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# REVISION OF *EPILOBIUM* AND CHAMERION IN THE CROATIAN HERBARIA ZA AND ZAHO

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**Strgulc Krajšek, S., Šegedin, T. & Jogan, N.: Revision of *Epilobium* and *Chamerion* in the Croatian herbaria ZA and ZAHO. Nat. Croat., Vol. 18, No. 1, 155–167, 2009, Zagreb.**

*Epilobium* (s. lat.) herbarium material in two major Croatian herbaria ZA and ZAHO was revised. The results of the revision of over 400 herbarium sheets confirmed the occurrence of 13 species already reported for Croatia and only slightly changed their known distribution patterns. However two species previously reported for Croatia and represented also by some herbarium sheets turned out to be wrongly determined, the results being that there is now no reliable confirmation of *E. alsinifolium* and *E. alpestre* from the territory of Croatia. Summarized results of the revision are also presented and they demonstrate the comparably good level of correctly determined material in the studied herbaria (but with some taxa much less reliably determined) and an alarmingly low state of collecting activity in the last decades.

**Key words**: *Epilobium*, *Chamerion*, *Chamaenerion*, flora, Croatia, herbarium ZA, herbarium ZAHO, distribution maps

**Strgulc Krajšek, S., Šegedin, T. & Jogan, N.: Revizija rodova *Epilobium* i *Chamerion* u hrvatskim herbarima ZA i ZAHO. Nat. Croat., Vol. 18, No. 1, 155–167, 2009, Zagreb.**

Revidiran je herbarski materijal *Epilobium* (s. lat.) iz dva velika hrvatska herbara ZA i ZAHO. Rezultati revizije više od 400 herbarskih listova su potvrdili prisutnost 13 vrsta već poznatih za Hrvatsku i samo ponešto promijenili njihovu rasprostranjenost. Dvije vrste prethodno zabilježene za Hrvatsku te prisutne nekim herbarskim listovima, pokazale su se krivo determinirane, pa tako zasad nema utemeljene potvrde za prisutnost *E. alsinifolium* i *E. alpestre* na teritoriju Hrvatske. Rad

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donosi sveukupne rezultate revizije, koji pokazuju relativno dobru razinu ispravno determiniranog materijala u obrađivanim herbarima (s nekim mnogo manje pouzdano determiniranim svojtama) i alarmantno slabu sakupljačku aktivnost zadnjih desetljeća.

**Ključne riječi**: *Epilobium*, *Chamerion*, *Chamaenerion*, flora, Hrvatska, herbar ZA, herbar ZAHO, karte rasprostranjenost

## INTRODUCTION

*Epilobium* is a large genus with approximately 165 species. Two out of the eight sections, *Epilobium* and *Chamaenerion* are cosmopolitan. The *Chamaenerion* group is a sister group to the rest of the genus and so it is often treated as separate genus (BAUM *et al.*, 1994) with the correct name of *Chamerion* (HOLUB, 1972).

According to the Flora Europaea (RAVEN, 1980) 24 species of the section *Epilobium* grow wild in Europe. Due to their superficial similarity, more than half of them can be treated as taxonomically critical with a relatively high proportion of misidentified herbarium material and consequently unreliable published records. Additionally, confusion is also caused by frequent interspecific hybridisation. In Croatia, 15 species of *Epilobium* and *Chamerion* have been recorded (REGULA-BREVILACQUA, 1997 & STRGULC KRAJŠEK & JOGAN, 2004), so it was expected that they would be available also as herbarium specimens in the two biggest herbarium collections in Croatia (ZA, ZAHO). Herbarium ZAHO is the historical collection of Croatian botanist I. Horvat. Herbarium ZA is the biggest collection in Croatia and has the status of national herbarium collection.

The main goal of our research was the revision of herbarium material of the herbaria ZA and ZAHO and comparison of the results with known distribution maps of *Epilobium* and *Chamerion* species for Croatia compiled in the Flora Croatica database (FCD).

