

Notes on the ecology and distribution of the annual fern *Anogramma leptophylla* (L.) Link. (Pteridaceae) in Northern districts of Iraq

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Abstract

The study involved the description of the environmental characters and distribution of *Anogramma leptophylla* (Annual Maidenhair fern) in Erbil and Garmian districts during May- 2017 in Kurdistan of Iraq. The geographical distribution of the taxa was recorded in Bani Bee region for the first time within the Garmian district but it was recorded before in the Zar Gali region within the Erbil district. The climatic characters of the studied site in Erbil district were: moist, cold and the elevation was up to 560 m above sea level with sandy clay soil texture whereas in the Garmian district: dry, hot, and the elevation was only 330 m above sea level with sandy stone soil. Plant up to 13 cm long, megaphyllous, fronds compound 3-6 cm long, divided into alternate petiolate pinnae. In the present work, some ecological, morphological, and geographical distribution for *A. leptophylla* is described for the first time in the Iraqi Kurdistan region.

Keywords: *Anogramma* , Pteridaceae, Iraq, Ferns.

1. Introduction

There are over 10,560 species of ferns and 1000 species of fern- allies, recorded in the world so far [1]. Seedless vascular plants have much more diversity over the world in contrast to other plants [2], whereas most previous studies have been carried out on the other vascular plants [3, 4]. Recently many scientific researches on phytochemical, morphological and anatomical features of ferns appeared [2, 5, 6, 7, 8, 9]. Pteridaceae includes over 1000 species which make up almost 10% of ferns [10], the members of this family have a world wide distribution in tropics and arid regions [11]. *Anogramma* is a genus of Pteridioideae, a subfamily of the Pteridaceae [12], which involves about ten species found in regions with alternating wet and dry seasons [13]. However, *A. leptophylla* has one of the widest ranges of distribution among all other fern species [14]. In the flora of Iraq, the authors referred to the geographical distribution and habitat of *A. leptophylla* only without any detail of its morphology or ecological features [8, 9, 15, 16] **Figure (1a-b)**. The present study aimed to investigate the ecology and the geographical distribution of the annual fern *Anogramma leptophylla* L. as it is the first attempt in Iraq that deals with pteridoflora in this respect.



Figure 2. a- Fern in Bani Bee

b- Fern in Zar Gali

2. Materials Method

Plant samples (mature sporophyte) have been collected from Erbil district within the Zar Gali region, geographical data were found to be as follows: GPS (36° 37. 490 N, 44° 26. 540 E), elevation up to 560 m above sea level whereas in Garmian district, the station was in Bani Bee region GPS (35° 02. 221 N, 045° 42. 650 E), elevation was only 330m above sea level. Voucher sample under the No. (4, 17, 2, An, 1e) of the ferns was deposited in the Herbarium of Howler Botanical Garden- Erbil City. Soil samples were collected from studied sites of both regions in plastic bugs and brought back to the laboratory, then the soil properties were estimated according to the standard procedure [17]. In addition, soil texture was also determined. The annual mean of metrological data for the two districts was; (1) in Erbil temperature 36°C, humidity 65% and rainfall 120 mm, but in (2) Garmian temperature 40.5 °C, humidity 55% and rainfall 90 mm. The morphological characters of the fern were studied using dissecting and light compound microscope in the advanced environmental postgraduate laboratory in Garmian University-Faculty of Science, Kalar. The classification was performed according to [11].

3. Results and Discussion

3.1. Ecological Study

Results of the present study showed a wide range of variation between soil samples of the two stations, in respect to pH, alkalinity, soil texture, chemical and physical properties of soil, plant nutrients were also estimated and documented in **Tables (1 and 2)**.

Table 1. Some chemical and physical characters of the soil in both studied sites.

