

Dryopteris caucasica: New Report from Iran Along with Morphological, Anatomical and Sporological Characterization Studies

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Abstract

In this study, the species, *Dryopteris caucasica* (A. Braun) Frazer-Jenkins & Jermy is recorded from the Iranian phytogeographic region. This species can be distinguished from the other species in the immediate environment based on morphological, anatomical and sporological characterization. It occurs in southwestern Asia, the Black Sea coasts in Turkey, and mountains of the Caucasus. Its distribution in Iran can be seen in Talesh and Asalem forests. This species is one of the parents of *D. filix-mas*.

Keywords: Ferns, Iran, Morphology, Anatomy, Spore

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Introduction

The genus *Dryopteris* belongs to the Dryopteridaceae family (1) and is widely distributed in North America, Africa, Europe and Asia, but does not exist in the southern areas of South America, Central America, western Australia and New Zealand (4). Northern Iran is also one of the areas where this genus is distributed. Wendelbo (5) has recorded the species *D. pallida*, *D. borreri* and *D. filix-mas* from Iran. Jenkins has recorded *D. affinis* from Nav Asalem area. It is notable that *D. affinis* is the new name of *D. borreri*, and the latter is considered as one of the subspecies of *D. affinis* (2). In a new study on the ferns of northern Iran, *Dryopteris caucasica* is recorded from Iran for the very first time. This species can be differentiated from its near species based on morphological, anatomical and sporological characterization. It is a diploid species and its hybrid together with another diploid, i.e. *D. oreades* forms a tetraploid species called *D. filix-mas* (3).

Materials & Method

Samples were gathered from the different areas of Talesh Forest and Nav Asalem in Gilan Province, and herbarium samples were prepared. These samples are kept at the herbarium of the Islamic Azad University. The herbarium samples were used in morphological and sporological studies, and a number of fresh samples were fixated in a solution of glycerine and alcohol for anatomical studies. They were identified by drawing on the sources and floras, and then sent to the Natural History Museum of Paris (Cryptogam Section) for confirmation. The samples were confirmed. Moreover, the samples were compared with the sample nomenclature by Jenkins in 1977 at the Herbarium of Iran Plant Pests and Diseases Institute and received final approval.

A. Method Used in Morphological Studies: Parts of the plant's pinnae and pinnule having a sore were separated and photographed using a camera stereo-microscope with $\times 0.66$ magnification.

B. Method Used in Anatomical Studies: Parts of the petiole ends (3 cm from the end) were placed in a solution containing equal ratios of glycerine and alcohol. Small sections were made manually and staining was done by means of alum carmine and methyl green. Finally, the required photographs with a magnification of $\times 0.66$ were obtained by camera stereo-microscope0

C. Method Used in Sporological Studies: Using an Scanning Electron Microscope (S.E.M.), the spore shape, spore surface decorations, length of the polar axis, length of equatorial axis and the P/E ratio were investigated and the required photographs were obtained.

Morphological Properties

Plant perennial, up to 80-120 cm high. Rhizome ascending. Leaves triangular to lanceolate. non-glandular, one pinnate to pinnatisect, ovate to lanceolate, Rachilla without any trichome and scale, the lowest pinnae having the same size as middle pinnae; pinnule having a length of 2-2.2 cm and a width of 2 cm with sharp teeth. rachis whitish light green without any trichome and scale; petiole being 1/2 or 1/3 of leaf length with brown scales in 1 cm. sore orbicular. indusium reniform.

Elliptic spore, surface decorations being of rugulate type (wrinkled), length of polar axis 38.82 μm , length of equatorial axis 49.5 μm , P/E ratio at 0.78, number of sporangium annulus being 15 to 16.

Anatomical Properties of Petiole: The petiole is round, including a layer of epidermis, a number of hypodermis layers, several layers of orbicular paranchymal cells, one layer of endodermis, one layer of pericycle, and six bundles of meristele. The steles are in the form of siphonosteles and are of amphiphloic siphonostele type (phloem is seen both in the external and internal surfaces of xylem).

Geographical Distribution

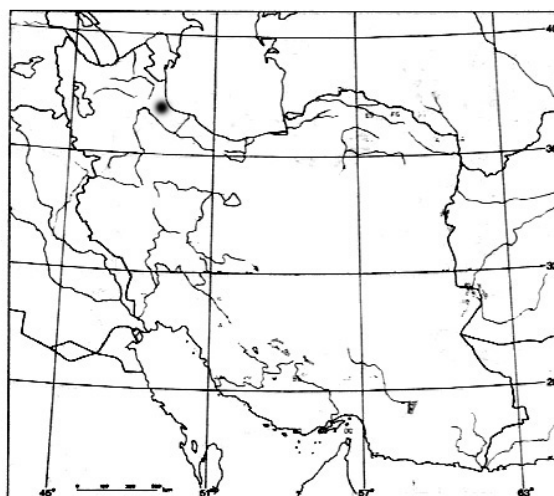
Southwestern Asia, the Black Sea coasts in Turkey, and mountains of the Caucasus.

