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PRESENT STATUS OF THE *SYRINGA JOSIKAEA* JACQ. EX RCHB., AN ENDEMIC SPECIES WHICH CONTRIBUTES TO THE DIVERSITY OF THE FLORA OF THE CARPATHIANS

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SUMMARY. This paper presents the actual distribution of the Carpathian endemic vascular plant, *Syringa josikaea* Jacq.ex Rchb. in the Apuseni Mountains, Romania. In the less than 200 years from the description of the species in 1830 by Joseph Franz von Jacquin, some of the formerly extant populations have disappeared, and much of the remnant populations have been declined in number. We have managed to identify a quite large population (94 clones) in the Iad Valley (and its affluent, Serenad) and just a few specimens in the valleys of Henţ (3 specimens), Arieş (5 specimens) and Crişul Negru (5 specimens) rivers. The populations from the Drăgan, Someşul Cald and Crişul Repede rivers' valleys have disappeared due to antropic factors.

Keywords: chorology, relict endemic species, the Romanian Carpathians, *Syringa josikaea*

Introduction

*Syringa josikaea (*syn. *Syringa prunifolia* Kit, *Syringa vincetoxifolia* Baumg.*)* (fam. OLEACEAE) is one of the 21-28 (depending on the taxonomic concept, McKelvey, 1928; Fiala, 1988) disjunctly distributed *Syringa* species between southeastern Europe and eastern Asia. It is an endemic species of the Carpathians with disjunctive and fragmented distribution in the north in Ukraine and in the south in the Apuseni Mountains, Romania. It has been long thought as a preglacial relic species, although fossil evidents are missing. Molecular phylogenetic studies (Kim and Jansen, 1998) place it in Series Villosae, sister with *S. wolfii*. Is a microphanerophyte, mezohydrophyte, micro-mesoterm, weakly acid-neutrofil species (Sanda et. al, 1983). Regarding its phytosociological characterization, it belongs to the association *Carici*

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brizoides-Alnetum I. Horvat 1938 em. Oberdorfer 1953, subassociation *syringetosum josikeae* Sanda et Popescu 1999 (syn: *Alno incanae-Syringetosum josikeae* Borza, 1965 n.n.) (Sanda *et al.*, 2008).

The species is listed in Annex II of the Habitats Directive and Appendix I of Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats), mentioned as endangered in the Carpathian List of Endangered Species (Witkowski *et al.*, 2003) and as vulnerable in the Red Book of Ukraine (Gyiduh, 2009).

It appears in various Red Lists of Romania (Boşcaiu *et al.*, 1994; Dihoru and Dihoru, 1994) and mentioned as a species with low risk in the Red Book of Romanian vascular plants (Dihoru *et al.*, 2009). According to the IUCN Red List of Threatened Species there is no information on the population size or trend and potential threats available for Romania. It is therefore classed as Data Deficient, but very probably belongs into a threatened category (Bilz, 2011).

Despite of its rarity we have no data on its Romanian distribution in the last decades. Herbarium specimens from the Alexandru Borza Botanical Garden, Cluj-Napoca (Herbarium CL) collected after 1950 are scarce (8, mainly from the hydrological station from Stâna de Vale), the most recent is from 1977. However, Ukrainian populations were recently studied (Kohut, 2013) and revealed a much more stronger present in the northern enclaves of the Carpathians.

The niche models have good tools to identify the potential distribution areas of the species and to determine the important ecological factors which influence the distribution (Phillipsa *et al.*, 2006, Kumar and Stohlgren, 2009).

The aim of the present paper is to present the distribution and size of the remnant populations of *Syringa josikaea* from Romania and niche modeling the potential distribution areas of the species.

In this study, we investigate the habitats known from literature for *Syringa josikaea* in order to address the following questions: (i) Where the studied species can actually be distributed? (ii) What are the dimensions of the remnant populations? (iii) Which are the causes of the extinction/declining in number of the former populations? and finally (iv) Does the species need any conservation strategy?

