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Palynological study of spores of the species *Aspleniumruta-muraria* L in Albania

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Abstract

Asplenium rutamuraria L is a small herbaceous. This species is an isospore plant with perispore. The study presents the morphological description of the spores of Asplenium rutamuraria L in Albania. At the same time, a comparison of the palynological data of this species with those from the literature is made. The spores are monolete and of the bilateral type. So, they have only one laesura. The spores have oval to ellipsoid, to bean-shaped contours. The surface of the exine is smooth (psilate) and of uniform thickness. The exine is about 1.5 -2 µm thick.

The perispora has spiny cristae, not uniform, but well developed. The perispore folds merge at the base. They form wrinkles of different shapes, giving the impression that they are independent of each other. The size of the perispore ornaments varies. They can reach up to 5 - 7 µm. Through this study, more information is provided on the morphological features of the spores of these species of our country compared to the literature data.

The material for the study was taken fresh in the Kolosian, Kukës area, Albania. The study was carried out with a Motic BA310 light microscope with 400x and 1000x magnification.

Keywords: *Asplenium*, spores, laesura, exine, perispor

INTRODUCTION

*Asplenium rutamuraria*L is a small herbaceous and isospore. According to Plants of the World Online it has 8 homotypic synonyms:

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Amesiumruta-muraria (L.) Newman in Hist. Brit. Ferns, ed. 2.: 10 (1844); *Asplenium murale* Salisb. in Prodr. Stirp. Chap. Allerton: 403 (1796), nom. superfl.; *Chamaefilixruta-muraria* (L.) Farw. in Amer. Midl. Naturalist 12: 273 (1931); *Phyllitisruta-muraria* (L.) Moench in Methodus: 724 (1794); *Scolopendrium ruta-muraria* (L.) Roth in Tent. Fl. Germ. 3(1): 52 (1799); *Tarachiaruta-muraria* (L.) C.Presl in Abh. Königl. Böhm. Ges. Wiss., ser. 5, 6: 81 (1851); *Belvisiaruta-muraria* (L.) Sloss. in How Ferns Grow: 30 (1906); *Acrostichumruta-muraria* (L.) Lam. in Tabl. Encycl.: t. 865, f. 1 (1799))

They are described as plants in the text Flora in Albania Vol.1. Paparisto (1989), and in the text Flora Europae. Vol. 1. ATutin (1993). In Albania, they are mainly found on rocky slopes, in mountainous and alpine areas. Barina (2016). The study of spores of these ferns is based on the terminology of Erdman (1965), Punt (1994), Kapidani (1996, 2005). Brief information on this species was published by Kapidani (1988). The article offers a more detailed morphological study of the spores of the species *Asplenium ruta- muraria*L from our country. At the same time, the palynological data of these species are compared with those obtained from the literature.

MATERIAL AND METHODS

The material for the study was taken fresh in the surroundings of Kolosian, Kukës area, Albania. (Fig 1-3) through project financing from AKSHI.

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. 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

*Asplenium ruta- muraria*L

The material for the study was taken fresh. In Flora Europae. Vol. 1 (1993) a description is given *A. ruta- muraria*L., *Sp. Pl.* 1081 (1753). Rhizome branched, often creeping; scales very narrow, filiform at the apex of the rhizome. Leaves 4-15 cm; petiole about as long as the lamina, dark only at very base, otherwise green, with occasional glandular hairs;

lamina 1-3 cm wide, ovate-lanceolate, glabrous, 2-pinnate; pinnae of 3-5 segments, the segments often again similarly divided; ultimate segments 2-3 mm, broadly flabellate to rhombic, the apex serrate to incised. Sori linear and medial, the sporangia covering the whole segment when mature; spores cristate. *Walls and base-rich rocks. Almost throughout Europe*. All except Az Fa Is Sb.(a) Subsp. ruta-muraria : Fronds thick and robust; pinnules usually without a pellucid margin. Mean exospore-length 40-50 µm. 2n = 144. *Throughout the range of the species*.(b) Subsp. dolomiticumLovis& Reichstein, *Brit. Fern Gaz.* 9: 143 (1964) (incl. *A. eberlei* D.E. Meyer): Leaves somewhat thinner and more delicate; pinnules usually smaller, with a distinctpellucid margin. Mean exospore-length 35-42 µm. 2n = 72. *S. & S.C. Europe*. Tutin T.G et al. (1993) (Fig 1-3)

Fig. 1- 3. Photo of *Asplenium ruta- muraria*L

The spores are bilateral in type, with oval-ellipsoidal to bean-shaped contours. The aperture or laesura is monolete or single ray.

The perispore is has cristae (lophate), not uniform and is well developed. It forms large ridges and folds that join together at the base and form long undulations. (Fig.4-8).

The perispore ridges form folds of various shapes. The perispore resembles open webs. They appear to be independent of each other. The size of the perispore ornaments varies. They can reach up to 5-7 µm. (Fig.4-8).

Fig. 4-8. Photo of *Asplenium ruta-muraria*L spores at 1000x magnification

The exine is smooth or psilate. Its thickness is uniform and reaches about 1.5-2 µm. (Fig.4). Length of spores with perispore 59-72 µm. Width of spores with perispore 50-53 µm.

After processing with the alkaline method, the perispore is well preserved. The color after processing with KOH is brown.

During processing by the acetolysis method, the parispore splits or disappears altogether, revealing the smooth exine.

The palynological features of *Asplenium ruta-muraria*L of our country compared with some data found in the literature are presented in Table 1. 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 palynological features of *Asplenium ruta-muraria*L of our country with literature data.

Author	Length of spores with perispore (µm)	Width of spores with perispore (µm)	Perispori (µm)	Laesura
Golloshi (2025)	59-72	50-53	5 – 7 Cristae (lophate)	Monolete
Babrov (1983)	54.0 -57.6 (61.2)	40.0-43.2 (44.0)	5.4-9 perispore creeping; sculpture folded,	Monolete
Nayar (1964)	36 x 48 x 36	28 x 40 X 28	8 Crista, irregular reticulations	Monolete
Kapidani (1988)	41-54 (50)	30-47(43)	5 Cristae, irregular	Monolete
Zenkteler (2012)	35-42	32-34	Echinulate, winged folds /cristate	Monolete
Lin (2013)	41-49		Lophate (cristate-alate)	Monolete
Szkudlarz (2024)	50–61	37–48	cristate (lophate)	Monolete

Based on the trait Length of spores with perispores, Golloshi (2025) reports a maximum length of 59-72 (µm). While Zenkteler (2012) reports a minimum length of 35-42 (µm). The spore dimensions reported by other authors do not make any major difference.

CONCLUSIONS

- The spores of *Asplenium ruta-muraria*Lis monolete. The perispore is has cristae (lophate), not uniform and is well developed. The perispore ridges in the upper part form conical peaks. The perispore can reach up to 5-7 µm. The ektexine is psilate.
- From the palynological analysis of *Asplenium ruta-muraria*L it is observed that our species does not have major morphometric differences from those given in the literature.

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