

## The first records of *Senecio inaequidens* along motorways in Poland and Slovakia

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**Abstract:** The paper reports on finds of the invasive species *Senecio inaequidens* along motorways in Poland and Slovakia. The species was already mentioned in the floras of both countries but until recently there had been no reports from motorways there. In 2015, a large population of *Senecio inaequidens* was found along the A4 motorway in Poland. In 2013, it was collected along the D2 motorway in Slovakia. Intensive road traffic is probably the main vector of *Senecio inaequidens* invasion along motorways in Central Europe. Motor vehicles can carry the propagules over long distances. The newly recorded sites along the A4 in Poland and the D2 in Slovakia are part of the species' invasion eastwards. It is assumed that *Senecio inaequidens* will continue to spread along motorways in both countries and in the region as a whole.

**Key words:** *Senecio inaequidens*, invasive species, motorway, Poland, Slovakia.

### Introduction

*Senecio inaequidens* DC., a perennial herb native to South Africa, was introduced into Europe at the end of the 19th century and successfully invaded considerable parts of Western and Central Europe in the last quarter of the 20th century. The history and patterns of this invasion are very well known and described (e.g. Ernst 1998, Heger & Böhmer 2005, 2006). In Germany, the species has been spreading eastwards along railway lines and motorways since the 1970s (e.g. Böhmer 2002, Radkowsch 2003). In the past three decades, besides the invasion along railways, the fast and long-distance spreading along the motorways of Central Europe has been quite remarkable. At the beginning of its Central European “motorway invasion”, the German motorway network was the first to be invaded in the 1980s and 1990s (e.g. Griesse 1996, Radkowsch 2003, Heger & Böhmer 2005). Following, records of *Senecio inaequidens* along motorways outside of Germany started to be reported from Switzerland (Stecher & Buckelmüller 2012), Austria (Hohla 2001, 2011) and the Czech Republic (Joza 2008, Kocián 2014). Until recently, *Senecio inaequidens* had not been reported from motorways in Poland and Slovakia, although the species was already mentioned in the floras of both countries (cf. Tokarska-Guzik *et al.* 2012, Kwiatkowski & Zajac 2014 for Poland; Jehlík 1998, Feráková 2002 for Slovakia). This article reports the first records of *Senecio inaequidens* along motorways in Poland and Slovakia.

### Materials and methods

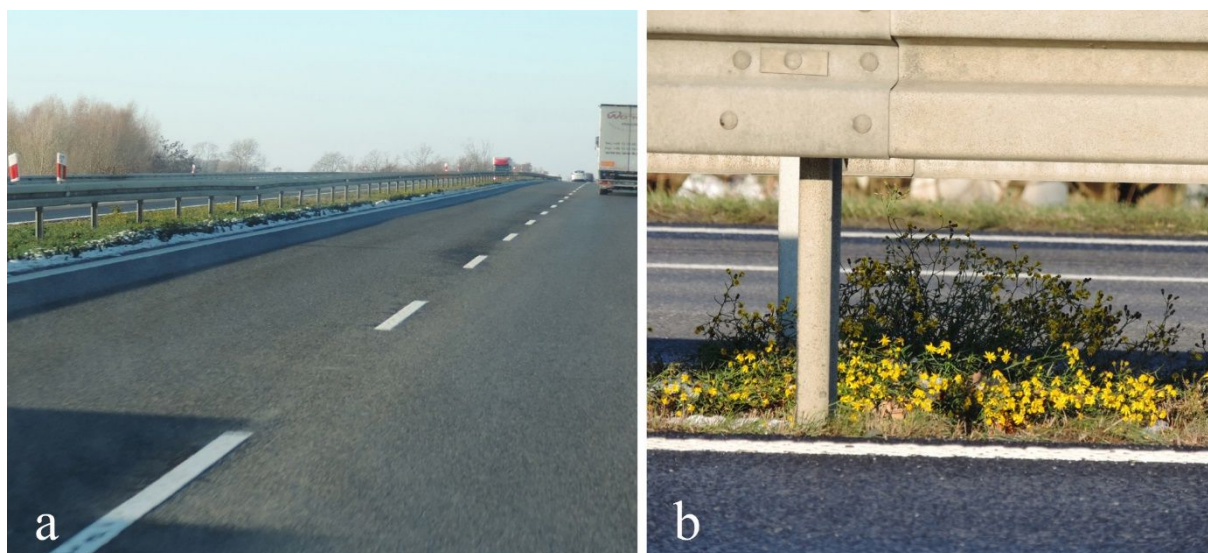
Data were collected from 2013 to 2015 while travelling along motorways in Slovakia and Poland. The following sections of motorways were mapped in both directions at a speed of 90 km/h: the section of the A4 from Wrocław to Gliwice in Poland and the section of the D2 from the CZ/SK border to Malacky in Slovakia. Mapping grids in Poland correspond to the ATPOL grid system (Zajac 1978). Mapping grids in Slovakia correspond to the Central European floristic mapping system (Slavík 1971). Mapping units are linear sections of the motorways and are based on motorway distance markers; the basic mapping unit is 1.0 motorway kilometre in Poland and 0.5 motorway kilometre in Slovakia. The GPS coordinates for each mapping unit are measured in the centre of these mapping units. Coordinates are given in WGS-84. Abundance levels (AL) are indicated as follows: (AL1) – one to several plants, (AL2) – scattered clusters of plants, (AL3) – numerous, linear population. Parts of the motorways