Materials and methods

In order to have a clear picture regarding the present distribution of *Syringa josikaea* in Romania, after a systematical documentation of the literature (Simonkai, 1886; Gulyás, 1907; Jávorka, 1925; Nyárády, 1943; Prodan and Buia, 1960; Morariu, 1962; Beldie, 1979; Csűrös, 1981; Raţiu *et al.*, 1984; Molnár, 2003; Ciocârlan, 2009, Lendvay *et al.*, 2013) and Herbarium CL sheets concerning the presence of the studied species in different locations we visit all the mentioned places in the spring and summer/autumn of 2012 and 2013. All the specimens found were marked by GPS (Garmin 62s) and also observations regarding the habitats (biotic and abiotic factors) have been made. For climatic niche modeling the MaxEnt version 3.3.3e

software was used. The nineteen bioclimatic variables (BIOCLIN) used in MaxEnt were obtained from WorldClim dataset (http://www.worldclim.org/). The maps were created using DiVa GIS version 7.5.

Results and discussion

We have managed to identify specimens (mainly clones) of *Syringa josikaea* in the valleys of Arieş, Crişuri (Crişul Negru, main affluents of the Crişul Repede: Iad Valley, Stâna de Vale, Henţ Valley) on a total estimated area of 2400 km^2 (Table 1, Fig.1). The total number of the identified specimens/clones is 107. We have not found the species in the wild in the Drăgan, Crişul Repede and Someşul Cald Valleys, although there are data in literature about former populations in these regions.

The *Syringa josikaea* is present with just a few specimens/clones in all the river basins where we have identified it, excepting the Iad Valley, where a population with high number of exemplars (97 clones) still exists. (Table 1).

Table 1.

Coordinates of the identified specimens in different river valleys

No	River Valley	Coordinates
1	Crişul Negru	N46.46116 E22.62666
2	Crişul Negru	N46.46134 E22.62937
3	Crişul Negru	N46.46189 E22.63481
4	Crişul Negru	N46.46148 E22.63350
5	Crişul Negru	N46.45967 E22.62488
6	Arieş	N46.45604 E22.93791
7	Arieş	N46.45703 E22.85047
8	Arieş	N46.46233 E22.77615
9	Arieş	N46.46311 E22.76821
10	Arieş	N46.46383 E22.76807
11	Henţ	N46.84988 E22.86346
12	Henţ	N46.83495 E22.85965
13	Henţ	N46.84241 E22.86069
14	Iad	N46.79164 E22.55788
15	Iad	N46.78973 E22.55639
16	Iad	N46.78425 E22.55377
17	Iad	N46.78247 E22.55367
18	Iad	N46.78194 E22.55371
19	Iad	N46.78144 E22.55395
20	Iad	N46.75226 E22.55503
21	Iad	N46.75382 E22.55564
22	Iad	N46.75434 E22.55582