## MATERIAL AND METHODS

All herbarium specimens from Herbaria ZA and ZAHO were revised. The data from herbarium labels were gathered as follows: determination before revision, determination after revision, author (collector) of herbarium sheet, date (year) of collecting and locality (with different levels of accuracy). The topographic accuracy of locality was dependent on the data on herbarium label and the legibility of the author's handwriting.

We have identified the region for every herbarium specimen. The regions were used as basis for comparison of herbarium and data compiled in Flora Croatica Database.

The data gathered during revision were used also for some other analyses: age of specimens in herbaria, number of specimens and species collected in different regions, accuracy of determination by authors, accuracy of determinations of *Epilobium* and *Chamerion* species.

Only material collected in Croatia from Herbaria ZA and ZAHO was included in analyses.

Synonyms used on labels of some old herbarium specimens were changed according to ICBN (McNeill *et al.*, 2006, http://ibot.sav.sk/icbn/main.htm) during revision.

## RESULTS AND DISCUSSION

### Age and authors of herbarium specimens

In the herbarium ZAHO 43 specimens of genera *Epilobium* and *Chamerion* from Croatia and 37 from abroad are stored. The oldest specimen was collected in 1918, and the most recent in 1951 (Fig. 1).

In the herbarium ZA, 380 specimens of the studied genera were stored until the year 2000. Of these, 334 were collected in Croatia. The oldest specimen was collected in 1830, and the most recent in 1999 (Fig. 1).

Authors with highest numbers of specimens in both collections were Rossi, Hirc, Horvat, Marković, Schlosser and Vukotinović (Fig. 2).

The overall impression is that the majority of herbarium specimens from both herbaria are old and that there is very small amount of recent herbarium specimens (only 13 specimens in the last 15 years) (Fig. 1).

### Reliability of determinations

Comparison of determinations before and after revision is shown in Tab. 1. Before the revision 61 specimens were not determined or were named only to the

