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COMPARATIVE ALLERGOPALINOLOGICAL STUDY OF *RUMEX SCUTATUS* (POLYGONACEAE) IN ALBANIA

SUMMARY

In this article, the palynomorphological features of pollen grains of *Rumex scutatus* (Polygonaceae) have been studied. Samples of flowers and pollen grains were found and collected during field expeditions by various plant individuals in the "Shebenik" National Park in Albania.

Two methods have been used for the preparation of pollen slides: acetolysis according to Erdtman and basic fuchsine method according to Smoljaninova and Gollubkova. The Kisser method was used to fix the slides.

The results obtained regarding the palynomorphological features and the size of pollen grains for *Rumex scutatus* have been studied for the first time in the albanian literature and they are compared with those of the other two species, *Rumex pulcher* and *Rumex acetosella*, previously studied by other authors.

The study showed that the pollen grains of *Rumex scutatus* are monads with radial and isopolar symmetry. Their dimensions at the polar and equatorial axis and the dimensions of their colpi and pores are larger than those of *Rumex acetosella* but smaller than those of *Rumex pulcher*.

The exine layer had a thickness of about 1.45 µm and was presented perforate, unlike that of *Rumex acetosella* (reticulate) and *Rumex pulcher* (microreticulate).

INTRODUCTION

Rumex L. are herbs, rarely shrubs, usually with long, stout roots, sometimes rhizomatous. Leaves are alternate; ochreae tubular. Flowers are hermaphrodite or unisexual, arranged in whorls on simple or branched inflorescences, anemophi-

lous. Perianth-segments in two whorls of 3, the outer remaining small and thin, the inner becoming enlarged and often hardened in fruit. Valves (fruiting inner perianthsegments) sometimes developing marginal teeth or dorsal tubercles as they mature. Stamens in two whorls of 3; anthers are basifixed. Fruit a trigonous nut (Tutin *et al*., 1964).

According to the Flora of Albania (Paparisto *et al*., 1988), in the Polygonaceae family are included 4 genera. These are: *Bilderdykia* Dumort., *Fagopyrum* Miller, *Polygonum* L. and *Rumex* L. The *Rumex* genus is represented by 20 species: *Rumex acetosella, R. scutatus, R. thyrsiflorus, R. acetosa, R. longifolius, R. alpinus, R. conglomeratus, R. sanguineus, R. hydrolapathum, R. patientia, R. crispus, R. pulcher, R. obtusifolius, R. dentatus, R. maritimus, R. bucephalophorus, R. nepalensis, R. kerneri, R. gussonei, R. nivalis*.

The pollen grains of the representatives of the genus *Rumex* are considered of moderate importance as the cause of allergic diseases in persons sensitive to the allergic factor. This is shown by numerous scientific works of local and foreign authors (Wodehouse, 1931; Solomon, 1969; Basset *et al*., 1978; Nowicke and Skvarla, 1979; Ciampolini and Cresti, 1981; Feliziani, 1986; Akeroid, 1991; Frank *et al*., 1991; Nilsson and Praglowski, 1992; Subiza *et al*.,1995; Gjebrea, 2003; Ianovici, 2007; Kallajxhiu, 2011; Lekli *et al*., 2008; Piotrowska, 2008).

The symptoms of pollen allergy confirm a good correlation with the airborne pollen count. The species of the Rumex genus are characterised by hight pollen production as an individual plant can produce about 400 million pollen grains (Puc, 2003).

Mean concentrations of Rumex airborne pollen was significantly higher in the rural area. The peak season is June (Ianovici, 2007).

From foreign and Albanian literature it has resulted that the pollen grains of species of the genus *Rumex* are 3-zone - (4-9) pantocolporate and ornamentation is microreticulate. They come in various sizes ranging from 15-35 micrometers. *Rumex* pollen grains are oblate-spheroidal to prolate with a thin sexine. The colpi are long and narrow and the pores are lolongate (Leeuwen *et al*., 1988; Zhang and Zhou, 1998; Yasmin *et al*., 2010; Kallajxhiu, 2011).