Table 1. continued

23	Iad	N46.75446 E22.55591
24	Iad	N46.75668 E22.55654
25	Iad	N46.76957 E22.56151
26	Iad	N46.75878 E22.55728
27	Iad	N46.75261 E22.55691
28	Iad	N46.75207 E22.55711
29	Iad	N46.75093 E22.55661
30	Iad	N46.77145 E22.56177
31	Iad	N46.77122 E22.56124
32	Iad	N46.77090 E22.56140
33	Iad	N46.77121 E22.56091
34	Iad	N46.77109 E22.56065
35	Iad	N46.76818 E22.55838
36	Iad	N46.76737 E22.55820
37	Iad	N46.76697 E22.55841
38	Iad	N46.82862 E22.59002
39	Iad	N46.83070 E22.60861
40	Iad	N46.83063 E22.60729
41	Iad	N46.74732 E22.55508
42	Iad	N46.74387 E22.55716
43	Iad	N46.74221 E22.55735
44	Iad	N46.74177 E22.55869
45	Iad	N46.74178 E22.55872
46	Iad	N46.74166 E22.55883
47	Iad	N46.74047 E22.55931
48	Iad	N46.74006 E22.55920
49	Iad	N46.73909 E22.56038
50	Iad	N46.73852 E22.56011
51	Iad	N46.73862 E22.56047
52	Iad	N46.73853 E22.56057
53	Iad	N46.73820 E22.56037
54	Iad	N46.73759 E22.56146
55	Iad	N46.73677 E22.56151
56	Iad	N46.73518 E22.56203
57	Iad	N46.73247 E22.55955
58	Iad	N46.72849 E22.56074
59	Iad	N46.72728 E22.56102
60	Iad	N46.72736 E22.56112
61	Iad	N46.72712 E22.56133
62	Iad	N46.72695 E22.56148
63	Iad	N46.72706 E22.56144
64	Iad	N46.72655 E22.56144

Table 1. continued

65	Iad	N46.72586 E22.56109
66	Iad	N46.72497 E22.56134
67	Iad	N46.72472 E22.56182
68	Iad	N46.72193 E22.56220
69	Iad	N46.72182 E22.56151
70	Iad	N46.72212 E22.56112
71	Iad	N46.72306 E22.56229
72	Iad	N46.72306 E22.56240
73	Iad	N46.72443 E22.56275
74	Iad	N46.72172 E22.56179
75	Iad	N46.72172 E22.56180
76	Iad	N46.72137 E22.56238
77	Iad	N46.72089 E22.56320
78	Iad	N46.72035 E22.56421
79	Iad	N46.72015 E22.56486
80	Iad	N46.72010 E22.56511
81	Iad	N46.71787 E22.56760
82	Iad	N46.71718 E22.56832
83	Iad	N46.71721 E22.56868
84	Iad	N46.71899 E22.57329
85	Iad	N46.71974 E22.57144
86	Iad	N46.71794 E22.57399
87	Iad	N46.71790 E22.57422
88	Iad	N46.71700 E22.57808
89	Iad	N46.71659 E22.57837
90	Iad	N46.71622 E22.57839
91	Iad	N46.71436 E22.58316
92	Iad	N46.71335 E22.58520
93	Iad	N46.71330 E22.59632
94	Serenad	N46.71359 E22.58465
95	Serenad	N46.71324 E22.58521
96	Serenad	N46.71317 E22.58540
97	Serenad	N46.71287 E22.58563
98	Serenad	N46.71269 E22.58539
99	Serenad	N46.71227 E22.58503
100	Serenad	N46.71218 E22.58501
101	Serenad	N46.71164 E22.58479
102	Serenad	N46.71144 E22.58427
103	Serenad	N46.71135 E22.58455
104	Serenad	N46.71123 E22.58444
105	Serenad	N46.71340 E22.58510
106	Stâna de Vale	N46.69034 E22.61460
107	Stâna de Vale	N46.69018 E22.62080