are indicated as follows: CR – central reservation, RS – road shoulder. Collected herbarium specimens are deposited as indicated in the Herbarium of the Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno (BRNU) and the Herbarium of Muzeum Novojičinska, Nový Jičín (NJM).

## Results

### *Senecio inaequidens* along motorways in Poland

In Poland, *Senecio inaequidens* was reported for the first time from Katowice in 1987 (Ernst 1998) and its invasion there has been related to railway lines (cf. Kwiatkowski & Zajac 2014). It is considered locally established in the flora of Poland (Tokarska-Guzik *et al.* 2012). Until recently there had been no reports from motorways. In 2015, *Senecio inaequidens* was recorded in rather high numbers along the A4 motorway (motorway section Wrocław Bielany – Gliwice Kleszczów) between the 168.0 km and 195.0 km distance markers. It occurs there in the central reservation with about hundreds individuals. *Senecio inaequidens* must have been present along the A4 motorway for a longer time, as it had developed nearly continuous populations along this section stretching out over about 23 km. Moreover, a single plant was discovered further eastwards on the A4 motorway (by the 239.0 km distance marker) near Prószków.



**Fig 1:** *Senecio inaequidens* in Poland: a – linear population in the central reservation along the A4 motorway between the 175.0 and 176.0 km distance markers (24. XI. 2015), b – flowering plant in the central reservation on the A4 motorway between the 184.0 and 185.0 km distance markers (24. XI. 2015). Photo by Petr Kocián.

**Tab 1:** *Senecio inaequidens* along the A4 motorway, in the direction of Gliwice.

ATPOL	Location	Part	GPS	Abundance	Altitude	Date
BE69	168.0–169.0 km	CR	50°56'33.816"N, 17°5'50.517"E	AL2	135	9. XI. 2015
BE69	171.0–172.0 km	CR	50°55'28.760"N, 17°7'42.125"E	AL1	139	9. XI. 2015
BE69	172.0–173.0 km	CR	50°55'4.635"N, 17°8'20.992"E	AL1	139	9. XI. 2015
CE70	174.0–175.0 km	CR	50°54'22.127"N, 17°9'37.669"E	AL1	142	9. XI. 2015
CE70	175.0–176.0 km	CR	50°54'0.693"N, 17°10'18.125"E	AL3	145	9. XI. 2015
CE70	176.0–177.0 km	CR	50°53'38.719"N, 17°10'56.208"E	AL1	146	9. XI. 2015
CE70	177.0–178.0 km	CR	50°53'14.982"N, 17°11'28.045"E	AL1	147	9. XI. 2015
CE70	180.0–181.0 km	CR	50°51'57.279"N, 17°13'4.616"E	AL3	144	9. XI. 2015
CE70	182.0–183.0 km	CR	50°51'5.251"N, 17°14'4.019"E	AL2	139	9. XI. 2015
CE70	184.0–185.0 km	CR	50°50'33.794"N, 17°15'32.172"E	AL2	141	9. XI. 2015
CE81	190.0–191.0 km	CR	50°48'21.764"N, 17°19'3.668"E	AL2	154	9. XI. 2015
CE81	191.0–192.0 km	CR	50°47'54.669"N, 17°19'28.619"E	AL3	164	9. XI. 2015
CE81	193.0–194.0 km	CR	50°47'5.230"N, 17°20'37.066"E	AL2	160	9. XI. 2015
CE81	194.0–195.0 km	CR	50°46'44.814"N, 17°21'14.840"E	AL2	160	9. XI. 2015
CF04	238.0–239.0 km	CR	50°34'4.035"N, 17°51'47.282"E	AL1 (1 ex.)	174	24. XI. 2015