Morphopalynological features of buckler - leaved sorrel (*Rumex scutatus*) pollen grains have been studied for the first time in the Albanian literature in this study.

The aim of this study is to investigate the palynomorphological features pollen grains of *Rumex scutatus* and to determine the similarities and differences with those of the other two species, sheep sorrel (*Rumex acetosella)* and fiddle dock (*Rumex pulcher*), studied by other authors in Albania (Kallajxhiu, 2011).

MATERIAL AND METHODS

Rumex scutatus (buckler-leaved sorrel) is a perennial herbaceous plant with polygamous flowers. It is widespread in rocky places of subalpine and alpine areas

and blooms in the period from May to August. Its pollination is anemophilous (Paparisto *et al*., 1988).

The study material was obtained fresh during field expeditions by various plant individuals, in "Shebenik" National Park. This park is declared in 2008 and it is one of the newest national parks in Albania. It is located in Librazhd District in the Elbasan Region, on the border with Northern Macedonia and has a total area of 34 507.9 ha, where with DCM no. 59 dated 26.01.2022 to the previous surface of 33 927.66 ha was added 589 ha of new surface.

The Park is dominated by mountains and valleys. It ranges in altitude from 300 to 2,200 m above sea level and includes a diversity of climatic conditions, geological types, landscapes, habitats and plant and animal species. "Shebenik" National Park represents an important scientific, economic, historical and cultural role etc.

The identification of this plant is based on the Flora of Albania (Paparisto *et al.,* 1988). The terminology used can be found in the dictionary of palynology presented by Kapidani (2005) and it is in accordance with Punt *et al*. (1994) and Faegri and Iversen (1975).

For the palynomorphological study of pollen grains several slides were prepared using two methods: acetolysis (according to Erdtman, 1960) and the method with basic fuchsine (according to Smoljaninova and Gollubkova, 1953). Fixation of the slides was done with gelatin-glycerin prepared according to the Kisser method (Erdtman, 1956).

Preparation of microscope slides by the method of acetolysis gives very specific data regarding sporoderm and its elements while the second method with basic fuchsine is used to accurately determine the number of exine openings and the size of pollen grains including their length and width, dimensions of furrows and pores, thickness of the exine and intine layer etc.

To accurately determine the dimensions of each morphological feature, measurements of 31 pollen grains were made and for each morphological feature, the minimum, average and maximum dimensions were determined. Slides of all samples are deposited at the Palynological Laboratory, Department of Biology.

For conducting the study, a Biological Microscope (Motic BA310 Series LED-Digital) was used, with magnification of 100x and 400x. The study was accompanied with microscopic photographs of pollen grains in the polar and equatorial view.

To see the influence of the ecological factor and that of the processing method on the characteristics and size of the pollen grains, was made their comparison with those of the pollen grains of *Rumex pulcher* and *Rumex acetosella* species, studied by other authors.

RESULTS AND DISCUSSION

Morphopalynological description

Family: Polygonaceae
Genus: *Rumex* L.
Species: *Rumex scutatus*

Rumex scutatus L., Sp. Pl. 337 (1753) (incl. *R. aetnensis* C. Presi). Suffrutescent, with subterranean shoots, branching from the base. Leaves scutate, variable in outline, about as long as wide, green or glaucous. Inflorescence very lax, with few, erect branches. Pedicels shorter than the valves. Flowers polygamous. Valves 4-5-6 x 5 mm, pale, cordate, without tubercles. Nut 3-3-5 mm, yellowish-grey. 2n = 20. Screes. Mountains of Center& South Europe; cultivated elsewhere and sometimes escaping. Al, Au, Be, Bu, Co, Cz, Ga, Ge, Gr, He, Hs, Hu, It, Ju, Lu, Po, Rm, Rs, (K), Sa, [Br, Ho, Su] (Tutin *et al.,* 1964).

The pollen grains of *R. scutatus* are 3 colporate. They are monads with isopolar radial symmetry. In the polar position, the pollen grains are almost spherical in shape, while in the equatorial position they are elliptical in shape. The length of the pollen grain varies from 22 - 30 (24.80) µm while the width of the pollen grain varies from 22 - 29 (23.33) µm. The contour shape of the pollen grain is compressed spheroidal (prolate spheroidal) (P/E = 1.06).