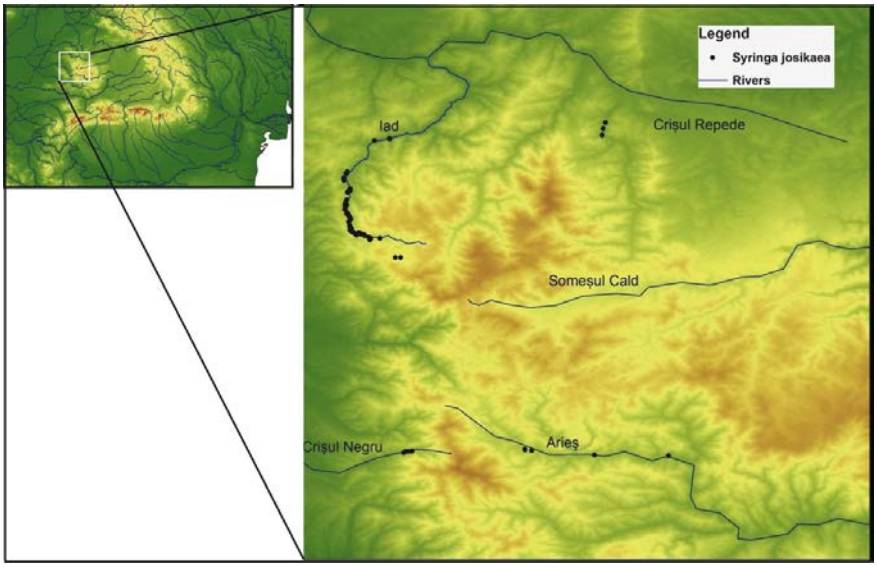

Figure 1. Actual distribution of *Syringa josikaea* in the Apuseni Mountains

The identified specimens are distributed at altitudes ranging between 500–1100 m. As most of them are growing along riversides, the exposition differs according to the direction of the river. The dimensions of clones are variable, maximum sizes are of 1000 m^2**.** Maximum circumference of the trunk (as measured at 50 cm height) is of 24 cm and maximum height of the studied specimens is 4.5m.

The main habitats where we identified the specimens are:

- Alongside mountain rivers, on cliffs and rocky shores
- Alongside mountain rivers, immediately on the shore
- Floodplain of rivers on the hilly zone
- Cultivated in gardens

The causes of the extinction of the former populations and the decrease of extant ones are as follows:

- construction of a reservoir on the Iad Valley
- construction of a reservoir (Beliş) on Someşul Cald Valley
- railway - and road construction on Crişul Repede Valley (Bologa zone)
- road-construction on the Arieş Valley
- development of tourist area in the zone Albac-Arieşeni (Arieş Valley)

- natural modification of the watercourse (in case of Arieş), in such a way, that formerly existed floodplains were disturbed, as a consequence specimens of *Syringa josikaea* were destroyed
- construction of a hydroelectric power plant in the Valley of Crişul Negru
- intensive deforestation

Climatic niche analyses of the species based on actual presence data in Romania tells that the most important factors in the distribution of the species are the humidity, the high level of precipitation evenly distributed during the whole year (precipitation seasonality) and the altitude (the species most probably occurs between 650 and 950 m). The potential distribution area of the species based on the niche modeling is illustrated in fig. 2. The results suggest that the species has a larger potential distribution area (where the bioclimatic factors are appropriate for *S. josikaea*), than it presents know. If we compare the actual climatic niche of the species (Fig. 2) with that during the Last Glacial Maximum (cca. 21000 years ago) (Fig. 3) we can conclude that the species had a potential larger distribution area in the Carpathians. Beside the present distribution areas (the Apuseni Mountains and the Ukrainian Carpathians) it had a potential distribution area in the Southern Carpathians, as well. Based on the niche modeling we can conclude that the *S. josikaea* has a relic status in the Apuseni Mountains.

