

NEW RECORDS OF VASCULAR PLANTS ON THE MT MEDVEDNICA

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During floristic research of the eastern parts of Mt Medvednica, in the period from 2007 to 2009, 23 taxa were recorded for the first time for this area, and a further 24 taxa were confirmed after 50 years, or more.

Key words: alien taxa, flora, invasive species, Medvednica, neophytes, new taxa

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Tijekom florističkog istraživanja istočnog dijela Medvednice, u razdoblju od 2007. do 2009.g., otkrivene su 23 nove svojte vaskularne flore. Dodatne 24 svojte, koje su posljednji put zabilježene prije pedesetak ili više godina, potvrđene su ovim istraživanjem, što predstavlja značajan doprinos poznavanju recentne flore Medvednice.

Ključne riječi: strane svojte, flora, invazivne vrste, Medvednica, neofiti, nove svojte

INTRODUCTION

The flora of Mt Medvednica has been studied over the last 150 years (cf. NIKOLIĆ, 2012), focused mainly on the area of the Nature Park (CIGIĆ *et al.*, 2003; MAREKOVIĆ *et al.*, 2005; KRANJČEV, 2005; DOBROVIĆ *et al.*, 2006a, 2006b, NIKOLIĆ & KOVAČIĆ, 2008; MAREKOVIĆ *et al.*, 2009; VUKOVIĆ *et al.*, 2010). However, plant richness outside the borders of the Nature Park has not been systematically researched and historic data are scarce and localities are given imprecisely (cf. NIKOLIĆ, 2012). Nevertheless, our floristic study of the eastern part of Mt Medvednica resulted in discoveries of some new plant species, together with confirmations of plants not recorded for at least 50 years, or more.

MATERIALS AND METHODS

Study area

Mt Medvednica is situated in the northwest part of Croatia and its southern slope is part of Zagreb's metropolitan area. The massif is 42 km long and approximately 9 km wide, with its highest peak Sljeme (1033 m.a.s.l.) (POLJAK, 2007).

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Mt Medvednica, due to its vertical zonation of vegetation and its geological and pedological heterogeneity, has high floristic diversity. In order to protect flora and vegetation, especially forest habitat, the Medvednica Nature Park was proclaimed in 1981 and currently covers an area of 17938 ha (ANONYMOUS, 2009a). Here, on only 0.4% of the national territory 1205 taxa are present, representing 22% of total Croatian flora (NIKOLIĆ & KOVAČIĆ, 2008).

The researched area (Fig. 1), which is exposed to very considerable human influence, occupies 5.5 km² outside the Nature Park's borders. It is located between four settlements – Čučerje, Goranec, Vugrovec and Šimunčevac. According to the climate classification by Köppen, the investigated area belongs to the temperate C climate (warm-temperate rainy climate - Cfb) (BERTIĆ *et al.*, 2005).

METHODS

Flora of the eastern part of Mt Medvednica was surveyed as a part the requirements for a bachelor's degree (HRUŠEVAR, 2009), in the period from 2007 to 2009, during all vegetation seasons and in all habitat types.

For plant identification, standard determination keys were used: TUTIN *et al.* (1968–1980, 1993), JERMY & TUTIN (1982), MARTINČIĆ *et al.* (1999), CONERT (2000), DOMAC (2002). Names of taxa were adjusted to the Flora Croatica Database (NIKOLIĆ, 2012). In the list of taxa names, each taxon is followed by chorological type, according to a newer approach made by LANDOLT *et al.* (2010) and then values are grouped in some of the categories proposed by HORVATIĆ (1963) and HORVATIĆ *et al.* (1967–1968); life form, according to SIMON *et al.* (1992) and LANDOLT *et al.* (2010); habitat types, adjusted to ANONYMOUS (2009b); conservation status, according to ANONYMOUS (2012) and legal protection, according to ANONYMOUS (2013). Furthermore, chronological type, according to MEDVECKÁ *et al.* (2012) and PYŠEK *et al.* (2012) and invasiveness, according to BORŠIĆ *et al.* (2008) and MITIĆ *et al.* (2008), are added to alien plant species.