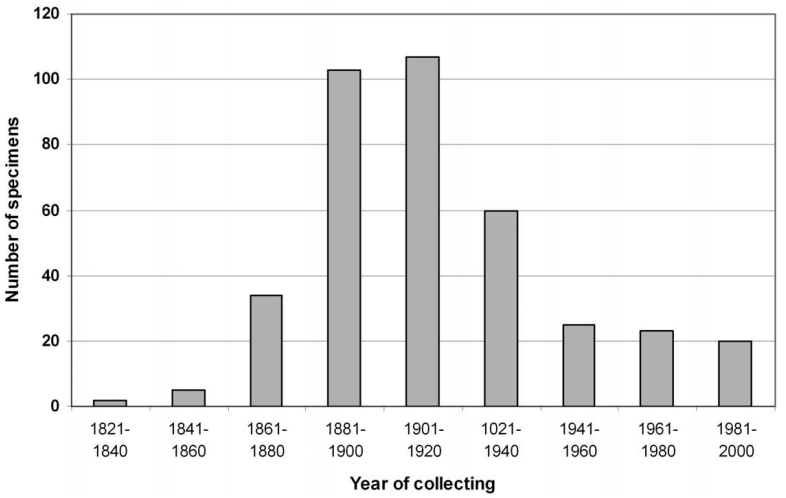


**Fig. 1.** Age of herbarium specimens in Herbaria ZA and ZAHO.

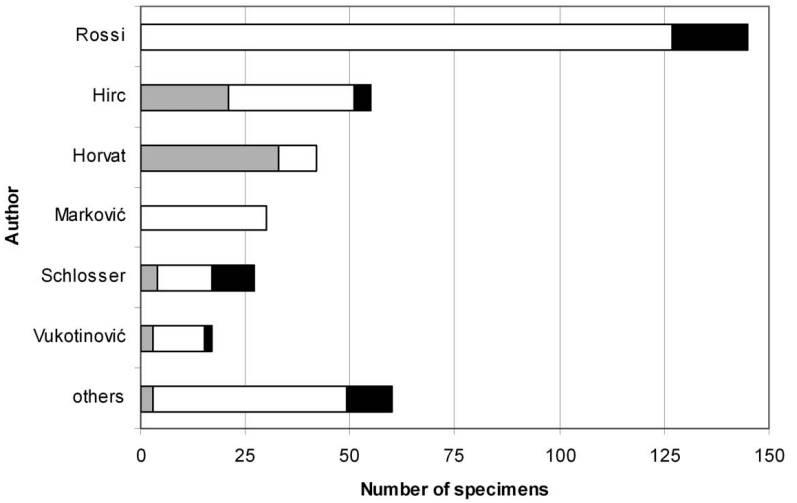


**Fig. 2.** Number of specimens of main collectors from Herbaria ZA and ZAHO collected in Croatia and correctness of their determination. Legend: white – correct determination, grey – no determination (or determination as *Epilobium* sp.), black – wrong determination.

level of genus. All of them were well preserved and were determined in revision. Seven other specimens remained undetermined after the revision. The most frequent among them are hybrids, where it was not possible to determine more than one of the parent species.

The species most represented in the studied herbaria is *E. montanum*. That was very expected, considering the results of similar analyses made in neighbouring Slovenia (STRGULC KRAJŠEK, 2006).

The important result is that *E. alpestre* and *E. alsinifolium* listed in Index Florae Croaticae (REGULA-BREVILACQUA, 1997) have no material from the area of Croatia in the revised herbaria. It does not mean that they are not present in the Croatian flora, but careful analysis of published records, biogeographic analysis, field sampling in reported localities and revision of other herbaria is needed to check their status. The specimen collected and determined as *E. alpestre* by Gušić in 1919 was a wrongly determined specimen of *Chamerion angustifolium*; similarly 4 specimens collected and determined as *E. origanifolium* (synonym of *E. alsinifolium*) by Schlosser in 19$^{th}$ century turned out to be *C. angustifolium*, too.

In Slovenia *E. alsinifolium* is a rare species confined to high altitudes in the Alps. One published record from Snežnik (near the Croatian border) (PISKERNIK, 1977) is not confirmed by a herbarium specimen, so it can be treated as questionable. From the description of both localities published in FCD (Strahinjščica, Hrvatsko zagorje (leg. REGULA-BEVILACQUA & ŠEGULJA, 2000), Pjesak brdo, Drenovec potok, Medvednica, Park prirode Medvednica (leg. Jelaska 1998)) we can conclude that the presence of *E. alsinifolium* in Croatia is questionable, but its scattered distribution in the

**Tab. 1.** Comparison of determinations before and after revision of *Epilobium* and *Chamerion* specimens from Herbaria ZA and ZAHO. Legend: CANG – *Chamerion angustifolium*, CDOD – *C. dodonaei*, EALP – *Epilobium alpestre*, EALS – *E. alsinifolium*, ECIL – *E. ciliatum*, ECOL – *E. collinum*, EHIR – *E. hirsutum*, ELAM – *E. lamyi*, ELAN – *E. lanceolatum*, EMON – *E. montanum*, EOBS – *E. obscurum*, EPAL – *E. palustre*, EPAR – *E. parviflorum*, EROS – *E. roseum*, ETET – *E. tetragonum*, ESP – *Epilobium* sp, x – hybrid.

