



FERN FLORA IN THE SMILJANOVA GRABA VALLEY AT MACELJSKA GORA MOUNTAIN (NORTH-WESTERN CROATIA)

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Sixteen fern taxa were found in a relatively small area (MTB 9760.4, 9761.3) in the mountain creek valley near the village of Smiljanova Graba at Maceljska Gora mountain (north-western Croatia). Three of these species have rarely been recorded in Croatian Flora: (*Dryopteris affinis* s. l. (A. Löve) Fraser-Jenkins, *Matteuccia struthiopteris* (L.) Tod., *Polystichum braunii* (Spenn.) Fée). Two species were recorded for the first time in the north-western part of Croatia (*Dryopteris dilatata* (Hoffm.) A. Gray, *Polystichum braunii* (Spenn.) Fée) while three taxa were observed for the first time in Croatia (*Dryopteris affinis* subsp. *cambrensis* Fraser-Jenkins, *D. cristata* (L.) A. Gray, and *Polystichum x wirtgenii* Hahne).

Key words: *Filicopsida*, flora, ferns, Croatia

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Na relativno malom području (MTB 9760.4, 9761.3) u dolini planinskog potoka kod sela Smiljanova Graba u Maceljskoj gori (sjeverozapadna Hrvatska) utvrđeno je 16 taksona paprati. Među njima, 3 vrste su dosad bile rijetko bilježene u hrvatskoj flori (*Dryopteris affinis* s. l. (A. Löve) Fraser-Jenkins, *Matteuccia struthiopteris* (L.) Tod., *Polystichum braunii* (Spenn.) Fée). Dvije su vrste (*Dryopteris dilatata* (Hoffm.) A. Gray, *Polystichum braunii* (Spenn.) Fée) po prvi puta bila zabilježene na području sjeverozapadne Hrvatske, dok su tri svojte zabilježene po prvi puta za Hrvatsku (*Dryopteris affinis* subsp. *cambrensis* Fraser-Jenkins, *D. cristata* (L.) A. Gray i *Polystichum x wirtgenii* Hahne).

Ključne riječi: *Filicopsida*, flora, paprati, Hrvatska

INTRODUCTION

Since systematic flora mapping has not yet yielded results in Croatia (NIKOLIĆ *et al.*, 1998) and since there are no prospects for such an enterprise in the near future, the distribution of hardly any plant species in Croatia is unknown, or indeed their presence in Croatia. Therefore any data that might contribute to the study of flora and species distribution (even though it may have been collected during sporadic research) is worth publishing, especially if it was collected in a way corresponding with the standards of floristic mapping in neighbouring countries (NIKOLIĆ *et al.*, 1998).

In the course of botanical research in a mountain creek valley upstream from the village of Smiljanova Graba at Maceljska Gora in north-western Croatia (Fig. 1) a surprising abundance of ferns was found. What was most surprising was both the relatively great number of species in a small area, in addition to their great abundance. Among the ferns found there were some rare taxa and some that have been rarely or never observed in Croatian flora.

THE AREA OF RESEARCH

The research area is located in the vicinity of Smiljanova Graba near the settlement of Donji Macelj, within the co-ordinates 15° 49' 30" – 15° 50' 15" E i 46° 14' 00" – 46° 14' 20" (MTB 9760.4, 9761.3) (Fig. 1).

The area is situated in north-western Croatia and is characterised by a humid climate (Cfbw^x" according to Köppen's classification; according to Thornwait's classification, the P/E index for the closest meteorological station Kostel, 10 km away, is 90) (BERTOVIĆ, 1975).

The habitat is a narrow creek valley with several hundred metre steep slopes on both sides and covered with thick mixed forest of sessile oak (*Quercus petraea* (Matt.) Liebl.), beech (*Fagus sylvatica* L.), fir (*Abies alba* Mill.) and hornbeam (*Carpinus betulus* L.) and can be identified as *Abieti-Fagetum*. The area by the creek itself is dominated by alder (*Alnus glutinosa* (L.) P. Gaertn.), although individual hornbeam (*Carpinus betulus* L.), wych elm (*Ulmus glabra* Huds.), elder (*Sambucus nigra* L.) and common sallow (*Salix cinerea* L.) trees and bushes can be found, this vegetation belonging to the *Alno-Ulmion* alliance. The whole valley abounds in shady places due to the vegetation (thick forest) and the slopes that shorten sunlight periods.