Chorological types are: M – Mediterranean, A – Atlantic, SE – South-European, CE – Central-European, E – European, EA – Eurasian, SEE – Southeast European, EEP – East European-Pontic and AC – Adventive and Cultivars.

Life forms are: T – Therophytes; G – Geophytes; H – Hemicryptophytes; Ch – Chamaephytes and P – Phanerophytes.

Habitat types are: Gr – Grassland, RH – Ruderal habitats, F – Forest, FE – Forest edge, Co – Coppice and Aq – Aquatic habitats.

From the Red book categories only DD – Data Deficient, is present.

Strictly Protected taxa are denoted as SPT.

Alien species are denoted as AR – Archaeophytes or NEO – Neophytes, and invasive alien species are marked with the abbreviation IAS.

RESULTS AND DISCUSSION

Our research resulted in 23 new taxa in the flora of Mt Medvednica. Also, 24 taxa were confirmed after 50 years or more and some of the new or confirmed species are quite rare in Croatian flora.

New taxa in the flora of Mt Medvednica

Brachypodium pinnatum (L.) P.Beauv. ssp. *pinnatum* (Poaceae, EA, H, FE and Co). Already known at the species level in the flora of Mt Medvednica, but recorded now for the first time at the infraspecific level. There are probably two reasons why this taxon is not frequently noted in Croatian flora (cf. NIKOLIĆ, 2012); the first is related to the absence of the subspecies level in Croatian determination keys, and the second explanation is that determination of the subspecies level seems problematic. Due to the fact that ZA does not have samples of this subspecies collected in Croatia, it was thought that only subsp. *rupestre* should be present in Croatia, which was disproved during this research. It is common in the researched area, especially in grasslands in succession.

Brachypodium pinnatum (L.) P.Beauv. ssp. *rupestre* (Host) Schübl. et M.Martens (Poaceae, SE, H, FE). Frequently recorded in the (Sub-)Mediterranean area of Croatia, but quite rare in the Continental region (cf. NIKOLIĆ, 2012). We collected only one sample in the researched area.

Chaenomeles japonica (Thunb.) Spach (Rosaceae, AC, P, RH, NEO). An ornamental species often planted in gardens, originating from Japan (NELSON, 1995). We found it only once outside culture. This taxon should be considered a casual alien plant.