| | | determination after revision | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CANG | CDOD | EALP | EALS | ECIL | ECOL | EHIR | ELAM | ELAN | EMON | EOBS | EPAL | EPAR | EROS | ETET | ESP | ∑ |
| determination before revision | CANG | 35 | 4 | | | | | | | | | | | | | | | 39 |
| | CDOD | 1 | 10 | | | | | | | | | | | | | | | 11 |
| | EALP | 1 | | | | | | | | | | | | | | | | 1 |
| | EALS | 4 | | | | | | | | | | | | | | | | 4 |
| | ECIL | | | | | | | | | | | | | | | | | 0 |
| | ECOL | | | | | | 5 | | 3 | 2 | | | | | | | 4 | 14 |
| | EHIR | | | | | | | 49 | | | | | | | | | | 41 |
| | ELAM | | | | | | | | 15 | | | | | | | 4 | | 19 |
| | ELAN | | | | | | | | | 2 | | | | | 1 | | | 3 |
| | EMON | | | | | | | | | | 109 | | | 1 | | | 1 | 111 |
| | EOBS | | | | | | | 1 | 1 | | | 2 | | 1 | 2 | | | 7 |
| | EPAL | | 1 | | | | | | | | | 1 | 5 | 1 | | | | 8 |
| | EPAR | | | | | | | 1 | | | | | | 37 | | | | 39 |
| | EROS | | | | | 1 | | 1 | | | 3 | | | | 3 | | | 8 |
| | ETET | | | | | 1 | | | 3 | | 1 | 1 | | | | 1 | | 7 |
| | ESP | 10 | 1 | | | | 1 | 5 | 4 | | 28 | 1 | 1 | 7 | 3 | | | 61 |
| | X | 1 | | | | | | | | | | | | 1 | | | 1 | 3 |
| | ∑ | 52 | 16 | 0 | 0 | 2 | 6 | 49 | 26 | 4 | 141 | 5 | 6 | 48 | 9 | 5 | 7 | 376 |

Balkan peninsula suggests that it might well occur in the subalpine areas of Croatia. There is a similar situation with *E. alpestre*. In Slovenia it is present only in the Alps. The species is very easily recognisable, so it is highly unlikely that it could have been overlooked in southern Slovenia, e.g. on Snežnik. There are probably proper ecological conditions in the Risnjak and Bjelolasica area, but for confirmation of records, published in FCD (NP Risnjak (leg. Šegulja *et al*. 1994), Bjelolasica (leg. Alegro 2001)), vouchers have to be checked.

The most difficult to determine and with the greatest percentage of incorrectly determined specimens were species of *Epilobium tetragonum* group (*E. tetragonum*, *E. lamyi* and *E. obscurum*). The distinguishing characters are small and can be easily overlooked or misinterpreted. One of the reasons for a lot of misdetermination in this group is the determination key in Mala flora Hrvatske (DOMAC, 1994) which includes only some unreliable distinguishing characters.

In total, 71 % of specimens were determined correctly, 17 % were not determined and 12 % had a wrong determination. The reliability of the most important authors of herbarium specimens is shown in Fig. 2. The percent is comparable to results in other herbaria (LJU, W, M) in revisions of critical genera.

## Distribution of *Epilobium* and *Chamerion* species in Croatia

The known distribution of *Epilobium* and *Chamerion* species in Croatian regions based on Flora Croatica database and revision of herbarium material is shown in Tab. 2.

Some herbarium labels from herbarium ZA are very incomplete. Important data, such as exact description of locality, date and author are missing. Sometimes very illegible writing is the reason for unreliable reading of some labels. About 15 % of labels were excluded from our analyses for one of those reasons. Only the specimens where it was possible to recognize locality at least at the level of regions were included in the analysis, so 50 specimens remained geocoded only to the level of country.

The macroregions with least specimens and species are Mediterranean and East Pannonian. In the herbaria there are specimens of 6 species of *Epilobium* and *Chamerion* collected in the **Mediterranean macroregion**: *C. angustifolium*, *E. hirsutum*, *E. lamyi*, *E. montanum* and *E. parviflorum*. A herbarium specimen for *E. tetragonum* s. str. from this macroregion is stored in Herbarium LJU. In the FCD there are also data for *C. dodonaei* and *E. palustre*. Both of those species are expected in this macroregion. There is no herbarium specimen from the southern mesoregion at all and only few published data.

**East Pannonian macroregion** has more data from publications and field observations. Only *C. angustifolium* and *E. montanum* are represented in herbaria. Published data show a more complete situation. Some species, such as *E. ciliatum*, an invasive species from North America, which is spreading towards south and east (STRGULC KRAJŠEK & JOGAN, 2004), *E. roseum* and *E. tetragonum* s. str. are also expected in this part of Croatia. All three species are common on ruderal sites in lowlands in the neighbouring Slovenia.

