

Anatomical Study of Common Maidenhair Fern (*Adiantum Capillus-Veneris* L) Pteridaceae, in Iraq

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Abstract

The family Pteridaceae in Iraq comprises 6 species belongs 5 genera. These species occur in a diverse range of environments including humid temperate forests, the falls of the waterfalls and shrub lands. The fern species was collected from different locations in environment and geographical habitats during different seasons from two districts in Iraqi Kurdistan. The anatomical structure of the aerial parts were studied. Fronds petiole and rachis (midribe) exhibit Y-shaped vascular system, pinnae were dichotomous venation, and the spores were pyramidal shape. The anatomical characterization of *A. capillus-veneris* were described with detail for the first time in Iraq.

1. Introduction

Ferns, or the monilophytes, are a group of vascular plants that similar to lycophytes in being reproduced by spores and undergo an alternation of generations [1]. *Adiantum capillus-veneris* L. Family: Pteridaceae subfamily: Vitarioidea is a fern species worldwide distribution, including Iraq and bordering countries [2-4]. It is known as kuzburat-elber, Krafis al-bir, Shaar-ul-jibal in Arabic, maidenhair fern in English, hansaaraja in Ayurvedic, Kazbaratul Ber in Unani, avenca in Brazil [2,4-6]. This fern is often found growing on moist, protected and shaded sandstone or limestone cliffs [4,7-9]. *A. capillus veneris* is small, rhizomatous, erect and evergreen herb up to 30 cm in height with black and wiry stipe [4, 9] (Figure 1). Recently some scientific researches were done on the anatomy of *Adiantum* species [10-13]. This work regards as first report deals with detailed the anatomical characters of *Adiantum capillus-veneris* from Iraqi Pteridoflora.



Figure 1. *Adiantum capillus-veneris* L. (habit and habitat-young sporophyte).

2. Materials and Methods

2.1 Study area and plant collection:

Adiantum capillus-veneris samples (mature sporophyte) were collected from Erbil and Garmian districts within Iraqi Kurdistan. GPS information's were summarized in Table (1). The samples were confirmed by Prof. Ihsan Shahbaz Chairman of Mizzory Botanical Garden in USA. *Adiantum capillus-veneris* L. samples were deposited in Herbarium of Erbil Botanical Garden. The fresh samples were divided to three groups after identification as follows; group dried specimens were mounted on herbarium sheets and labeled properly after including all the relevant information and then preserved in Kurdistan herbarium in Erbil city and has dimensioned of WP. 21/59. The rest samples were divided

into two groups: the first group was used for the morphological study by using a dissecting and light microscope whereas the second part was kept and preserved in F.A.A. preservative solution [14] for anatomical studies, transect sections were prepared by free hand sectioning [15] and sectioned, stained with safranin and photographed by using digital camera type (Canon).

Table 1. Geographical aspects of the sites studied.

Districts	Elevation (m)	Longitude	Latitude
Erbil	559	36° 37 490 E	44° 26 540 N
Garmiam	883	34° 56 501 E	45° 44 084 N

3. Results and Discussion

3.1 Morphological characters:

The fern herbaceous 14-35 cm height, terrestrial, erect or spreading or drooping, rhizome creeping, short, brown color. Petiole (stipe) 6-8 cm long, wiry black or dark brown, slender, smooth. Fronds blade up to long 25 cm bi or trip innate, midrib (rachis) like petiole in morphology, fronds were divided to green leaflets (1-1.5×0.7-1.5 cm), deltoid or rhomboid, lobbed with toothed margin. Venation open dichotomous without veinlet's, veins are reach leaflet margin (Figure 2).

3.2 Anatomical characters:

- Transfer section of petiole observed circular shaped with thick layer of cuticle, consist of single layered epidermal thickened wall cells without stomata. Epidermis is followed by outer 2-3 layered sclerenchymatous cells and many layered, thin walled ordinary parenchymatous cells. Endodermis layer followed by thin layered pericycle cells. The vascular system consists of solitary vascular bundle with two xylem arms formed Y shaped (Figure 3).
- Transfer section of pinnae observed; a- Dermal tissue system consist of uniseriat upper epidermis with wavy wall cells, irregular contain chloroplast, without stomata. Lower epidermis looklike the upper but contain normocytic sunken stomata (Figure 4).
 - b- Ground tissue system consists of homogenous mesophyll (spongy chlorenchyma) (Figure 5).
 - c- Vascular tissue system consist of closed vascular bundles (without prochambium).
 - d- Midrib observed in circular transfer section look like the petiole in the tissue systems structure.
- Transfer section of sori present in different shape on the leaflet margin, contain sporangia (15-20/sorus) (Figure 6 (a,b), sporangium globoid or spherical, stalked 50 μ long, annulus 40 μ thick walled (Figure 7). The spores pyramidal or triangular shaped, ornamented wall (Figure 8).

The morphological characters were accordance with other scientific research [4,16-18]. The recent scientific studies interested with anatomical characters which there were very important in the development and systematics of

the ferns [18,19,20]. The results of this work agreed with recent scientific researches in the ground structure of midribe and the description of stomata [12,13,18]. The results accordance with the other scientific studies [11] in the description of the stomata (normocytic). So, these results accordance with many scientific researches dealing with taxa belong family Pteridaceae ferns [21,22].



Figure 2. *A. capillus-veneris* (pinnae venations).