## ***Senecio inaequidens* along motorways in Slovakia**

In Slovakia, *Senecio inaequidens* was first found in the inland port of Komárno in 1997 (Jehlík 1998) and one year later in Bratislava (Feráková 2002). The most recent records come from the railway station in Rimavská Sobota (Eliáš jun. 2015), a gravel pit near Dunajská Lužná, and Trstín limestone quarry (Košťál 2012, 2015). The species is classified as casual in the flora of Slovakia (Medvecká *et al.* 2012). Until recently there had been no reports of *Senecio inaequidens* from motorways. In 2013, it was collected along the D2 motorway in the direction of Bratislava (motorway section CZ/SK border – Malacky) between the 2.0 and 2.5 km distance markers (leg. P. Kocián, herb. BRNU, NJM). Later in 2015, more plants were found at this locality and new localities were found elsewhere along the D2 motorway. It occurs there along a gravel road shoulder and in the central reservation.



**Fig 2:** *Senecio inaequidens* in Slovakia: a – scattered plants along the road shoulder on the D2 motorway between the 2.0 and 2.5 km distance markers (12. IX. 2015), b – detail of a flowering plant along the road shoulder on the D2 motorway between the 2.0 and 2.5 km distance markers (12. IX. 2015). Photo by Petr Kocián.

**Tab 2:** *Senecio inaequidens* along the D2 motorway, in the direction of Bratislava.

CEFMS	Location	Part	GPS	Abundance	Altitude	Date
7367b	2.0–2.5 km	RS	48°39'58.519"N, 16°59'22.935"E	AL1 (1 ex.)	150	13. X. 2013
7367b	2.0–2.5 km	RS	48°39'58.519"N, 16°59'22.935"E	AL1 (4 ex.)	150	12. IX. 2015
7367b	2.5–3.0 km	RS	48°39'42.200"N, 16°59'27.300"E	AL1 (2 ex.)	150	12. IX. 2015
7368c	6.0–6.5 km	CR	48°37'54.306"N, 17°0'21.335"E	AL1 (1 ex.)	150	12. IX. 2015

## **Discussion**

*Senecio inaequidens* becomes very apparent along motorways especially in the period from September to November because of its yellow flowering heads and “shrubby” appearance, so that it can be easily distinguished while travelling by car at normal speed. It is also one of the last flowering plants along motorways of the season. This is due to the long flowering period (it flowers from July to November) and its ability to recover after mowing of the roadside vegetation.

Intense international road transport in Central Europe after the turn of the millennium is probably the main vector for some invasive species that spread along motorways in the region. One of these plants (sometimes called “motorway plants”) is *Senecio inaequidens* that has lately been reported from motorways in Austria and the Czech Republic. Until recently, there had been no records of *Senecio inaequidens* along motorways in Poland and Slovakia. The newly recorded sites along the A4 motorway in Poland might be a result of intensive road traffic using

this road while heading from France/Belgium/Germany eastwards, as the A4 motorway is part of the European E-class road E40 connecting Western Europe with Eastern Europe. Considering the traffic directions, the history of the species invasion in Central Europe, intensive road transport and the relative closeness of the German populations, it seems likely that *Senecio inaequidens* is already present along some motorways in other parts of Poland (e.g. the A2, A4, A6 motorways), especially near the border with Germany and has remained unnoticed by botanists. In Slovakia, the sites of *Senecio inaequidens* along the D2 motorway are clearly an extension of its range along the D1/D2 motorway in the Czech Republic (the Czech D2 motorway is followed up by the Slovak D2 motorway at the CZ/SK border). On the D2 motorway in Slovakia, *Senecio inaequidens* was found along motorway lanes which are used by traffic heading from (Praha–) Brno towards Bratislava (in south-eastern direction). Moreover, there is a quite large population (about 50 plants) on the Czech D2 motorway (by the 45.0 km distance marker near the village of Ladná) just some 17 km (a 9-minute drive) to the nearest site of *Senecio inaequidens* on the D2 motorway in Slovakia. The propagules could therefore have originated from this nearby site or from sites further along the D1/D2 motorway in the Czech Republic.

## Conclusion

*Senecio inaequidens* was found for the first time along motorways in Poland and Slovakia, continuing its “motorway invasion” in Central Europe. It is assumed that the invasion will continue along motorways in both countries and in the region as a whole. Motorways provide effective dispersal corridors and the spread of *Senecio inaequidens* along the motorways is promoted mainly by intensive road traffic. Preliminary data from a survey in the eastern part of the Czech Republic (cf. Kocián 2014) show that motorways might have become the primary invasion routes for *Senecio inaequidens* while it is continuing to expand its range eastwards in Central Europe. However, it is too early to draw definitive conclusions. Collection of more relevant data will be necessary. Therefore, a more thorough survey of the motorways in the Czech Republic, Poland and Slovakia is planned for the next years.

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