The furrows are long and reach up to 11 µm. The width of the furrow reaches up to 1.8 µm. Mesocolpium (the distance between furrows) reaches up to 16.77 µm. The pore is almost spherical and its diameter is 1.5 µm.The exine layer reaches up to 1.45 µm. Its sculpture is perforated.

In order to show the similarities and differences related to the palynomorphological features of the pollen grains of *R. scutatus*, the microscopic photos of the pollen grains of three species of the genus *Rumex* taken with different magnifications of the microscope are presented in the study.

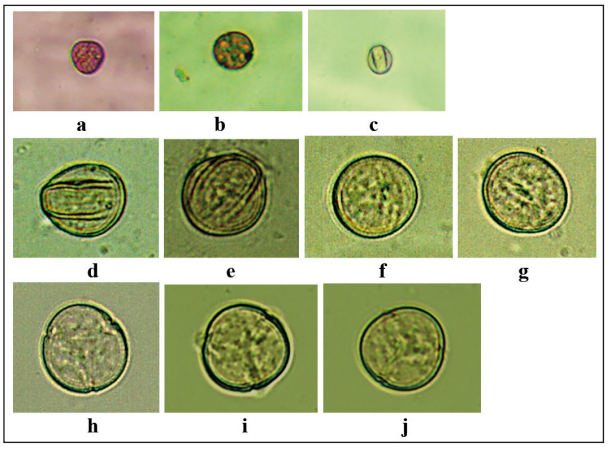

Fig. 1- *Rumex scutatus* pollen grains: a - b polar view; c - equatorial view (100x magnification); d - e - f - g equatorial view (400x magnification); h - i - j polar view (400x magnification); (photo: Kallajxhiu N.).

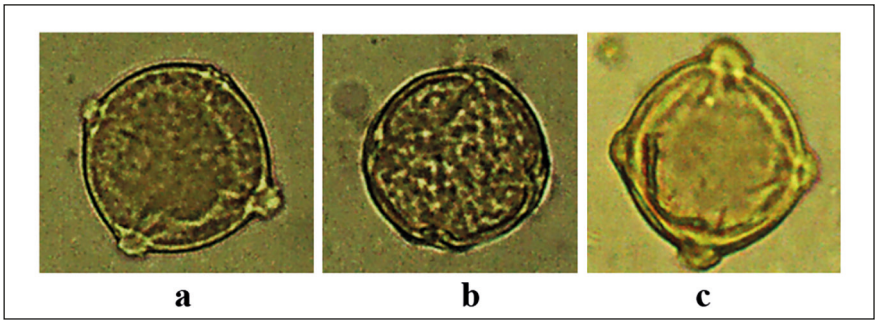

Fig. 2- *Rumex pulcher* pollen grain: a- b - c polar view (400x magnification).

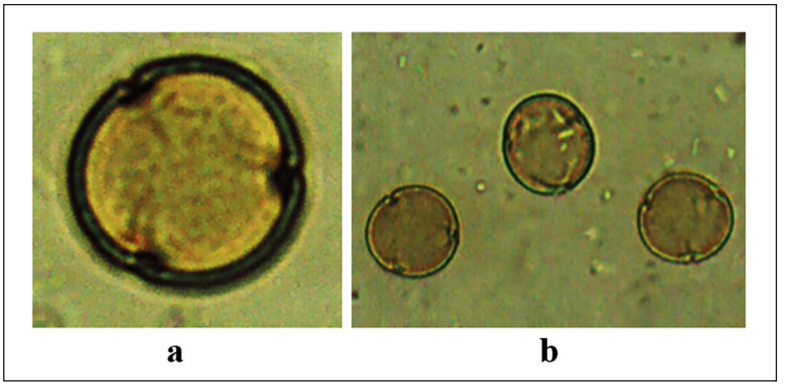

Fig. 3- *Rumex acetosella* pollen grains; a- polar view (1000x magnification); b - polar and equatorial view.
(400x magnification) (photo: Kallajxhiu N.)