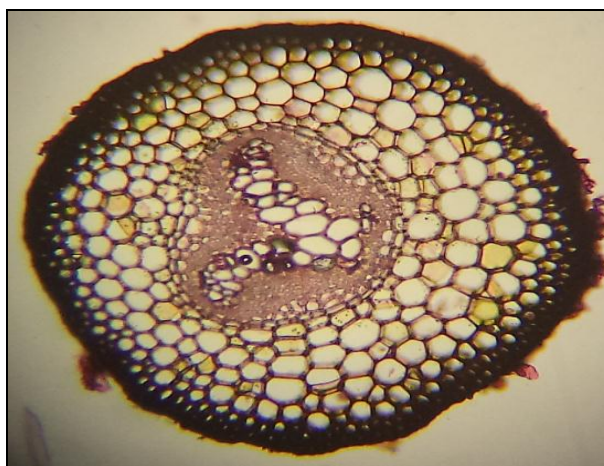


Figure 3. *A. capillus-veneris* (c.s of petiole).

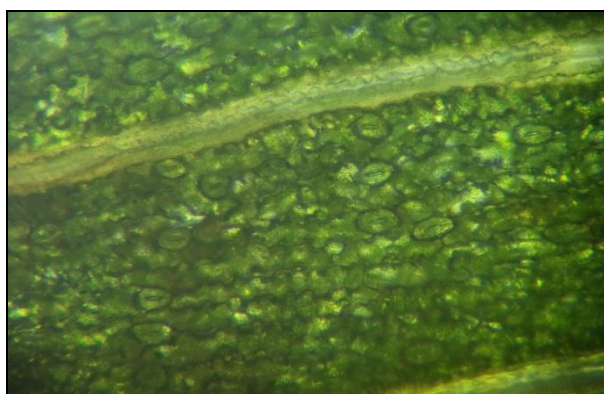
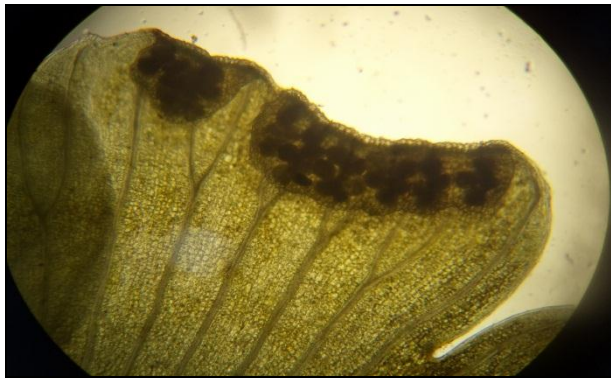


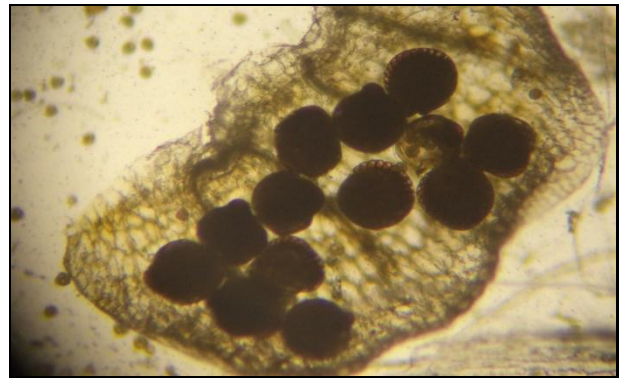
Figure 4. *A. capillus-veneris* (t.s of pinna lower epidermis).



Figure 5. *A. capillus-veneris* (t.s of pinna blade).



(a)



(b)

Figure 6. (a) *A. capillus-veneris* (leaflet with sorus), (b) *A. capillus-veneris* (sorus with mature sporangia).

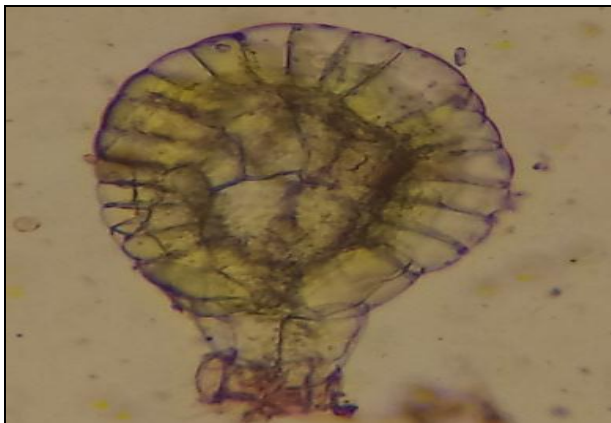


Figure 7. *A. capillus-veneris* (stalked mature sporangium).

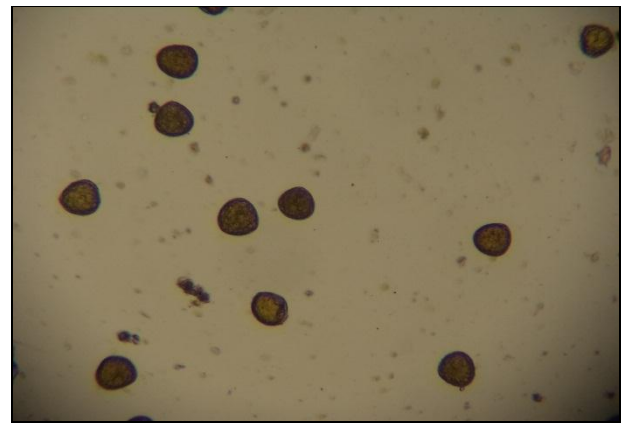


Figure 8. *A. capillus-veneris* (mature spores).

4. Conclusions

The stipe and midrib anatomy of species *Adiantum capillus-veneris* L. in the studied districts was observed look like structural tissue and Y-shaped vascular system.

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