METHODS

Identification of fern taxa was carried out using the following keys: KRAMER (1984), JERMY & CAMUS (1998), LAUBER & WAGNER (1998), PHILIPPI (1993), TUTIN *et al.* (1993).

Nomenclature of species follows HRŠAK (1994). The abbreviations of species author's names follows BRUMMITT & POWELL (1992).

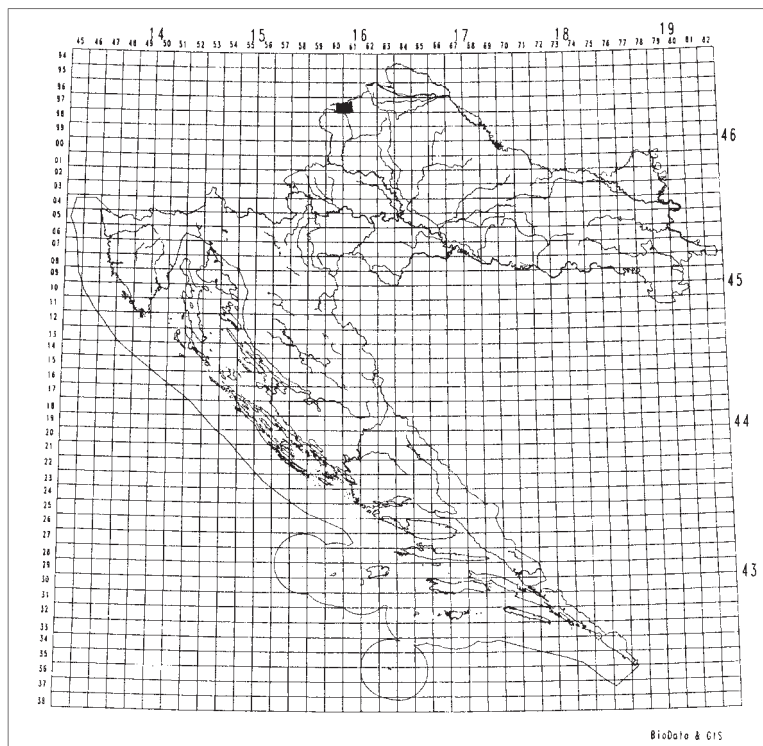


Fig. 1. MTB position of quadrants in which the research area is located (MTB 9760.4, 9761.3)

Geocoding and mapping were done according to NIKOLIĆ *et al.* (1998). The data on the distribution known so far were taken from the CROFlora 2.0 base, FADLJEVIĆ (1996) and SASUNIĆ (1996).

RESULTS AND DISCUSSION

Tab. 1 The list of fern taxa found

ASPLENIACEAE

- Asplenium scolopendrium* L.
- Asplenium trichomanes* L.

DRYOPTERIDACEAE

- Dryopteris affinis* (A. Löve) Fraser-Jenkins subsp. *cambrensis* Fraser-Jenkins
- Dryopteris carthusiana* (Vill.) H. P. Fuchs

Dryopteris cristata (L.) A. Gray
Dryopteris dilatata (Hoffm.) A. Gray
Dryopteris filix-mas (L.) Schott
Polystichum braunii (Spenn.) Fée
Polystichum setiferum (Forssk.) T. Moore ex Woyn.
Polystichum x *wirtgenii* Hahne (*P. braunii* (Spenn.) Fée x *P. setiferum* (Forssk.)
 T. Moore ex Woyn.)

HYPOLEPIDACEAE

Pteridium aquilinum (L.) Kuhn

POLYPODIACEAE

Polypodium vulgare L.