In order to compare the sizes of pollen grains of *Rumex scutatus* with those of the other two studied species, the minimum and maximum data of equatorial axis and those of the polar axis are listed in Tab. 1.

Tab. 1- Pollen grains minimum and maximum dimensions of *Rumex* taxa.

Pollen grain dimensions (µm)	Minimum *Rumex scutatus*	Minimum *Rumex acetosella*	Minimum *Rumex pulcher*	Maximum *Rumex scutatus*	Maximum *Rumex acetosella*	Maximum *Rumex pulcher*
Polar diameter	22	17.34	28.56	30	21.01	33.04
Equatorial diameter	22	17.74	27.74	29	21.42	32.84

From the data of Tab. 1, it is clear that the pollen grains of *Rumex scutatus* appear larger in both sizes of axes (minimum and maximum dimensions).

From the comparison of the size values, it results that the pollen grains of

Rumex scutatus are classified in the group of pollens that are larger than 22 µm, together with those of *Rumex pulcher*, while the pollens of *Rumex acetosella* are included in the grouping of pollens that are smaller than 22 µm. This conclusion reached in this study is in full agreement with local and foreign literature (Leeuwen *et al*., 1988; Kallajxhiu, 2011).The same conclusions are reached for the average values of pollen grains. The graph below shows this.

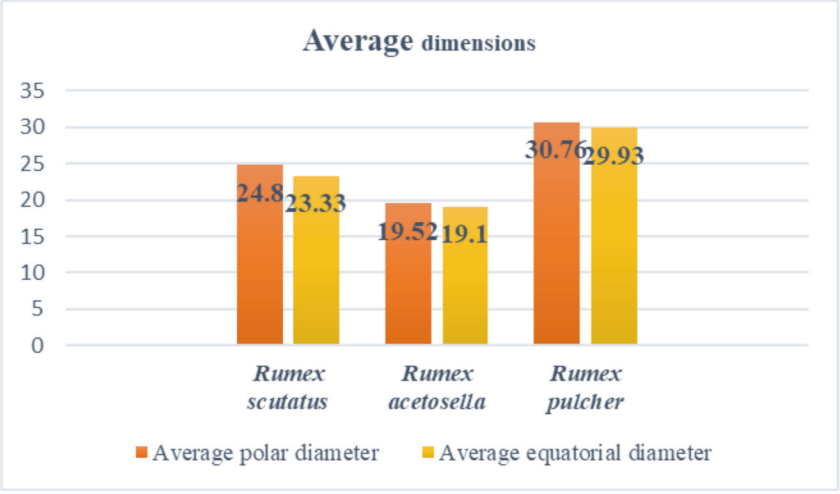

Fig. 4- Graphical presentation of comparative pollen grains average dimensions of three species.

From the comparison of the photos in Figs. 1, 2, 3, it is clear that the pollen grains of *Rumex scutatus* are 3 colporate, like those of *Rumex acetosella*, while those of *Rumex pulcher* vary from 3 to 4 colporate. Changes have also been made with the dimensions of the furrows.

From the values presented in Tab. 2, it is clear that the furrows of the pollen grains of *Rumex scutatus* are larger than those of *Rumex acetosella* but smaller than those of *Rumex pulcher*. Also, the size of the pore and the distance between two furrows (mesocolpium) of *Rumex scutatus* are larger than those of *Rumex acetosella* and smaller than those of *Rumex pulcher*.

Tab. 2- Average dimensions of some features of *Rumex* taxa

Average dimensions (µm)	*Rumex scutatus*	*Rumex acetosella*	*Rumex pulcher*
Length offurrows	11	9.5	12.73
Width offurrows	1.8	1	2.05
Mesocolpium	16.77	15.91	20.15
Pore diameter	1.5	1.04	2.05

The study shows that exine layer of *Rumex scutatus* is thicker than that of *Rumex acetosella* and thinner than that of *Rumex pulcher*. Their values are presented in Tab. 3 and can be seen clearly in Fig. 5.

Tab. 3- Comparison of thickness and sculpture of exine in *Rumex* taxa.