Habitat

Rich soils of *Fagus orientalis* forests.

Distribution in Iran

Gilan, Asalem-Khalkhal road, 900 meters, Mazouji, 2068, Asalem-Khalkhal road, Nav Asalem, next to the shrine, 1200 meters, Mazouji, 2069.



Distribution of *D. caucasica* in Iran

Discussion

Dryopteris caucasica is different from the other widely distributed species existing in Nav Asalem area, i.e. *D. affinis* subsp. *persica* and *D. pallida* subsp. *raddeana* in terms of morphology, petiole anatomy and sporology. This species is bipinnate but *D. affinis* subsp. *persica* is pinnate to pinnatisect (Figure 2). *D. caucasica* has pinnules with deep teeth but *D. pallida* has serrated teeth (Figure 1). There is a gray spot at the junction of the rachilla and rachis in *D. affinis* subsp. *persica* while this stain does not exist in *D. caucasica*. Pinnules in *D. caucasica* are lanceolate at an angle of 45 degrees to the rachilla, but in *D. pallida* the pinnae is oblong and is perpendicular to the rachilla (Figure 1). The length of pinnule in *D. caucasica* is 2 to 2.2 cm but in *D. pallida* is 1.5 to 1.8 cm (Figure 2). The petiole length in *D. caucasica* is between 1/3 to 1/2 of the lamina length (Figure 1). The cross section of the petiole in *D. caucasica* is round and has 6 amphiphloic siphonostelic meristeleles, while in *D. affinis* it is approximately round and has 8 meristeleles of amphiphloic siphonostele type (Figure 4). In terms of sporology, *D. caucasica* has an elliptic spore with rugulate decorations, but *D. pallida* has an elliptic spore with ornate-vermiculate decorations, and *D. affinis* subsp. *persica* has an elliptic spore with rugulate decorations with the difference that the lengths of the equatorial axis and polar axis in *D. caucasica* is 10 μm longer than *D. affinis* (Figure 3).



Figure 1 – Parts of the Pinnae of:

(a) *D. caucasica*, $\times 0.66$

(b) *D. pallida*, $\times 0.66$

(c) *D. affinis* subsp. *persica*, $\times 0.66$



Central Herbarium
Islamic Azad Univ (Sciences & Researches Branch, Iran)
No.: 1546 fam:
Name: Dryopteris caucasica
Prov.: جاده اسلام به خلخال - مجاور زیارتگاه نادر
Alt.: 1200m Date:
Leg.:
Det.:

(a)

Figure 2 – Herbarium Images of

(a) *D. caucasica*

(b) *D. pallida*

(c) *D. affinis* subsp. *persica*

**Central Herbarium**

Islamic Azad Univ (Sciences & Researches Branch, Iran)

No.: 1545 fam:

Name: *Dryopteris pallida*

Prov.: جاده اسلام به خلخال - نهبستان پارس

Alt.: 1200m Date:

Leg.:

Det.:

Y

(b)



Central Herbarium
Islamic Azad Univ (Sciences & Researches Branch, Iran)

No.: 1539 **fam:**

Name: Dicyopteris affinis
sub sp. persica

Prov.: چادّه قومن به مانیوله

Alt.: 900m **Date:**

Leg.:

Det.:

(c)

