



## Anatomical Study of the Leaf Epidermis of the Genus *Lepidium* L in Iraq

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### 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*

### INTRODUCTION

*Brassicaceae* is an economically important family which comprises many economical plants [1-4] 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 leave 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 [12-15]. 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 tichomes 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 and 2) (Figures 1 and 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 [9,10]. Regarding the dimensions of the cells on both surfaces the cells appeared 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*.

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>	91.6	92.5	245.98	219.19
<i>L. perfoliatum</i>	69.73	81.4	175.44	195.09
<i>L. persicum</i>	96.16	88.7	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

Table 2: 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	54.2	37.95	40.22	62.97	66.44
<i>L. sativum</i>	48.04	48.42	39.56	39.6	46.85	49.83
<i>L. ruderale</i>	47.6	48.36	37.28	36.84	31.46	41.2
<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

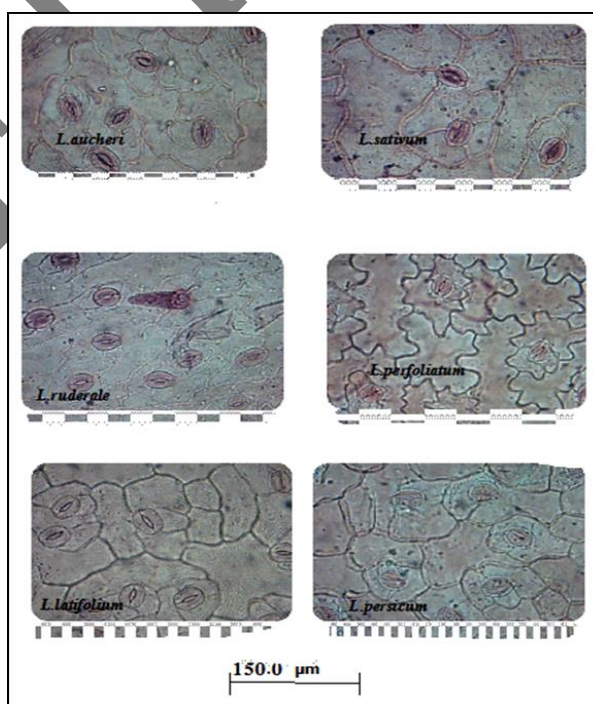


Figure 1: Variations in adaxial epidermis

### Stomata

The stomata are commonly anisocytic type in the leaf epidermises of all species which that the leaf is amphistomatic (Tables 1 and 2) (Figures 1 and 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*.

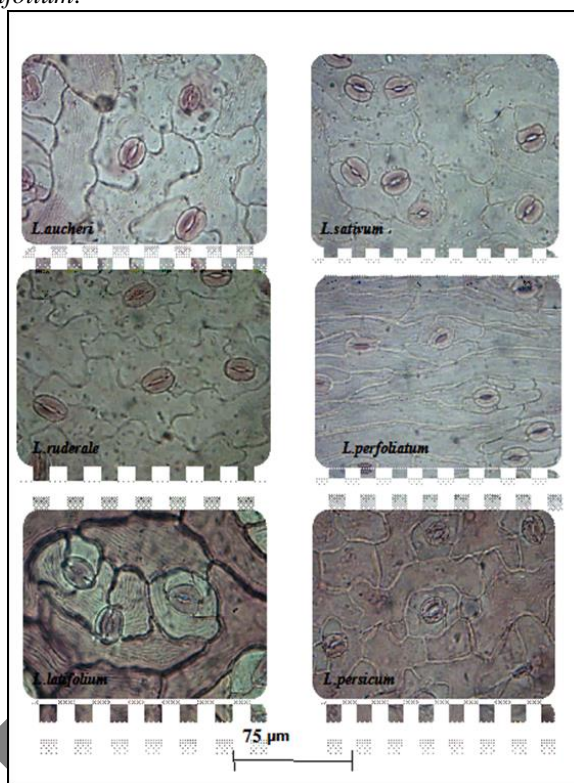


Figure 2: Variations in abaxial epidermis

### 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 (Figure 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.

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