Palynological of features	*Rumex scutatus*	*Rumex acetosella*	*Rumex pulcher*
Thickness of exine (µm)	1.45	1.30	1.88
Pollen class	3 colporate	3 colporate	3-4 colporate

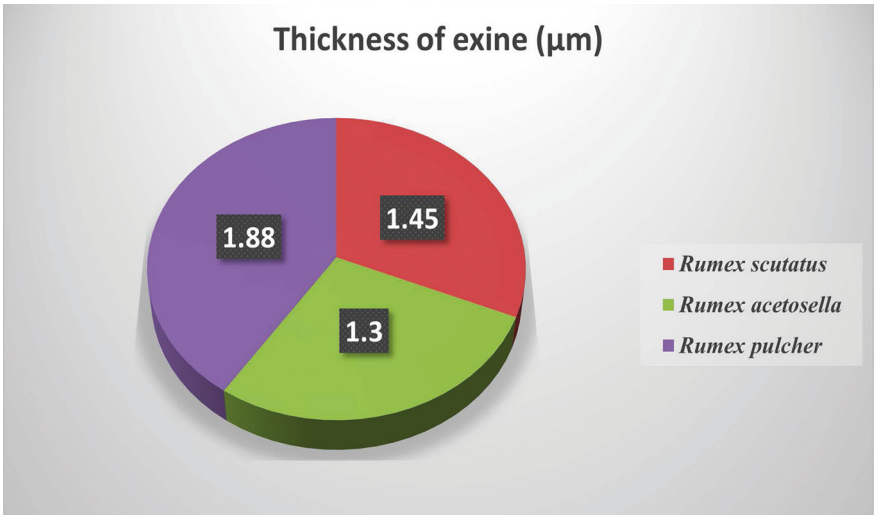

Fig. 5- Thickness of exine in *Rumex* taxa.

The sculpture of exine of the pollen grains of *Rumex scutatus* appears perforated, while in *Rumex acetosella* it is reticulate and in *Rumex pulcher* it is microreticulate.

CONCLUSIONS

From the study and comparison of the morphopalynological features of the pollen grains of *Rumex scutatus* with those of *Rumex acetosella* and *Rumex pulcher* (Polygonaceae) it was found that:

- Pollen grains of *Rumex scutatus* are 3 colporate, the same as those of *Rumex acetosella* while in *Rumex pulcher* they vary in 3 - 4 colporate
- *Rumex scutatus* has larger pollen grains than *Rumex acetosella* and smaller than *Rumex scutatus*

- The exine layer of *Rumex scutatus* pollen grains is thicker than that of *Rumex acetosella* but thinner than that of *Rumex pulcher*. Its sculpture is perforated, unlike the exine of *Rumex acetosella* (reticulate) and *Rumex pulcher* (microreticulate).

REFERENCES

Akeroid J. R., 1991 - A new Subspecific Combination in *Rumex acetosella*. *Botanical journal of the Linnean Society,* **106**: 97-119.

Bassett I. J., Crompton C. W., Parmelee J. A., 1978 - An atlas of airborne pollen grains and common fungus spores of Canada. Biosystematics Research Institute Ottawa, Ontario, Research Branch, *Canada Department of Agriculture*. Monograph No. 1**8:** 322 pp.

Ciampolini F. and Cresti M., 1981 - Atlante dei Principali Pollini Allergenici Presenti in Italia. *Istituto di Botanica Universitá di Siena*: 152-154.

Erdtman G., 1956 - Morfologija pilci i sistematika rastenij, *Angiosperma*. Moskva: 12-14, 25-85.

Erdtmann G., 1960 - The acetolysis method, revised description. *Svensk Botanisk Tidskrskrift*., **54**: 561-564.

Faegri K. and Iversen J., 1975 - *Textbook of Pollen Analysis*. Munksgaard, Copenhagen, 3rd edition, revised, 295 pp.

Feliziani V., 1986 - Pollini di Interesse Allergologico. Guida al Loro Riconoscimento. Masson Italia Editori S.p.A.

