

Supplementary material

Table S1. MAT values in the meteorological stations of the Pannonian region from north to south.

Country	Town	Latitude (°)	Altitude (m)	MAT (°C)	MAT-B
Slovakia	Prešov	49.00'	270	8.3	9.4
Hungary	Nyíregyháza	47.96'	107	9.5	9.5
Hungary	Szombathely	47.25'	218	9.4	10.2
Hungary	Pécs	46.25'	141	11.2	11.5
Serbia	Belgrad	44.80'	132	11.8	12.0

MAT-B = corrected MAT to 100 m altitude above sea level regarding adiabatic lapse-rate

We demonstrate the possible routes for *Silene flavescent* with two 'resource' areas and a single isolated Pannonian population (Figure 1), emphasizing that the rationale is almost the same for the other four species which have multiple routes. The two possible 'resource' populations of *S. flavescent* are located in Transylvania. The tracks follow the type C and D scenarios of Figure 2 (of the main text). Tracks 1 and 1' connect the northern one to the only Hungarian occurrence in Budapest (Gellért Hill). Track 2 connects the southern one (Iron Gates and the Domogled Mts.) across the hills of North Serbia (the Fruška Gora Mts. etc.) and Croatia (scenario B).

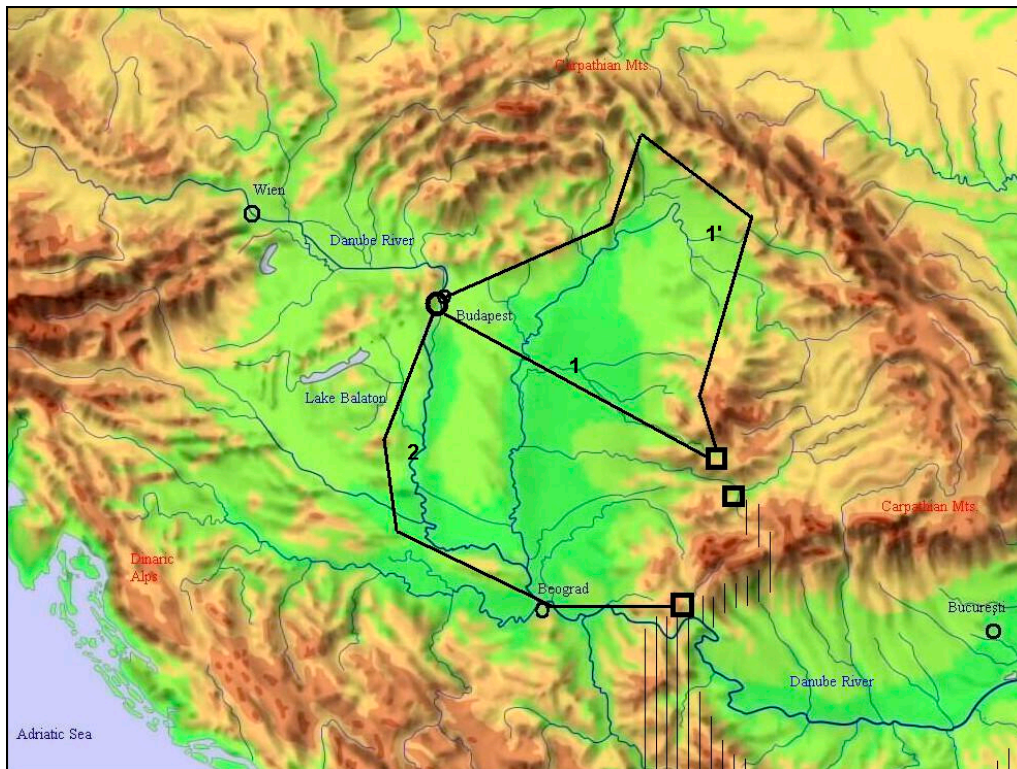


Figure 1. Possible (simplified) migration routes (or tracks) for the *Silene flavescent* until the HTM (or an earlier warmer climatic period). The numbers indicate the tracks: Tracks 1, 1', 2 (→ see the text below). The black circle is the northernmost isolated population on the dolomite Gellért Hill in the centre of Budapest; black squares indicate the nearest southern populations; black solid lines indicate tracks (panbiogeographic approach); the area

crosshatched by vertical, thin, solid lines indicates sporadic, contiguous distribution. The southernmost and northernmost points of the given track are more important than the specific curve itself.