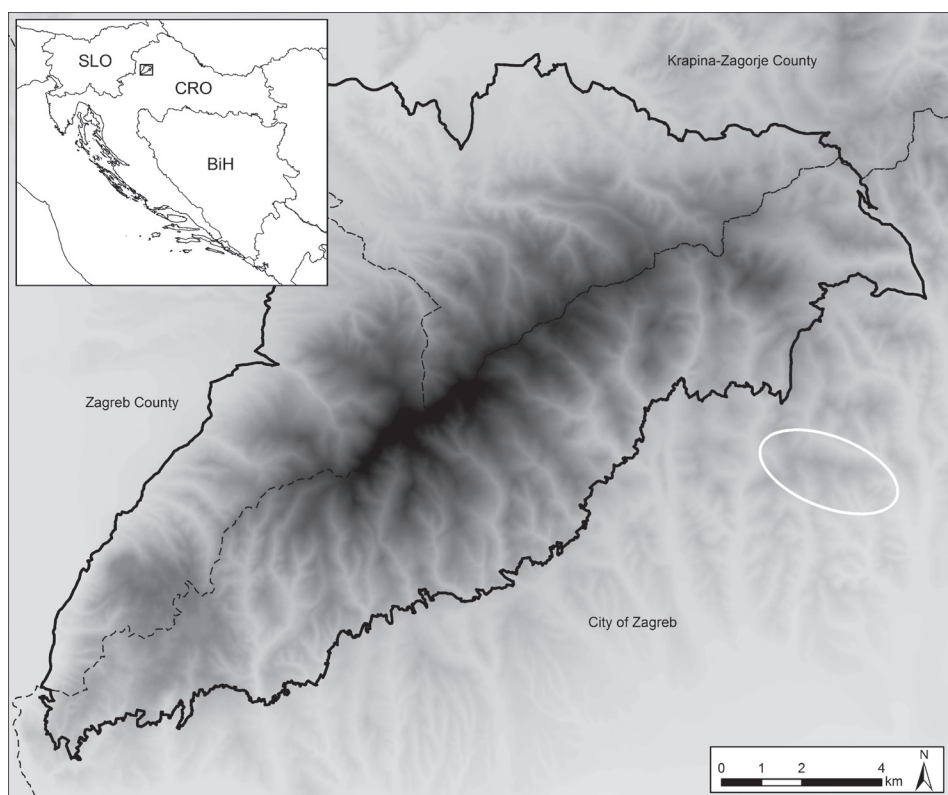


Fig. 1. Upper left corner – position of Mt Medvednica in Croatia. Larger image – Medvednica Nature Park is marked with black line and the studied area is indicated as a white oval circle.

Consolida ajacis (L.) Schur (Ranunculaceae, M, T, RH, NEO) (Fig. 2). The species is native in the Mediterranean area of Croatia (cf. NIKOLIĆ, 2012). It is treated as a neophyte species in the flora of the Czech Republic (PYŠEK *et al.*, 2012) and Slovakia (MEDVECKÁ *et al.*, 2012) and we consider this status appropriate for the Continental region of Croatia, because its occurrences in that area are lacking in historical data (cf. NIKOLIĆ, 2012). Also, due to its conspicuous white flowers it can be assumed that *C. ajacis* was grown as an ornamental plant (CULLEN & MAXWELL, 1989) and escaped from culture, which is supported by the fact that it was found near the cemetery in the settlement of Vugrovec. This appearance outside its natural area of distribution was the reason why we have not treated this taxon as a critically endangered (NIKOLIĆ & TOPIĆ, 2005) and strictly protected species (ANONYMOUS, 2013).

Eruca vesicaria (L.) Cav. (Brassicaceae, M, T, RH, NEO). A common species in the Mediterranean area, recorded for the first time in the Continental region. We found only few individuals at the edge of the road. This taxon should be considered as a casual alien plant, as in PYŠEK *et al.* (2012) for the flora of the Czech Republic.

Euphorbia nutans Lag. (Euphorbiaceae, AC, T, RH). A commonly and frequently recorded species in Croatian flora (cf. NIKOLIĆ, 2012). We found a few populations on abandoned land through the whole researched area.



Fig. 2. Habitus of *Consolida ajacis* (photo by D. Hruševar)

Galeopsis angustifolia Hoffm. (Lamiaceae, SE, T, RH) (Fig. 3). Previously recorded in Zagreb (cf. NIKOLIĆ, 2012). We found only a few individuals, near the edge of the road.

Galium laevigatum L. (Rubiaceae, SE, G, F). Previously recorded in Zagreb (cf. NIKOLIĆ, 2012). We found this taxon to be quite common in the forest of the alliance *Erythronio-Carpinion*.

Hordeum vulgare L. (Poaceae, AC, T, RH, AR). Probably a remnant of previous agriculture, it was found in several places through the whole researched area.

Hypericum tetrapterum Fr. (Clusiaceae, E, H, Aq). Previously recorded in Zagreb (cf. NIKOLIĆ, 2012). We found this taxon once, in a wet place.

Lotus corniculatus L. ssp. *hirsutus* Rothm. (Fabaceae, E, H, Gr). On the species level already known in the flora of Mt Medvednica (cf. NIKOLIĆ, 2012), but we recorded it for the first time at the infraspecific level. We found this taxon in warm and sunny places of south exposition, in grasslands of the alliance *Bromion erecti*.

Lotus glaber Mill. (Fabaceae, A, H, Gr). This species has been previously recorded in Zagreb (cf. NIKOLIĆ, 2012). We found it in a single locality in the researched area.

Malva neglecta Wallr. (Malvaceae, EA, T, RH, AR). A common and frequently recorded species in Croatia (cf. NIKOLIĆ, 2012). We found it at the edge of roads, in a nitrogen rich habitat, in vegetation of the order *Sisymbrietalia*.



Fig. 3. Habitus of *Galeopsis angustifolia* (photo by D. Hruševar)

Muscari neglectum Guss. ex Ten. (Liliaceae, SE, G, Gr). For the first time recorded in the NW part of Croatia, but known for the Continental region (cf. NIKOLIĆ, 2012). We found a few individuals on dry grassland of the alliance *Bromion erecti*.