**Tab. 2**. Known distribution of *Epilobium* and *Chamerion* species in Croatian regions based on Flora Croatica database (grey field – data from publications, striped field – data from observations) and revision of herbarium material. The first number in field shows the number of herbarium specimens from herbaria ZA and ZAHO, the number after symbol »+» represent Croatian material from Herbaria LJU and WU.

| | Mediterranean macroregion | | | Mountain macroregion | | | West-Pannonian macroregion | | | | | | | East/Pannonian macroregion | | | | | Croatia | ∑ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | c1 | c2 | c3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | | |
| C. angustifoliun | | 1 | | 1 | 1 | 11 | | | 3 | 21 | 2 | | 1 | | | 1 | | 2 | 2 | 46 |
| C. dodonaei | | | | | | 1 | | | | 9 | | | | | | | | | 5 | 15 |
| E. alpestre | | | | | | | | | | | | | | | | | | | | 0 |
| E. alsinifolium | | | | | | | | | | | | | | | | | | | | 0 |
| E. ciliatum | | | | | | | | | | 2 | 0+2 | | | | | | | | | 2+2 |
| E. collinum | | | | 2 | | | | 1 | | 1 | | | | | | | | | 2 | 6 |
| E. hirsutum | 1 | 3 | | 4 | 1 | 2 | | 2 | 6 | 12 | 3 | | 1 | | | | | | 8 | 43 |
| E. lamyi | | 1 | | | | 1 | 1 | | 5 | 6 | 0+3 | 1 | 1 | | | | | | 9 | 25+3 |
| E. lanceolatum | | | | | | | | 1 | | 3 | | | | | | | | | | 4 |
| E. montanum | | 2 | | 15 | 2 | 44 | | 3 | 8 | 29 | | 2 | 1 | | | | | 4 | 9 | 119 |
| E. obscurum | | | | 1 | | 1 | | | | 1 | | | | | | | | | 1 | 4 |
| E. palustre | | | | 3 | | | | | | | | | | | | | | | 1 | 4 |
| E. parviflorum | 2 | | | 2 | | 3 | | 3 | 10 | 14 | 0+2 | | | | | | | | 12 | 46+2 |
| E. roseum | | | | 3 | | 2 | | | | 1 | | | 1 | | | | | | 1 | 8 |
| E. tetragonum s. str. | 0+1 | | | | 1 | | | | 3 | 2 | 0+5 | | | | | | | | | 5+6 |
| E. tetragonum s. str. | | | | | | 1 | | | | | | | | | | | | | | 0 |
| ∑ | 3+1 | 7 | 0 | 31 | 4 | 65 | 1 | 10 | 35 | 101 | 5+12 | 3 | 5 | 0 | 0 | 1 | 0 | 6 | 50 | 327 |

In two macroregions that also include higher altitudes, more *Epilobium* and *Chamerion* species can be found. It seems also that the Mountain and West-Pannonian macroregions are more interesting for botanists, resulting in more floristic data in FCD and herbaria.

In the mesoregion that includes the capital Zagreb, the most *Epilobium* and *Chamerion* species are recorded, and 12 of them also confirmed with herbarium specimens. For two additional species (*E. palustre* and *E. lanceolatum)* records are given in FCD. *E. palustre* is highly expected in the region. One of the reasons for large number of specimens in this mesoregion is the good accessibility of the region and therefore maybe it is more intensely investigated.

## Known and expected distribution of *Chamerion* and *Epilobium* species in Croatia

### *Chamerion angustifolium* (L.) Holub

Frequently used synonyms: *Epilobium angustifolium* L., *Chamaenerion angustifolium* (L.) Scop., *Epilobium spicatum* Lam.

*C. angustifolium* is a common species, very easy to recognise. It has been recorded in all Croatian macroregions, but it is more frequent in western part of Croatia in higher altitudes. It is especially ecologically connected to forest clearings, open spaces along forest roads and forest edges in higher altitudes. In revised herbaria it was sometimes misdetermined as *C. dodonaei*, despite very clear discrimination characters.

### *Chamerion dodonaei* (Vill.) Holub

Frequently used synonyms: *Epilobium dodonaei* Vill., *Chamaenerion palustre* Scop., *Epilobium rosmarinifolium* Haenke in Jacq.