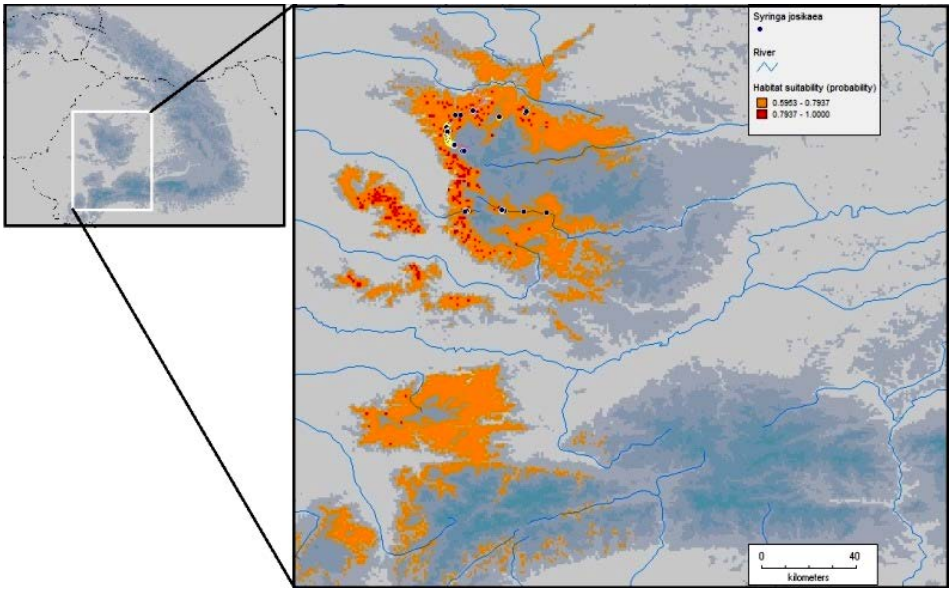

Figure 2. Predicted potential distribution area of *Syringa josikaea* in Romania – actual situation (higher probability than 59%)

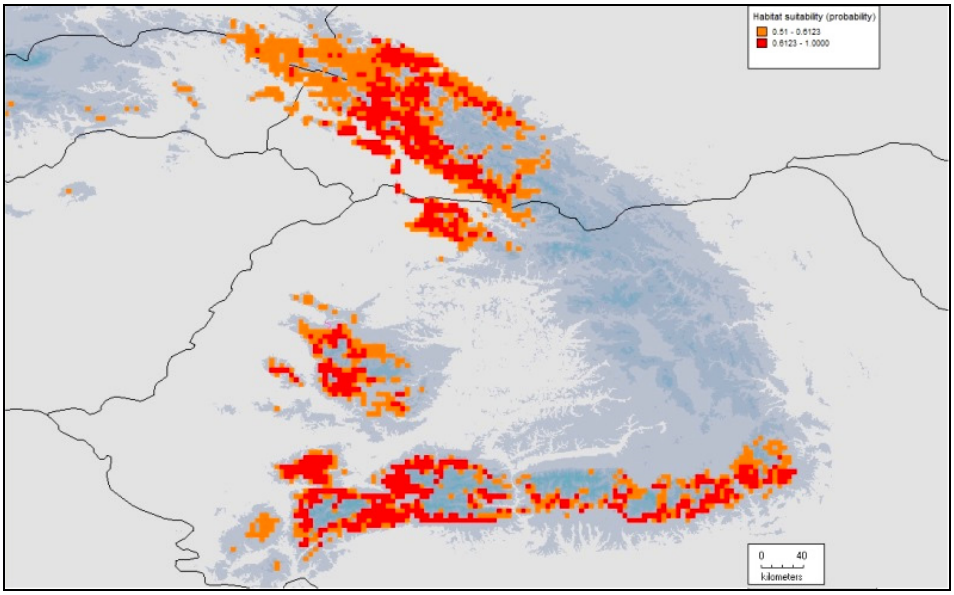

Figure 3. Predicted potential distribution area of *Syringa josikaea* in Romania – situation during the Last Glacial Maximum (higher probability than 51%)

Conclusions

We can conclude that some of the formerly extant populations have disappeared, and those remained have decreased in their number, due mainly to antropogenic factors, but also some climatic extremes as high level of precipitations in summer time can caused the massive decline of the species in Romania. The only population with a high number of specimens (94 clones) is that in Iad Valley, probably because this is the only valley from those studied which presents (at least upstream the reservoir) the smallest human impact on it.

Conservation strategies are needed for the preservation of this species in the Romanian flora. These should be focused on the protection of the Iad Valley's population.

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*** The Habitats Directive: EU Council Directive 92/43/EEC

*** Bern Convention - Convention on the Conservation of European Wildlife and Natural Habitats