WOODSIACEAE

Athyrium filix-femina (L.) Roth
Cystopteris fragilis (L.) Bernh.
Cystopteris montana (Lam.) Desv.
Matteuccia struthiopteris (L.) Tod.

In a relatively small area there are 16 taxa from the fern class (*Filicopsida*) belonging to 5 families. Such a high number of fern taxa in such a small area can be accounted for by the humid climate and quite a few shaded and semi-shaded places. Humid and shaded places are favourable habitats for most fern species (DOSTÁL, 1984; PHILIPPI, 1993).

Of the taxa found some were rarely and some have never been reported in Croatia. Such particularly interesting taxa are:

Dryopteris affinis (A. Löve) Fraser-Jenkins has so far been recorded only in a few locations in Croatia (CROFlora 2.0, SASUNIĆ, 1996). All those findings date from the last century or the beginning of this century. Such a small number of data about this species is probably due to its great similarity with the *D. filix-mas* (L.) Schott species (Appendix 1), which lead to its misidentification. *D. affinis* subspecies *cambrensis* Fraser-Jenkins (Appendix 2) has not yet been recorded in Croatia, so this is the first published finding of this taxon in Croatia.

Dryopteris cristata (L.) A. Gray has not been recorded in Croatia, although it was mentioned by DOMAC (1950, 1984). MAYER & HORVATIĆ (1967) quoted *D. cristata* only for Slovenia. Later it was omitted by DOMAC (1994) too – probably since he had not found a single published quote of the presence of *D. cristata* in Croatia. Nor was it mentioned by HRŠAK (1994, 1996). Thus this is the first published mention of the presence of this species in Croatia.

Dryopteris dilatata (Hoffm.) A. Gray was first recorded in north-western Croatia (CROFlora 2.0, SASUNIĆ 1996), making this the first published data on the occurrence of it in this part of Croatia.

Matteuccia struthiopteris (L.) Tod. is a rare species in Croatia (ALEGRO *et al.*, 1999). HIRC (1905) even claimed that all data on its occurrence in Croatia were uncertain

and that this species should be erased from Croatian flora. The Herbarium Croaticum collection (ZA) does not contain specimens collected in Croatia, all the specimens it does have coming from neighbouring Slovenia. However in the Ivo and Marija HORVAT herbarium collection (ZAHO) there is a sample of the species collected by M. Tortić on May 2 1980 in the Macelj area, hence in the vicinity of Smiljanova Graba or perhaps even in the same locality since the label does not state clearly this information. This species was also found in June 1994 in the Curak creek valley near Skrad in the Gorski Kotar region (MTB 0555.1, 14° 53' 35" E, 45° 26' 30" N; the author's personal observation), and it can also be found in some other ecologically appropriate habitats (ALEGRO *et al.*, 1999).

Polystichum braunii (Spenn.) Fée is also a rarely recorded species in Croatia (8 data in CROFlora 2.0). None of the recorded locations is in north-western Croatia (CROFlora 2.0, SASUNIĆ, 1996). Therefore, this is the first item on the occurrence of this species in north-western Croatia.

Polystichum setiferum (Forssk.) T. Moore ex Woyn. is a species more rarely recorded in Croatia than the similar species *P. aculeatum* (L.) Roth (CROFlora 2.0, SASUNIĆ, 1996). However, according to the author's personal observation, *P. setiferum* is much more frequently found and more abundant than *P. aculeatum*, at least in the mountains and hills of the continental part of Croatia (Papuk, Psunj, Moslavačka Gora, Medvednica, Zrinska Gora, Ivančica). Since these two species are so similar (Appendix 3), many of the data, at least in the continental part of Croatia, for *P. aculeatum* most likely refer to *P. setiferum*.

Polystichum × *wirtgenii* Hahne (*P. braunii* (Spenn.) Fée × *P. setiferum* (Forssk.) T. Moore ex Woyn.) has not been recorded in Croatia previously, and this is its first finding in Croatia. According to DOSTÁL & REICHSTEIN (1984) this hybrid can be found almost everywhere its parental species are found. This is a rare case in nature, but Smiljanova Graba is one such rare example.