*C. dodonaei* is also a common species, easy to recognise. In revised herbaria there were some misdeterminations, in which it was identified as *C. angustifolium*. The species is ecologically connected to sandy and rocky places and also dry ruderal sites. In Croatia it is expected especially in the western part, and also in the coastal regions. As expected it has not been recorded in the East Pannonian macroregion.

### *Epilobium hirsutum* L.

*E. hirsutum* is one of the widespread *Epilobium* species, with the biggest flowers of the Croatian representatives of the genus *Epilobium* (s. str.). The species is more common in the lowlands. It occurs in wet habitats especially in wet ditches among roads in places rich in nitrates. It has been recorded in all Croatian macroregions, and very few data for East-Pannonian macroregion does not mean that the species is very rare in that part of Croatia. Due to the high percentage of correctly determined specimens of *E. hirsutum* we can also have confidence in the published data.

### *Epilobium parviflorum* Schreb.

Frequently used synonym: *Epilobium intermedium* Mérat

*Epilobium parviflorum* is also one of the most widespread *Epilobium* species. It is expected in all regions of Croatia, including the Pannonian part and in the coastal regions. It does not occur only in high (subalpine, altimontane) altitudes. It is connected to very moist to wet habitats. Sometimes it is mistaken for *E. roseum*, despite the discrimination characters among these two species, which are very clear. The stigma of *E. parviflorum* is 4-lobed and of *E. roseum* clavate and the inferior parts of *E. parviflorum* and fully developed leaves are densely covered with up to 0.5 mm long unglandular trichomes. Trichomes of *E. roseum* are always much shorter (up to 0.3 mm).

### *Epilobium montanum* L.

*E. montanum* is the most frequent of all the *Epilobium* species in Croatia. In contrast to the majority of other *Epilobium* species it is ecologically connected to dry to moderately moist forest edges and light forests. It is expected in all parts of Croatia, except the most warm and dry coastal parts and very ruderal Pannonian lowlands. Specimens of *E. montanum* can be misdetermined as *E. collinum*, a much more rare *Epilobium* species.

### *Epilobium collinum* C. C. Gmel.

*E. collinum* is a rare *Epilobium* species, frequently mistaken for the very common species *E. montanum* and the very rare *E. lanceolatum*. The main difference among this species and both others is the absence of erect glandular trichomes on the calyx and fruit of *E. collinum*. They are present on *E. montanum* and *E. lanceolatum*. *E. collinum* occurs on silicate rocks and wet places on silicate. Only sometimes can it be found on carbonate. The species is more frequent in western part of Croatia, in the Mountain and West Pannonian macroregions. The data published in FCD from the East Pannonian region (Slavonia, leg Tomašević 1998) have to be checked before any conclusions are made.

### *Epilobium lanceolatum* Sebast. & Mauri

*E. lanceolatum* is a very rare European *Epilobium* species connected to light forests on silicate. There is only one locality with a recent finding of this species in Croatia, Mt Medvednica near Zagreb, confirmed also with herbarium specimens. Published data are not very reliable, because of the high similarity of the species to *E. montanum* and *E. collinum*.

### *Epilobium palustre* L.

In the revision of the genus *Epilobium* in Slovenia (STRGULC KRAJŠEK, 2006) it was found out that *E. palustre* is a more critical species than was known before. The first reason is the unintentional misidentification with *Chamerion dodonaei* with the synonym *Chamaenerion palustre*, which makes distribution maps unclear and unreliable. The second reason is the variability in themorphological characters of the species. Plants from different habitats differ morphologically to a great extent. The species is related to endangered wet habitats, so it is potentially endangered. Its distribution in Croatia is scattered. The species is expected in all macroregions, expect close to the coast.

### *Epilobium tetragonum* L.

Frequently used synonym: *Epilobium adnatum* Griseb.

*Epilobium tetragonum* is one of those *Epilobium* species that typically occur in lowlands, mostly on wet or moist ruderal sites. Morphologically it is very similar to *E. lamyi* and therefore misdeterminations are frequent. This has to be taken into consideration when published data are used. The species is expected in all lowland parts of Croatia, also on the coast including the islands.