Plantago media L. ssp. *stepposa* (Kuprian.) Soó. (Plantaginaceae, EEP, H, Gr). A rare taxon of the Croatian flora (cf. NIKOLIĆ, 2012). We found it in warm and sunny places of southern exposition, in grasslands of the alliance *Bromion erecti*.

Poa angustifolia L. (Poaceae, EA, H, Gr). This taxon has been previously recorded in Zagreb (cf. NIKOLIĆ, 2012). We found it only once in the researched area.

Pulmonaria mollis Hornem. (Boraginaceae, CE, H, Gr) (Fig. 4). Recorded more frequently in recent times (cf. NIKOLIĆ, 2012). Previously perhaps mistaken for forms of *Pulmonaria officinalis* L. or for *Pulmonaria obscura* Dumort. We found it on grasslands of the alliances *Arrhenatherion elatioris* and *Bromion erecti*.

Silene vulgaris (Moench.) Garcke ssp. *angustifolia* Hayek (Caryophyllaceae, E, H, Gr). A common taxon in the (Sub-)Mediterranean area, but with rare occurrence in the Continental region (cf. NIKOLIĆ, 2012). We found it in grasslands of the alliance *Bromion erecti*.



Fig. 4. Habitus of *Pulmonaria mollis* (photo by D. Hruševar)

Solanum lycopersicum L. (Solanaceae, AC, T, RH, NEO). Originating from Central and South America (MEDVECKÁ *et al.*, 2012), used for nutrition. We found it in several places outside culture. It should be considered a casual alien plant.

Thuja orientalis L. (Cupressaceae, AC, P, RH, NEO). An ornamental plant, originating from N China (LEWIS, 1990). We found it only once outside culture. This taxon should be considered a casual alien plant.

Thymus pulegioides L. ssp. *montanus* (Benth.) Ronniger (Lamiaceae, E, Ch, Gr). Taxon occurs in the Continental and Alpine region of Croatia (cf. NIKOLIĆ, 2012). We found it in warm and sunny places, in grasslands of the alliance *Bromion erecti*.

Valerianella carinata Loisel. (Valerianaceae, M, T, Gr and RH). Not a frequently recorded species in Croatia (cf. NIKOLIĆ, 2012). We found it only once, at the edge of the road.

Veronica triloba Opiz (Scrophulariaceae, SEE, T, RH, AR). Not a frequently recorded species in Croatia (cf. NIKOLIĆ, 2012). We found it several times, in dry places near the edge of roads.

Chorological analysis of new taxa shows that more than one third of them, if we calculate them together, are Adventives and Cultivars or originated from the Mediterranean. These species are naturally adapted to microclimatically warmer and drier habitats, as well as to those created by humans. In the latter case, native taxa are usually not competitive enough and the new species are able to find favourable growth and propagation conditions. (c.f. FERRER-CASTÁN & VETAAS, 2003). Lying on the calcareous bedrock, the eastern part of Mt Medvednica represents a dryer habitat than it would be according to the regional climate, enhancing the anthropogenic effect. Due to that fact, in the future, a higher presence of Adventives and Cultivars and Mediterranean chorology type can be expected out of culture, such as plants that are frequently grown in these days, e.g. *Phacelia tanacetifolia* Benth (cf. NIKOLIĆ, 2012) and *Lavandula* spp. (ŠILJKOVIĆ & RIMANIĆ, 2005), which have the potential to become casual or even naturalized non-native taxa in the broader area of Mt Medvednica, or in the Continental biogeographical region of Croatia, as well. The high amount of therophytes among new taxa (39,1%) are connected with intense anthropogenic influence on the researched area. Annual plants produce large numbers of easily transmitted seeds which enable fast and successful reproduction and dispersal (GRIME, 1979). Thus, it is not surprising that the new species occur mainly on ruderal habitats (43.5%), and open grasslands (39.1%) which are under a moderately or intensively anthropogenic influence.

Species confirmed after 50 years or more

Allium oleraceum L. (Liliaceae, EA, G, Gr). Previously quoted in the first half of the 20th century by Pevalek, Herbarium ZA (1929). We found this taxon in several places, on grasslands in succession belonging to the alliance *Bromion erecti*.