CONCLUSION

In a small area in the valley of a mountain creek by Maceljska Gora mountain, which encompasses only a smaller part of MTB quadrants 9760.4 and 9761.3, sixteen fern taxa were found.

Such a relatively rich abundance in species is due to ecological conditions, which are favourable for the growth of most fern species.

Of the sixteen species established, three have rarely been recorded in Croatia and three taxa (one species, one subspecies and one hybrid) have been recorded for the first time in Croatia.

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S A Ž E T A K

Flora paprati u dolini Smiljanova Graba u Maceljskoj gori
(sjeverozapadna Hrvatska)

V. Hršak

Tijekom botaničkih istraživanja u dolini gorskog potoka kod sela Smiljanova Graba nedaleko naselja Macelj pronađeno je 16 svojiti paprati na relativno malom području te obilje primjeraka nekih od tih vrsta. Istraženo područje zahvaća samo manje dijelove MTB kvadranta 9760.4 i 9761.3.

Među pronađenim svojtima tri vrste su dosad bile rijetko zabilježene u flori Hrvatske (*Dryopteris affinis* s. l. (A. Löve) Fraser-Jenkins, *Polystichum braunii* (Spenn.) Fée i *Matteuccia struthiopteris* (L.) Tod.), dvije vrste su po prvi put zabilježene za ovaj dio Hrvatske (*Dryopteris dilatata* (Hoffm.) A. Gray, *Polystichum braunii* (Spenn.) Fée), a tri su svoje po prvi puta zabilježene u flori Hrvatske (*Dryopteris affinis* (A. Löve) Fraser-Jenkins subsp. *cambrensis* Fraser-Jenkins, *Dryopteris cristata* (L.) A. Gray i *Polystichum x wirtgenii* Hahne).

APPENDIX 1

Determination key for distinguishing *Dryopteris affinis* (A. Löve) Fraser-Jenkins, *Dryopteris filix-mas* (L.) Schott, *Dryopteris cristata* (L.) A. Gray

- | | | |
|---|---|---------------------|
| 1 | Fertile leaves longer and more erect than sterile, pinnae 10–20 on each side | <i>D. cristata</i> |
| | Sterile and fertile leaves similar in size, pinnae at least 20 on each side | 2 |
| 2 | Point on insertion on secondary rachis blackish, pinnules or ultimate segments ± parallel-sided | <i>D. affinis</i> |
| | Point on insertion on secondary rachis not blackish, pinnules or ultimate segments with somewhat curved sides | <i>D. filix-mas</i> |

APPENDIX 2

Determination key for distinguishing infraspecific taxa of *D. affinis* (A. Löve) Fraser-Jenkins

- | | | |
|---|---|---------------------------------|
| 1 | Pinnule teeth obtuse, indusium thick ± persistent | 2 |
| | Pinnule teeth acute, indusium thin, deciduous | subsp. <i>borreri</i> |
| 2 | Leaves persisting in winter, axes of lamina not glandular | subsp. <i>affinis</i> |
| | Leaves not persisting in winter, axes of lamina glandular | subsp. <i>cambrensis</i> |

APPENDIX 3

Determination key for distinguishing *Polystichum braunii* (Spenn.) Fée, *Polystichum setiferum* (Forssk.) T. Moore ex Woyn. and *Polystichum x wirtgenii* Hahne

- | | | |
|---|--|--|
| 1 | Pinnules distinctly stalked, not decurrent
Pinnules sessile or sessile, decurrent | <i>P. setiferum</i>
2 |
| 2 | Leaves rigid, pinnules glabrous above
Leaves soft, pinnules hairy above | <i>P. aculeatum</i>
<i>P. braunii</i> |

P. x wirtgenii Hahne, according to appearance, is situated between both parental species. It differs from *P. braunii* by its longish spiked pinnae, and by partially short stalked and denticulate pinnules. It differs from *P. setiferum* by short stalked pinnules and especially by individual and clearly visible hairs on the top of the pinnules.