### *Epilobium lamyi* F. W. Schultz

*E. lamyi* is sometimes treated as a subspecies of *E. tetragonum* (RAVEN, 1980). In Mala Flora Hrvatske (DOMAC, 1994) it is published at species level, but it is difficult to make correct determination of the material because of unreliable characters used in the key. In this publication it is asserted incorrectly that *E. lamyi* occurs in forests. This is not true, because the most common habitats of *E. lamyi* are ruderal and other well illuminated sites with moderate humidity. It is expected in all lowland parts of Croatia.

### *Epilobium obscurum* Schreb.

Frequently used synonym: *Epilobium virgatum* Lam.

*E. obscurum* is a rare species, connected to wet habitats, preferably on silicate. Morphologically it is very similar to *E. lamyi*. The most obvious difference is the presence of long green stolons on *E. obscurum*, which can be easily torn off when the plant is collected carelessly. The second discrimination character is the presence of tiny glandular trichomes on the calyx of *E. obscurum*. *E. lamyi* is always completely without glandular trichomes.

### *Epilobium roseum* Schreb.

*E. roseum* is a very common species in lowlands, mostly on moist ruderal sites. It does not have any very peculiar discrimination character, and maybe this is the main reason for the many misdeterminations. It has been mistaken for *E. obscurum, E. ciliatum, E. montanum, E. hirsutum* and *E. ciliatum*. In FCD there are very few records for the species but because of the distribution map in Slovenia it must have been overlooked in Croatia.

### *Epilobium ciliatum* Raf.

*E. ciliatum* is connected to similar habitats as *E. roseum*, and they often occur together. *E. ciliatum* is a weak invasive species from North America spreading from north east Europe southwards and eastwards. The first published recording for Slovenia is from 1993 and for Croatia from 2001 for Hrvatsko Zagorje (STRGULC KRAJŠEK & JOGAN, 2004). In the revised herbarium material from ZA there were two herbarium sheets with *E. ciliatum*, one determined as *E. roseum* and the other as *E. tetragonum*. Both specimens were from Zagreb and surroundings, the first from 1992 and the second from 1996.

*Epilobium alpestre* (Jacq.) Krock.

Frequently used synonym: *Epilobium trigonum* Schrank

As already stated the status of *E. alpestre* in the flora of Croatia is questionable. The published presence in NP Risnjak and Bjelolasica has to be checked before any reliable conclusions can be drawn.

*Epilobium alsinifolium* Vill.

Frequently used synonym: *Epilobium origanifolium* Lam.

The second species with a questionable status in the flora of Croatia is *E. alsinifolium*. In the revised herbaria there was no specimen of the species and all the published data included in FCD are doubtful, but its scattered distribution in the Balkan peninsula shows that it could well occur in subalpine areas of Croatia.

## Conclusions

After the revision of herbaria ZA and ZAHO, the occurrence of 11 *Epilobium* species and 2 *Chamerion* species are confirmed in the flora of Croatia. *E. alpestre* and *E. alsinifolium* listed in Index Florae Croaticae (REGULA-BEVILACQUA, 1997), have no material from the area of Croatia in revised herbaria. This does not mean, that they are not present in Croatian flora, but careful analysis of published records, biogeographic analysis, field sampling on known localities and revision of other herbaria is needed to check their status.

The level of correct determination of herbarium material is low, but quite comparable to the situation in some other European herbaria. Several widespread taxa are under-recorded. There are huge areas of Croatia with very low coverage, especially the eastern parts of Croatia and northern ruderal areas. For a clearer picture of distribution and ecology of *Epilobium* species in Croatia, much more attention should be focused on systematic sampling of the genus in Croatia and neighbouring regions.

Some authors have a high percentage of wrongly determined herbarium material. It is important to be critical, when using published data based on those determinations.

