

Palynological study of spores of the alien species *Cyrtomium falcatum* C.Presl (*Dryopteridaceae* Herter) in Albania

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Abstract

The article provides data on the morphological study of spores of the species *Cyrtomium falcatum* (L.f.) C.Presl. (*Dryopteridaceae*, Herter) in our country. At the same time, a comparison of palynological data of this species with those obtained from the literature is made. This species is alien to our country and is popularly known as Japanese fern. *Cyrtomium falcatum* (L.f.) C.Presl was first reported to us by Barina³, who introduced it on his social media, in 2021.

The spores are of the bilateral type. They are monolete. So they only have one laesura. The spores have oval to ellipsoidal contours, up to bean-shaped. The perispore is cristates, scabrates and is well developed. The folds of the perispore join at the base. They form wrinkles of various shapes, giving the impression that they are independent of each other. The size of the perispore ornaments varies. They can reach up to 4 -5 μm . The exine is relatively thick and is divided into two layers. Its layers are equal.

The palynological study of *Cyrtomium falcatum* spores from our country is presented for the first time in domestic and foreign literature. Through this study, more information is provided on the morphological features of the spores of this alien species of our country compared with the literature data.

Keywords: *Cyrtomium*, grains spore, laesura, exine, perispor

INTRODUCTION

The genus *Cyrtomium* is represented worldwide by 40 species. (Lu 2005). It belongs to the *Dryopteridaceae* family. There are no representatives of this genus in the spontaneous flora of our country. But recently the alien species of the fern *Cyrtomium falcatum* (L.f.) C. Presl has appeared. This fern has many synonyms such as: *Asplenium*

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falcatum (L.f.)Sw, *Cyrtomium yiangshanense* Ching &Y.C.Lan, *Dryopteris falcate* (L.f.) Kuntze, *Phanerophlebia falcate* (L.f.) Copel, *Polypodium falcatum* (L.f.), *Polypodium japonicum* Houtt, *Polystichum falcatum* (L.f.) Diels, *Polystichum falcatum* Fée. It is known by the popular name Japanese fern and was first found in our country by Barina³ who introduced it on his social media, in 2021. It was then photographed and collected on a roof near the Kamza overpass from Meço¹ in 2023. (Foto 1).

Literature data show that *Cyrtomium falcatum* (L. f.) C. Presl is found in many places as an alien species, but is also used as an ornamental plant. The Japanese fern is considered native to East Asia (Japan, China, Vietnam, Korea). Then it spread to Australia, New Zealand, Brownsey (2021), North America, Pakistan, Awan (2013), Iran, Gholipouri (2010), Africa and Madagascar, Roux (2011) and more recently to Europe. It has since become naturalized at local levels. Its presence in Italy is reported in 1990-1993, Bonafede (1993), Marchetti (2000) and in Croatia in 1994. Maslo (2021). It is described in the text of Flora Europaea, Vol. 1., as a locally cultivated and naturalized ornamental plant. Tutin (1993). The distribution of this species in our country has not been studied.

For the study of this species i consulted with the authors: Avetisjan (1950), Agashe (2009), Bobrov (1983), Kramer (1990), Nayar (1964), Sladkov (1967), Lu Jin-Mei (2005),

The article provides data on the morphological study of spores of the species *Cyrtomium falcatum* from our country. At the same time, a comparison of palynological data of this species with those obtained from the literature is made.

MATERIAL AND METHODS

The material for the study was taken fresh from a rooftop at the Kamza intersection, Tirana. (Fig. 1). A variety of processing methods can be used to study the morphological characteristics of microspore grains. The results of palynological studies of spores depend to a large extent on the method of chemical processing. Also, cracks and deformations of the spores are observed during chemical processing. (Fig. 5)

It is therefore recommended to use more than one processing method. In our work we have chosen the alkaline method.

Alkaline method

This method consists in processing the material with KOH or NaOH at a concentration of 10%. The spores are boiled in the alkaline solution for 2-5 minutes and are constantly checked under the microscope so that they do not turn dark. After we have reached the right color, we rinse the material with distilled water several times until the neutral environment is reached. Rinsing is done by decantation and centrifugation. After rinsing, the preparation is closed with glycerin gelatin.

To realize the fixing of preparations we used the adhesive method of preparation made by gelatin-glycerol (Kisser, 1937). The terminology used is based on that recommended by Erdtman (1965), Punt.et al. (1994) and Kapidani (1996, 2005)

The palynological features analyzed in this paper are classification by type, shape, size, aperture characteristics, exine sculpturing, etc. For the study of microspore grains, a Motic BA310 light microscope was used. Measurements and microscopic photographs were taken at 400X and 1000X magnification.