Arctium tomentosum Mill. (Asteraceae, EA, H, RH, AR). Previously quoted by FORENBACHER (1908). We found this taxon in several places on arable land, in an area adjacent to "closed" vegetation.

Carex caryophylla Latourr. (Cyperaceae, EA, H, Gr). Quoted last time in the middle of the 19th century (KLINGGRÄFF, 1861) but frequently recorded in Zagreb (cf. NIKOLIĆ, 2012). We found this taxon on warm and sunny places, in grasslands of the alliance *Bromion erecti*.

Crepis tectorum L. (Cichoriaceae, EA, T, Gr, AR). Previously quoted in the middle of the 20th century (BEVILACQUA, 1957). We found this taxon on open grasslands.

Cucubalus baccifer L. (Caryophyllaceae, EA, G, RH). Previously quoted by FORENBACHER (1908). We found this taxon next to houses in the settlement of Šimunčevac.

Dichanthium ischaemum (L.) Roberty (Poaceae, EA, H, Gr). Previously quoted by FORENBACHER (1908). We found this taxon in warm and sunny places, in highly anthropogenically influenced grasslands of the alliance *Bromion erecti*.

Dorycnium herbaceum Vill. (Fabaceae, SEE, Ch, Gr). Previously quoted in the middle of the 20th century (KUIŠ, 1955). We found this taxon on a warm and sunny place, in grasslands of the alliance *Bromion erecti*.

Hippocrepis comosa L. (Fabaceae, E, Ch, Gr). Previously quoted by FORENBACHER (1908). We found this taxon in warm and sunny places, in grasslands of the alliance *Bromion erecti*.

Holosteum umbellatum L. (Caryophyllaceae, M, T, RH). Previously quoted by FORENBACHER (1908). We found this taxon as a weed in a crop field in the settlement of Čučerje.

Iris pseudacorus L. (EA, G, Aq, SPT). Previously quoted by FORENBACHER (1908) but frequently recorded for the Continental region of Croatia (cf. NIKOLIĆ, 2012). We found this taxon only once, in a ditch.

Kickxia spuria (L.) Dumort. (Scrophulariaceae, M, T, RH). Previously quoted by FORENBACHER (1908). We found this taxon several times on abandoned agricultural land.

Lepidium ruderales L. (Brassicaceae, EA, T, RH, AR). Previously quoted in the middle of the 20th century (MARKOVIĆ-GOSPODARIĆ, 1965). We found this taxon several times on arable land.

Oenothera biennis L. (Onagraceae, AC, H, RH, NEO - IAS). Previously quoted by FORENBACHER (1908). An ornamental species often planted in gardens; we found it on several places outside culture.

Ornithogalum pyrenaicum L. (Liliaceae, SE, G, F). Previously quoted by FORENBACHER (1908). We found this taxon in a single place, in the open stands of a forest belonging to the alliance *Erythronio-Carpinion*, where a few individuals have been grown.

Orobanche gracilis Sm. (Orobanchaceae, EA, G, Gr). Previously quoted in the middle of the 20th century (BEVILACQUA, 1957). We found this taxon several times on warm and sunny places, in grasslands of the alliance *Bromion erecti*.

Peucedanum alsaticum L. (Apiaceae, SEE, H, FE). Previously quoted by FORENBACHER (1908). Not frequently recorded in Croatia (cf. NIKOLIĆ 2012). We found this taxon only once, in fringe vegetation of the alliance *Geranion sanguinei*.

Prunella laciniata (L.) L. (Lamiaceae, EA, H, Gr). Previously quoted in the middle of the 20th century (URLIĆ-IVANOVIĆ, 1952). We found this taxon on warm and sunny places, in grasslands of the alliance *Bromion erecti*.

Ranunculus polyanthemos L. (Ranunculaceae, EA, H, Gr). Previously collected by Pevalek, Herbarium ZA (1928). We found this taxon on the grassland in succession, near fringe vegetation of the alliance *Geranion sanguinei*.

Rosa corymbifera Borkh. (Rosaceae, EA, P, Co). Quoted only once, in the middle of the 20th century (HERMAN, 1969). We found this taxon on grassland in succession belonging to the alliance *Bromion erecti*.