It is important to use other determination keys from neighbouring countries instead of the determination key in Mala Flora Hrvatske (DOMAC, 1994). Critically written determination keys that include all species from the Croatian flora and can be used for the determination of Croatian material are in Austrian Exkursionsflora (FISCHER *et al.*, 2005) and in Mala flora Slovenije (MARTINČIČ *et al.*, 2007).

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## SAŽETAK

### Revizija rodova *Epilobium* i *Chamerion* u hrvatskim herbarima ZA i ZAHO

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*Epilobium* je jedan od najvećih rodova porodice Onagraceae s približno 165 vrsta. Unutar roda *Epilobium* postoje dvije sekcije, Epilobium i Chamenerion, koje su rasprostranjene širom svijeta. Sekcija Chamaenerion je bliska s ostatkom roda (*Epilobium* s. str.) i često se tretira kao zaseban rod (BAUM *et al*., 1994) pod imenom *Chamerion* (HOLUB, 1972). Prema djelu Flora Europaea (RAVEN, 1980) navode se 24 vrste roda *Epilobium* koje su rasprostranjene širom Europe.

U Hrvatskoj je do sada zabilježeno 15 vrsta *Epilobium* i *Chamerion* (REGULA BEVILACQUA, 1997; STRGULC KRAJŠEK & JOGAN, 2004), i za očekivati je da će ovi rodovi biti zastupljeni, kao herbarski primjerci u zbirkama ZA i ZAHO.

Hrvatski herbarij (Herbarium Croaticum, ZA) najveća je zbirka u državi i spada u kategoriju zbirke od nacionalnog značaja. Herbarij Ivo & Marija Horvat (ZAHO) plod je marljivog rada hrvatskog botaničara Ive Horvata i njegove supruge Marije.

Glavni cilj istraživanja bio je revidiranje herbarskog materijala i kompariranje rezultata s poznatim kartama rasprostranjenosti vrsta rodova *Epilobium* i *Chamerion* na području Hrvatske, a prema bazi podataka Flora Croatica (FCD). Revidirani su svi herbarski primjerci iz Herbarija ZA i Herbarija ZAHO te je ukupno obrađeno više od 400 herbarskih listova.

Nakon revizije opći je dojam da je glavnina herbarskog materijala vrlo stara. Najstariji primjerak skupljen je 1830. godine, a zadnja godina skupljanja je 1999. (Fig. 1). Skupljači koji su zastupljeni s najvećim brojem primjeraka su Rossi, Hirc, Horvat, Marković, Schlosser i Vukotinović (Slika 2).

Nadalje, revizija je pokazala da 61 herbarski primjerak nije determiniran, odnosno da je određen samo do razine roda (Tab. 1). Od ukupnog biljnog materijala, 71 % primjeraka bilo je točno determinirano, 17 % nije uopće bilo determinirano i 12 % bilo je krivo determinirano (Fig. 2).

Značajna promjena nakon revizije može se uočiti kod svojti *E. alpestre* i *E. alsinifolium*. To su vrste koje se nalaze na Popisu flore Hrvatske (REGULA-BEVILACQUA, 1997), ali revizijom herbarskih primjeraka utvrđeno je da su determinacije bile pogrešne. To još uvijek ne znači da navedene vrste uopće nisu prisutne u hrvatskoj flori, nego je potrebno izvršiti dodatna detaljna istraživanja kako bi se utvrdio njihov status.

Rezultat revizije, što se tiče rasprostranjenosti, pokazuje da najmanje herbarskih primjeraka potječe iz dvije makroregije, mediteranske i istočno panonske, dok je najviše primjeraka zastupljeno iz zapadnopanonske i planinske makroregije. Usporedbom dobivenih rezultata s već poznatim kartama rasprostranjenosti iz baze podataka (FCD) uočene su neznatne razlike, odnosno nije se moglo utvrditi postojanje nekih svojti rodova *Epilobium* i *Chamerion* na temelju proučenog materijala (Tab. 2).

Revizijom herbarskog materijala u herbarijima ZA i ZAHO je za floru Hrvatske potvrđeno 11 vrsta roda *Epilobium* i 2 vrste roda *Chamerion*.