RESULTS AND DISCUSSIONS

The material for the study was taken fresh. In Flora Europaea. Vol. 1 (1993), the description is given, *Cyrtomium falcatum* (L. fil.) C. Presl, *Tent. Pteridogr.* 86 (1836) (*Polystichum falcatum* (L. fil.) Diels). Stems with large, dark scales. Leaves are 20-80 cm, coriaceous, the upper surface shining; petiole $\frac{1}{4}$ - $\frac{1}{2}$ as long as the lamina. Pinnae 5-12×(1.5-)2-4 cm, ovate-lanceolate, falcate, acuminate, shortly stalked. *Cultivated for ornament, and locally naturalized in W. Europe, especially by the sea.* [Az, Be, Br, Ga, Hb, Ho.] (*E. Asia.*) Tutin T.G et al.(1993)

Cyrtomium falcatum is a well-developed fern. (Fig 1-3) The leaves are pinnate and have alternate leaflets. The number of leaflets reaches up to 15. The sporangia are collected in large clusters. They are covered with a circular indusium. The margin of the indusium are wavy. (Fig. 4)



Fig. 1- 4. Photo of *Cyrtomium falcatum*

The spores are bilateral in type, with oval-ellipsoidal to bean-shaped contours. The aperture or laesura is monolete or single ray. The laesura is $\frac{3}{4}$ of the length of the spore. The perispore is cristates scabrates and is well developed. The folds of the perispore join at the base. They form wrinkles of various shapes, giving the impression that they are independent of each other.

The size of the perispore ornaments varies. They can reach up to 4 -5 μm . The exine is two-layered with equal layers. The ektexine is psilate. The thickness of the exine is about 2 μm . (Fig.5)

Length of spores with perispore 36-50 (42) μm . Length of spores without perispore 28-42 (32) μm Width of spores with perispore 26-40 (30) μm . Width of spores without perispore 18-32 (26) μm . After processing with the alkaline method, the perispore is well preserved. The color after processing with KOH is light brown. During processing by the acetolysis method, the perispore splits or disappears altogether, revealing the smooth exine. (Fig. 5-8)

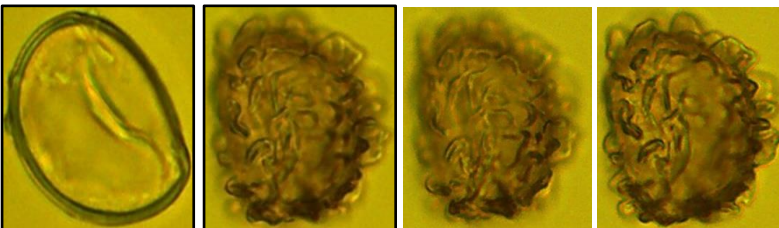


Fig. 5-8. Photo of *Cyrtomium falcatum* spores at 1000x magnification

The palynological features of *Cyrtomium falcatum* (L.f.) C.Presl of our country compared with some data found in the literature are presented in Table 1. The literature on the study of *Cyrtomium falcatum* spores is poorly developed. We believe that palynological study of the spores of this fern will contribute to a better understanding of this plant.

Table 1. Comparative table of palynotaxonomic features of *Cyrtomium falcatum* (L.f.) C.Presl of our country with literature data.

Author	Length of spores with perispore (µm)	Length of spores without perispore (µm)	Width of spores with perispore (µm)	Width of spores without perispore (µm)	Perispori (µm)	Laesura
Gollosi (2024) worldfloraonline.org/ taxon/wfo-0061109555 (2024)	36-50 (42)	28-42 (32)	26-40 (30)	18-32 (26)	4 - 5	Monolete
Nayar (1964)	28 x 40 x 24		24 x 35 x 24		4	22 µm
Tryon (1991)	30-47					Monolete

From the analysis of the palynological features presented in the table above, it is observed that our species does not have major morphometric differences from those given in the literature.

Based on the trait Length of spores with perispore, our species has slightly smaller dimensions than those presented in the literature on worldfloraonline.org. But it has larger dimensions than the spores studied by Nayar (1964) and Tryon (1991).

CONCLUSIONS

- The spores of *Cyrtomium falcatum* (L.f.) C.Presl are monolete. Laesura is about $\frac{3}{4}$ of the length of the spore. The perispore is cristates scabrates and is well developed. They can reach up to 4-5 µm. The exine is two-layered with equal layers. The ectexine is psilate. The thickness of the exine is about 2 µm.
- From the palynological analysis of *Cyrtomium falcatum* it is observed that our species does not have major morphometric differences from those given in the literature.

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