Frank E., Leonhardt L., Geissler W. and Jäger S., 1991 - Allergenic significance of *Rumex* pollen. In (D'Amato G., Spieksma, F. T. M., Bonini, S. Eds.) "*Allergenic pollen and pollinosis in Europe*. *Blackwell Scientific Publications,* London: 119-120.

Gjebrea E., 2003 - Identification and concentration in the air of the main allergenic pollensin Tirana and the pollen calendar

Nowicke Joan W. and Skvarla John J., 1979 - Pollen Morphology: The Potential Influence in Higher Order Systematics. *Annals of the Missouri Botanical Garden*. Vol. **66**, No. 4: pp. 633-700, Missouri Botanical Garden Press

Ianovici N., 2007 - Airborne *Rumex* pollen in the atmosphere of Timisoara, Romania. Series of Chemistry **16** (**4**): 133-140, ISYPMR 2007-ACM-V-The IX International Symposium "Young People and Multidisciplinary Research"

Kallajxhiu N., 2011 - *Allergopallinological study of allergic plants of the district of Elbasan and allergies caused by them.* Monograph. Elbasan, Albania. Rama Graf. 106 pp.

Kapidani G., 2005 - *Glossary of palynological terminology*. Seiko Press, Elbasan, Albania. 149 pp.

Punt W., Blackmore S., Nilsson S. and Thomas L., 1994 - *Glossary of Pollen and Spore terminology*. LPP Foundation, Utrecht. LPP contributions Series No. **1**.

Lekli L., Mersinllari M., Qirko E., Xhixha F., Hoxha M., 2008 - *Allergic plants in Albania. Tirana*, Presso Arti Grafiche Favia S.R.L.: 299 pp.

Nilsson S. and Praglowski J., 1992 - (Eds.) *Erdtman's Handbook of Palynology*. 2nd edition. Munksgaard International Publisher, Kopenhagen. ISBN 87-16-10846-9.

Piotrowska K., 2008 - Pollen production in selected species of anemophilous plants. *Acta Agrobotanica*, Vol. **61** (1): 41-52.

Paparisto K., Demiri M., Mitrushi I., Qosja Xh., 1988 - *Flora of Albania*. Volume **I**, Academy of Sciences of Albania. Tirana: 140-159.

Puc M., 2003 - Characterisation of pollen allergens. *Ann Agric Environ Med*., **10**: 143-149.

Smoljaninova L. A. and Gollubkova V. F., 1953 - Metodike issledovani pilci. DokladyAkademia Nauk SSSR T LXXXVIII, **1**: 125-126.

Solomon W. R., 1969 - An appraisal of *Rumex* pollen as an aeroallergen. *J Allergy* **44** (1): 25-36.

Subiza J., Jerez M., Jimenes J. A., Narganes M. J., Cabrera M., Varela S., Subiza E., 1995 - Allergenic pollen pollinosis in Madrid, *J. Allergy Clin Immunol*., **96** (1): 15-23.

Tutin T. G., Heywood V. H., Burges N. A., Valentine D. H., Walters S. M. and Webb D. A., 1964 - Flora Europaea, Lycopodiaceae to Platanaceae, Vol. **I**, Cambridge at the University press, 84 pp.

Van Leeuwen P., Punt W., Hoen P. P., 1988 - The northwest European pollen flora, 43: Polygonaceae. *Review of Palaeobotany and Palynology*, **57** (1-2), 81. Elsevier. ISSN 00346667.

Yasmin G., Khan M. J., Shaheen N., Hayat M. Q., Ali S., Abbas S., 2010 - Taxonomic implications of pollen morphology of seven species of *Rumex* L., from Pakistan. *Pakistan Journal of Botany* **42** (3): 1435-1442.

Zhang X. P. and Zhou Z. Z., 1998 - A study on pollen morphology and its phylogeny of *Polygonaceae* in China. *Paleobotany and Palynology*. *University of Science and Technology of China Press*, Hefei: 154 pp.

Wodehouse R. P., 1931 - Pollen Grains in the Identification and Classification of Plants VI. *Polygonaceae*. *American Journal of Botany*, Vol. **18**, No. **9**: 749-764.