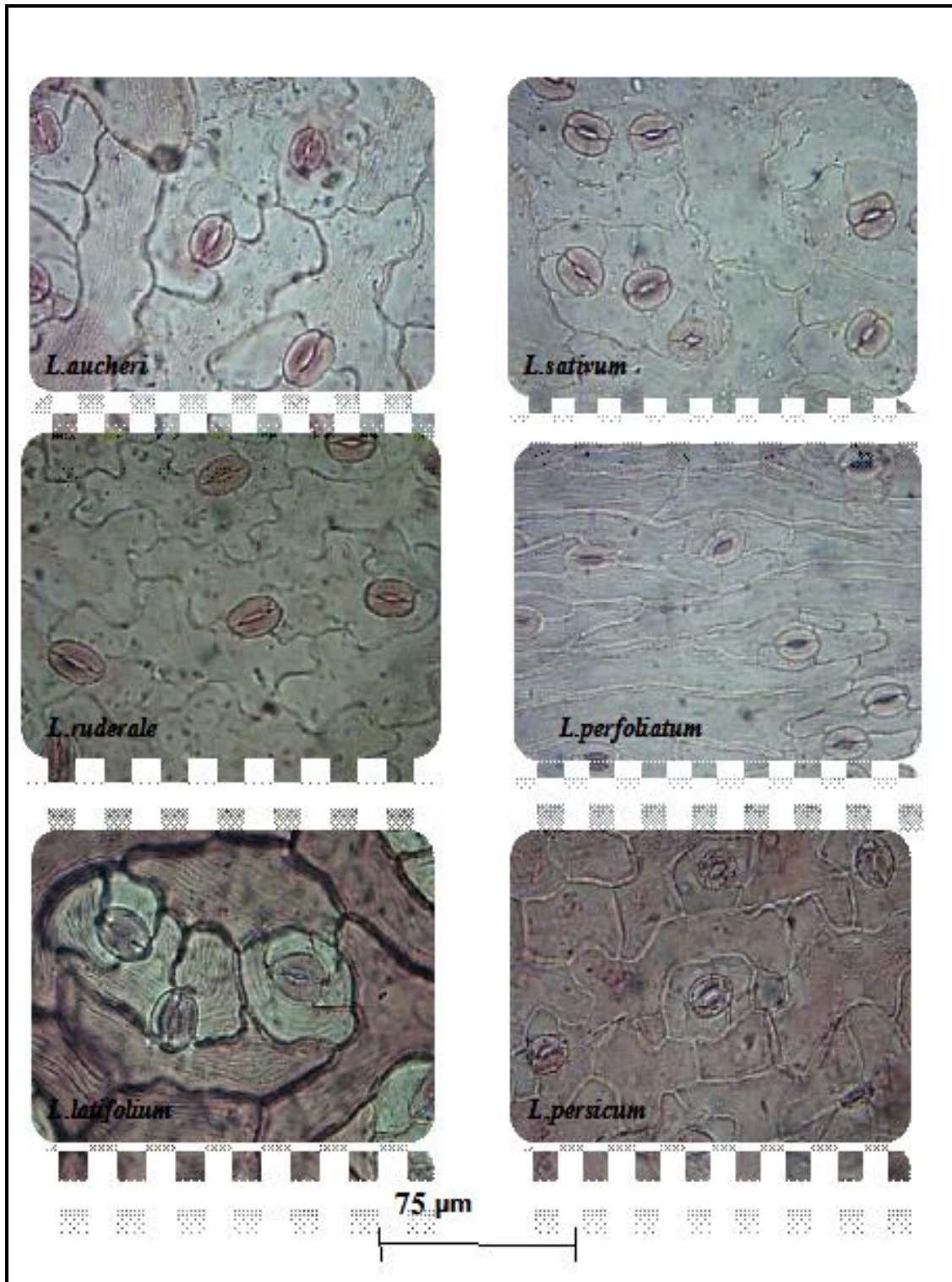


Fig. 2: variations in abaxial epidermis

## REFERENCES

- [1] Al-Marzoqi, A. H.; Al-Khafaji, N. M.S. and Hussein, H.J. 2016. In vitro antibacterial activity assessment of the crude henolic, Alkaloid and Terpenoid compounds extracts of *Lepidium sativum* L. on human pathogenic bacteria. Int.J.ChemTech Res. 9(4): 529-532.
- [2] Ananthi<sup>1</sup>, P. and Kumari, B. D. R. 2013. GC – MS determination of bioactive components of *rorippa indica* L. Int.J.ChemTech Res. 5(4): 2027-2033.
- [3] Chauhan, K.; Sharma, S.; Agarwal, N.; Chauhan, S. and Chauhan, B. 2012. A study on potential hypoglycemic and hypolipidemic effects of *Lepidium sativum* (Garden Cress) in alloxan induced diabetic rats. Am. J. PharmTech Res. 2(3): 522-535.
- [4] Townsend, C.C. and Guest, E., 1980. Flora of Iraq. Ministry of Agriculture and Agrania, Baghdad, Vol.4: pp.886-892.
- [5] Stober, J. P. 1917. A comparative study of winter and summer leaves of various herbs contributions from the hull botanical laboratory 224. The Botanical Gazette. Vol. LXIII (2): 89-107.
- [6] Metcalfe, C.R., Chalk, L. (1950). Anatomy of Dicotyledons. Vol. 1 Clarendon Press, Oxford. pp. 724.
- [7] Ahmad, K., Khan, M.A., Ahmad, S., Nazir, N. A., (2010).Taxonomic diversity in epidermal cells of some sub-tropical plant species. Int. Agric. Biol. 12, 115 – 118.
- [8] Tuo, Z. and Zhou, G. (2010). Micromorphologic characteristic of leaf epidermis of eight species in Brassicaceae (Cruciferae). Journal of Xinjiang Agricultural University. 1.
- [9] Sun, Z.Y.and Li, F.Z. 2007. Studies on the leaf epidermal features of *Lepidium* (Brassicaceae) from China. Zhongyaocai= Journal of Chinese medicinal materials, 30(7): 780-785.