Track 1 is more or less theoretical, considering only the difference between the latitude of the potential 'resource' population and that of the Hungarian locality. This track assumes the crossing of wide lowlands, which is highly improbable as *S. flavescens* lives in dry thermophilous *Quercus pubescens* woods and hill-slopes covered by open vegetation which are absent on the lowlands. Furthermore, it is more likely that *S. flavescens* migrated on the route of track 1' which provides more or less continuously suitable habitats between the 'resource' and the extant disjunct occurrence. This route passed through the foothills of the North-Carpathians and reached much higher latitudes (the northernmost point is the Vihorlat Mts., Slovakia) than its existing occurrence. It is likely that during the past warm climatic period, this route was not a 'route-corridor', but a continuous distribution of the species, and the recent 'resource' populations are not resources, but continuous distributions further south. The five species characterised by more than one potential route and a brief description of these routes are as follows (the selected version is indicated by an asterisk, "+" indicates an extinct population. "+" indicates potential resource-localities close to each other on the same latitude: (see supplementary Table 2 for further details):

Aethionema saxatile (Types C and D on Figure 2). Possible routes are:

(1) = recent occurrence in Maramureş (Romania) → Vértes Hills (Hungary)

*(1') = Maramureş (Romania) → northernmost part of the N-Hungarian Mts. (Vihorlat Mts.), Slovakia → Vértes Hills (Hungary)

(2) = Cheile Nerei and surroundings (Romania) → Vértes Hills (Hungary)

Asplenium lepidum (Types A and D on Figure 2). Possible routes are:

(1) = Vadu Crişului (Romania) → recent occurrence in N-Hungarian Mts. (Bükk Mts., Hungary)

*(1') = Vadu Crişului (Romania) → northernmost part of the N-Hungarian Mts. (Vihorlat Mts.), Slovakia → recent occurrence in N-Hungarian Mts. (Bükk Mts. Hungary)

(2) = Middle Croatia, Bosnia → Pécs (Hungary, †)

Onosma viridis. (Types C and D on Figure 2). Possible routes are:

(1) = Cheile Turzului (Romania) → recent occurrence in N-Hungarian Mts. (Aggtelek Karst and Slovak Karst Mts., Hungary, Slovakia)

*(1') = Cheile Turzului (Romania) → northernmost part of the N-Hungarian Mts. (Vihorlat Mts., Slovakia) → recent occurrence in N-Hungarian Mts. (Aggtelek Karst and Slovak Karst Mts., Hungary, Slovakia)

(2) = Iron Gate (Romania, Serbia) → Budapest → recent occurrence in N-Hungarian Mts. (Aggtelek Karst and Slovak Karst Mts., Hungary, Slovakia)

Potentilla pedata (Types C and D on Figure 2). Possible routes are:

(1) = Turda (Romania) → Tihany Peninsula of Lake Balaton (Hungary)

(1') = Turda (Romania) → northernmost part of the N-Hungarian Mts. (Vihorlat Mts.), Slovakia → Tihany Peninsula of Lake Balaton (Hungary)

*(2) = South-Croatia → Tihany Peninsula of Lake Balaton (Hungary)

Silene flavescens (Types C and D on Figure 2). Possible routes are:

(1) = Zam + Deva (Romania) → Budapest

(1') = Zam + Deva (Romania) → northernmost part of the N-Hungarian Mts. (Vihorlat Mts.), Slovakia → Budapest

*(2) = Domogled + Iron Gate (Romania) → Budapest

Table 2. The 5 'more-than-one-way' species with their potential migration routes. Note, that path 1 is rather unlikely. We compare paths 1' and 2 and choose among them, keeping to the protocol of Figure 2. An asterisk indicates the selected version.

Species	Southern, continuous occurrence ¹ (Degree of latitude)	Northern, isolated occurrence ² (Degree of latitude)	N-SD (distance in degree of latitude)	Difference in temperature as derived from N-SD (°C)
<i>Aethionema saxatile</i> (1)	47.5	47.5	0	0
<i>Aethionema saxatile</i> (1') *	47.5	49.0	1.5	1.0
<i>Aethionema saxatile</i> (2)	45.0	47.5	2.5	1.7
<i>Asplenium lepidum</i> (1)	47.0	48.1	1.1	0.8
<i>Asplenium lepidum</i> (1') *	47.0	49.0	2.0	1.4
<i>Asplenium lepidum</i> (2)	44.5	46.0	1.5	1.1
<i>Onosma viridis</i> (1)	46.6	48.5	1.9	1.3
<i>Onosma viridis</i> (1') *	46.6	49.0	2.4	1.7
<i>Onosma viridis</i> (2)	44.8	48.5	3.7	2.6
<i>Potentilla pedata</i> (1)	46.4	46.9	0.5	0.3
<i>Potentilla pedata</i> (1')	46.4	49.0	2.6	1.8
<i>Potentilla pedata</i> (2) *	45.2	46.9	1.7	1.2
<i>Silene flavescens</i> (1)	46.0	47.5	1.5	1.1
<i>Silene flavescens</i> (1')	46.0	49.0	3.0	2.1
<i>Silene flavescens</i> (2) *	44.8	47.5	2.7	1.9

¹ Northernmost edge of the large southern distribution, on the southern side of the gap of the distribution.

² Isolated occurrence, on the northern side of the gap of the distribution or the northernmost point of the suitable habitat-belt required to traverse.