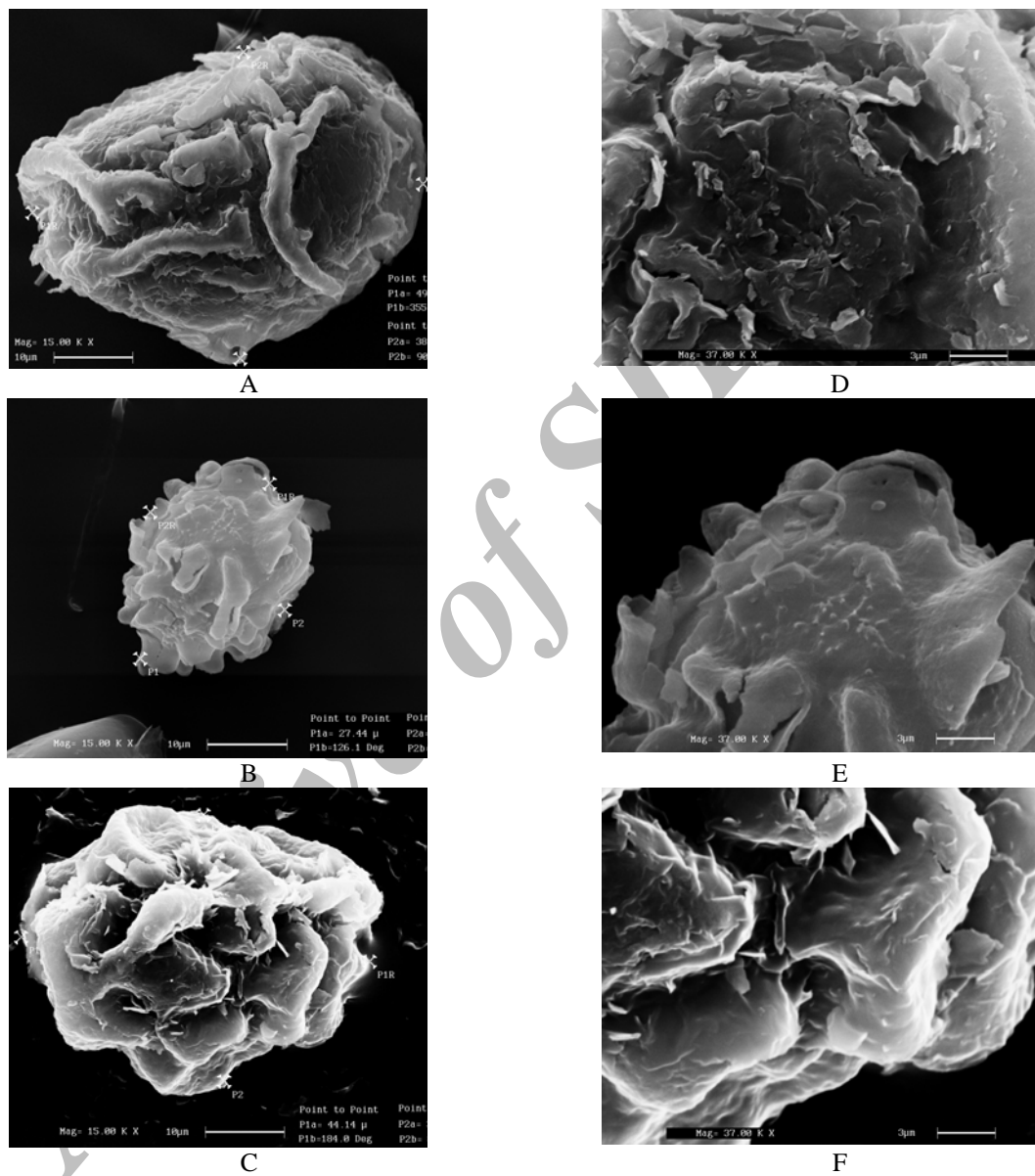


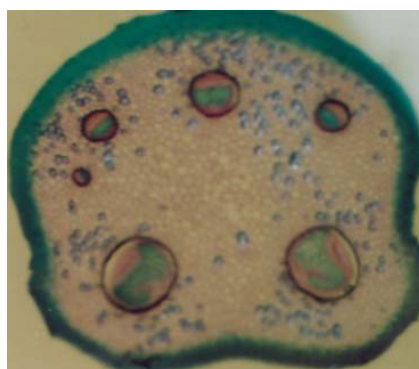
Figure 3 – Scanning Electron Microscope Images:

(a, b, c $\times 15,000$ and d, e, f $\times 37,000$)

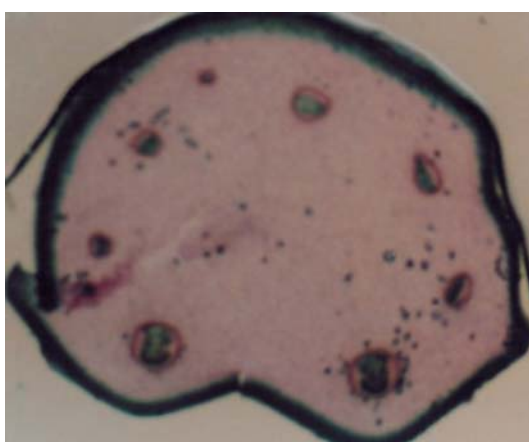
(a) *D. caucasica*

(b) *D. pallida*

(c) *D. affinis* subsp. *persica*



a



c



b

Figure 4 – Petiole Cross Section of

(a) *D. caucasica*, $\times 0.66$ (b) *D. pallida*, $\times 0.66$ (c) *D. affinis* subsp. *persica*, $\times 0.66$

References

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