Sites	pH	EC $\mu\text{sem./cm}$	CO ₃ ppm	NO ₃ ppm	PO ₄ ppm	Ca ppm	Mg ppm	K ppm	Na ppm
Zar Gali	7.9	240	200	2.0	0.3	48	42	40	30
Bani Bee	7.8	400	145	0.8	0.13	41	37	28	60

Table 2. Soil color, texture and total organic content of soil samples from the two sites.

Sites	Color	Texture	Total organic content % (TOC)
Zar Gali	Light brown	Sandy clay	14.6
Bani Bee	Light red	Sandy stone	5.4

The result of the present investigation showed a wide range of variation between soil samples of the two stations in respect of both chemical and physical parameters. The outcome results of pH, electrical conductivity, bicarbonate, nitrate, phosphate, and major cations are represented in table (1) whereas **Table (2)** involved the result of soil texture, color, and total organic content of soil samples. It is found that soil color ranged from light brown in Zar Gali to light red in Garmian whereas total organic content in Zar Gali was more than double of that of Bani Bee (14.6% & 5.4%) respectively although soil pH in both sides was weak alkaline the electrical conductivity was almost half of that of Bani bee. Variation and difference between the two sites were quite evident in respect to elevation as it exceeded 560 m in Zar Gali- Rwanduz whereas it did not exceed 360 m in Garmian. However, the variation extended to the difference in metrological data also between the two sites as its shown in **Table (3)** where the amount of rainfall in Zar Gali exceed 120 mm with the temperature only 36°C whereas in Garmian mean annual rainfall do not exceed 90mm and temperature normally exceed 40°C.

Table 3. Meterological data in the studied sites.

Sites	Temperature (°C)	Rainfall (mm)	Humidity (%)
Zar Gali	36	120	65
Bani Bee	40.4	90	55

3.2. Morphological Study

The fern morphologically is found to be herbaceous 8.5-13 cm long, petiole up to 4 cm long, brown near the rhizome and green near the blade, blade up to 3 cm long, frond up to 7 cm long, divided into pinnules with a short petiole, pinnule consist of four deltoid segment, smooth ad axial surface, venation is dichotomous, rhizome erect very short up to 0.5 cm long, roots are brown color up to 1-2 cm long, petiole dark brown, with a few small scales near the base, pinna is divided into trilobite pinnules, sori clustered on ab axial surface of pinna along the veins without indicium **Figure (2)**.



Figure 2. *Anogramma leptophylla* (mature sporophyte in the laboratory).

3.3. Habitat and Distribution

The concerned fern is known to be found in moist shaded rocky cliffs which was the case in the current study. In the present investigation, plant was recorded at different elevations (330-560 m) above sea level the habitat was either individual form among other plants or rarely found aggregate in groups. In the Erbil district, the associated taxa were *Cheilanthes fragrance* in the Zar Gali region. [15] had found the fern in moist and low-temperature climate in Derbendikhan region also they had recorded the fern even in Khanaqin region which is quite hot and regarded as a temperate climate, had also recorded the fern in Rawandoose and Iranian foothills regions which is characterized with low temperature and high humidity at an elevation of 800 m above sea level was recorded by [16]. The climate in the Iraqi Kurdistan districts characterized by Iran toraniane climate [15]. In New Zealand, the plant is normally reported to begin growth in late Winter and early Spring but the maturity has been found in August and September [18], had reported were the fern growth with aggregate form and associated with some bryophytes and grasses which inhabit sandy stone soil and moist environment this agree with present finding in Erbil (Zar Gali) whereas, the results from this work in Bani Bee region disagree with [18] and [19] study because the Garmian district characterized with high temperature and low humidity [8, 9] and the fern was found as individual plants along the area between stones and rocks.

4. Conclusion

The fern *Anogramma leptophylla* have been recorded in a wide range of climatic environments in Kurdistan of Iraq the plant was found to be either a single individual or an aggregation group among the mosses or ferns. Description, habitat, and some ecological factors have been reported for the first time in Iraq in respect to this fern.

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