- [10] Doaigey, A.; El-Habashy,I.; Al- Watban, A.; Milagy, A.; Al Sahli,A.; Siddiqui, M.; Al-Whaibi, M. and El-Zaidy, M. (2013) Epidermal characteristics of 34 species of Brassicaceae growing in desert of Saudi Arabia. Wulfenia Journal. Vol. 20 (9): 202-221.
- [11] Abdel Khalik, K. (2005) Morphological studies on trichomes of Brassicaceae in Egypt and taxonomic significance. Acta Bot. Croat. 64 (1), 57–73.
- [12] Orcan, N. and Bünzet, R. (2003) The Anatomical and Palynological Properties of *Alyssum obtusifolium* Steven ex DC. (Brassicaceae). Turk. J. Bot. Vol. 27: 3-68.
- [13] Selvi, S. and Pakoyi, M. Y. (2013) Comparative anatomy of stem and leaf of *Ricotia* L. growing in Turkey. Bangladesh J. Bot. 42 (1): 123-130.
- [14] Khan,G.; Zhang, F.; Gao, Q.; Mashwani<sup>1</sup>, Z.; Rehman<sup>1</sup>, K.; Khan, M. and Chen, S. (2013) Trichomes diversity in the tropical flora of Pakistan. Journal of Medicinal Plants Research. Vol. 7 (22): 1587-1592.
- [15] Mousavi, S. M. and J. Sharifi-Rad (2014) Anatomical, palynological and micromorphological study of seed, trichome and stomata of *Cardaria draba* L. Desv (Brassicaceae) in Sistan, Iran. Int. J. Biosci. Vol. 5 (11): 63-69.
- [16] Sivaranjani, R.; Ramakrishnan, K.; Bhuvaneswari, G. 2013. Morpho-Anatomical and preliminary phytochemical studies of the leaf of *Stachytarpheta jamaicensis* (L) Vahl. 5(2): 577-582.
- [17] Mubeen, M.; Periyanyagam, M. K. and Basha, S. S. 2014. Anatomical investigation on the leaves of *Piper betle* (L) var. *Sirugamani* 1(SGM1) links an ethnomedical important medicinal plant and its pharmacognostic relevance. Int.J.PharmTech Res. 6(1): 244-251.
- [18] Culter,D.; Botha, T. and Stevenson, D. (2007). Plant Anatomy an Applied Approach. Blackwell. USA. Publishing. pp.302.