Scrophularia umbrosa Dumort. (Scrophulariaceae, EA, H, Aq). Not frequently recorded in Croatia (cf. NIKOLIĆ, 2012) and for Mt Medvednica quoted only once, in the middle of the 20th century (BEVILACQUA, 1957). We found this taxon several times, in wet places.

Thalictrum flavum L. (Ranunculaceae, E, H, Gr). Previously collected by Pevalek, Herbarium ZA (1910). We found this taxon in a single place, in the wet grassland near the stream of Čučerje.

Verbascum blattaria L. (Scrophulariaceae, EA, H, Gr and FE). Frequently recorded in Croatia and for Mt Medvednica and quoted in the middle of the 20th century (BEVILACQUA, 1957). We found this taxon throughout the whole researched area.

Verbascum chaixii Vill. ssp. *austriacum* (Schott ex Roem. et Schult.) Hayek (Scrophulariaceae, EEP, H, Gr, DD). Previously quoted in the middle of the 20th century (ŠUTIĆ-SUHIĆ, 1952). We found this taxon only once, on grassland in succession of the alliance *Bromion erecti*.

Veronica anagallis-aquatica L. (Scrophulariaceae, EA, H, Aq). Previously collected by Pevalek, Herbarium ZA (1910). We found a few individuals in the stream of Čučerje.

Among the 24 taxa confirmed, the grass species *Dichanthium ischaemum* seems interesting, because it was not recorded in the most recent researches into Medvednica Nature Park (MAREKOVIĆ *et al.*, 2009). Special attention should be given to *Oenothera biennis*, the only invasive species among the taxa presented in this article. It has not been confirmed for the area of Medvednica Nature Park (VUKOVIĆ *et al.*, 2010), but it is just matter of time when it will become the 28th on the list of invasive species for that area. Continuous monitoring of alien plants, especially new and invasive taxa is required on the whole area of Mt Medvednica, inside (VUKOVIĆ *et al.*, 2010), as well as outside the Nature Park.

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SAŽETAK

Nova zapažanja vaskularne flore na području Medvednice

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Florističkim istraživanjem istočnog dijela Medvednice (Zagrebačka gora), provedenim u razdoblju od 2007. do 2009. g., zabilježene su 23 nove svojte vaskularne flore. Trećina novozabilježenih svojti su strane vrste, kultivirane još u davnoj prošlosti, poput ječma *Hordeum vulgare*, ili neofiti poput ukrasne japanske dunje *Chaenomeles japonica*. Po prvi je puta zabilježena na području Medvednice *Pulmonaria mollis*, česta vrsta plućnjaka na istraživanom području, koja je zapažana vjerojatno i u prošlosti, ali je zbog taksonomske složenosti roda i otežane determinacije vrlo vjerojatno krivo određivana. Većina novootkrivenih vrsta nepo-

voljne uvjete preživljava u obliku terofita, što je usko povezano s antropogenim utjecajem i ruderalnim staništima kojima su se novootkrivene svojite najbolje prilagodile. Istraživanjem je također potvrđeno prisutstvo 24 biljne svojite čiji se nalazi u posljednjih pedesetak godina, ili čak više od stoljeća, ne bilježe za područje Medvednice. To je uzrokovano dijelom stoga što su floristička i vegetacijska istraživanja uglavnom usmjerena na područje Parka Prirode koje je izloženo nešto slabijem antropogenom pritisku, izuzev skijaške staze i planinarskih domova, i koje je uglavnom prekriveno stabilnim šumskim sastojinama. Samo je jedna od novozabilježenih svojiti invazivna – dvogodišnja pupoljika *Oenothera biennis*, i za očekivati je da će se, s povećanjem broja izletnika te izgradnjom novih stambenih ili infrastrukturnih objekata, i ona proširiti iz rubnih prema središnjim dijelovima masiva. Potvrda prisutstva svojiti poput *Hippocrepis comosa*, *Holosteum umbellatum* ili *Peucedanum alsaticum* značajna je tim više što se navedene vrste rijetko bilježe za šire zagrebačko područje, kao i za čitavi sjeverozapadni dio Hrvatske.