

Evaluation of Reproductive Success in *Senecio coincyi* Rouy, a Threatened Species from Spain

S Guerrero-García¹, F Martínez-García¹, V Martínez-Fernández¹, and F Pérez-García²

¹ETSI Montes, Universidad Politécnica de Madrid, Ciudad Universitaria, 28040 Madrid, Spain

²EUIT Agrícola, Universidad Politécnica de Madrid, Ciudad Universitaria, 28040 Madrid, Spain

Corresponding author. Email felipe.martinez@upm.es

Introduction

Senecio coincyi Rouy (Asteraceae) is a threatened endemic species from the mountains of Sierra de Gredos, central western Spain. This species is protected by the Autonomous Community of Castile and León (Spain) and is included in the "In danger of extinction" category in the protected flora catalogue of that region. It was later catalogued as Vulnerable (VU) on the Red List of Threatened Spanish Vascular Flora (Moreno et al., 2008). In this paper, the results of a two-year investigation of *S. coincyi* population biology are shown. The aim of this work was to study several aspects of *S. coincyi* reproductive biology.

Methods

Ripe cypselas of *S. coincyi* were taken from six populations located in Ávila province (Spain) in early summer 2007. Cypselas were stored dry under laboratory conditions at about 25°C until the start of the germination trials in December 2007. Germination experiments were carried out in order to detect germination differences among: (1) populations, (2) individuals belonging to the same population, and (3) heads from the same individual plant. In all trials, four replicates of 25 seeds each were tested for germination on top of two sheets of filter paper (previously moistened with 3.5 ml distilled water) in 7-cm diameter glass Petri dishes. Germination of cypselas was tested at different constant temperatures (10°C, 15°C, 20°C, 25°C and 30°C) and the alternate temperatures of 25/15°C under a 16/8h light/dark photoperiod. Cypselas belonging to the population SAN01 were tested for germination at alternate temperatures (25/15°C) under a 16-h light photoperiod and additionally under constant darkness. At the end of the germination period, the final germination percentage (mean value \pm standard error) and the mean germination time (MGT, mean value in days \pm standard error) were calculated. The number of empty cypselas in each replicate was taken into account for calculating the final germination percentage.

Results and Conclusions

The total number of *S. coincyi* individuals is approximately 26,000, distributed in 13 populations over a 350 ha area. Its reproduction is basically sexual and characterized by a high plasticity regarding pollinators, as well as a remarkable facility to spread its seeds. A high production of flowers, fruits (cypselas) and seeds could be observed in the field. The mean number (\pm standard deviation) of heads per individual plant was 13 ± 6 (44 maximum-3 minimum), the mean number of flowers per head was 153 ± 34 (290-85), and the mean number of cypselas per head was 152 ± 38 (290-71). The effect of incubation temperature on the germination of cypselas from two populations is shown in Table 1. The final germination percentages (except at 10°C) were very high ($\geq 90\%$). Seed germination was not significantly affected by light conditions (16-h light photoperiod or constant darkness). Germination at 25/15°C of cypselas belonging to six populations is shown in Table 2. Significant differences ($P < 0.05$) were found among populations for final germination percentages and MGT values. Similarly, the number of empty cypselas varied significantly among populations (from 0 to 33%). However, no significant differences were found among the final germination percentages reached by cypselas belonging to different individuals of two populations (Table 3). In most cases, no significant differences ($P > 0.05$) were found for the germination reached by cypselas of single heads from individual plants. In conclusion, obtained results seem to highlight the sexual reproductive ability of *S. coincyi*. This indicates that its conservation problems are not due to agents related to its reproductive biology, but mostly to other agents, such as the alteration of its habitat caused by the continuous and intense presence of livestock.

References

Moreno et al. (coord.) (2008) *Lista Roja 2008 de la flora vascular española*, Dirección General de Medio Natural y Política Forestal (Ministerio de Medio Ambiente, y Medio Rural y Marino, y Sociedad Española de Biología de la Conservación de Plantas), Madrid, Spain.

Table 1. Effect of different temperature regimes on the final germination percentage and mean germination time (MGT) of *S. coinyci* cypselas belonging to two populations. Results after 20 days of incubation under a 16-h light photoperiod. For each population, mean values within a column followed by the same letters are not significantly different at the 5% level of probability.

Population	Temperature	Germination (% ± SE)	MGT (days ± SE)
HER02	10°C	19 ± 3.28 a	13.42 ± 0.22 d
	15°C	98 ± 1.73 bc	8.05 ± 0.06 c
	20°C	98 ± 1.00 bc	6.45 ± 0.19 ab
	25°C	100 c	5.87 ± 0.08 a
	30°C	92 ± 3.34 b	6.65 ± 0.38 b
	25/15°C	98 ± 1.00 bc	6.02 ± 0.11 ab
NAV02	20°C	98 ± 1.00 a	7.77 ± 0.32 a
	25°C	90 ± 3.75 a	7.12 ± 0.44 a
	25/15°C	91 ± 5.92 a	7.55 ± 0.43 a

Table 2. Final germination percentages and mean germination time (MGT) of *S. coinyci* cypselas belonging to 6 populations. Mean values followed by the same letters in a column are not significantly different ($P > 0.05$). Results after 20 days of incubation under a 16-h light photoperiod at 25/15°C.

Population	Empty cypselas (% ± SE)	Germination (% ± SE)	MGT (days ± SE)
HER02	14 ± 7.00 b	85 ± 4.39 abc	7.50 ± 0.26 ab
PIE01	10 ± 2.24 ab	92 ± 3.21 bcd	7.52 ± 0.53 ab
SAN01	0 a	99 ± 0.87 d	8.90 ± 0.30 c
TIE01	33 ± 6.22 c	74 ± 5.49 a	8.82 ± 0.18 c
PEV01	0 a	97 ± 1.66 cd	8.07 ± 0.25 bc
NAV01	2 ± 1.00 ab	84 ± 5.48 ab	6.90 ± 0.20 a

Table 3. Final germination percentages and mean germination time (MGT) of *S. coinyci* cypselas belonging to different individuals of two populations. Results after 20 days of incubation under a 16-h light photoperiod at 25/15°C.

Population	Individual plant N°	Empty cypselas (% ± SE)	Germination (% ± SE)	MGT (days ± SE)
HER02	1	0	100	9.65 ± 0.25
	2	46 ± 1.41	96 ± 2.83	9.65 ± 0.25
	3	0	98 ± 1.41	6.40 ± 0.14
	4	8 ± 0.00	98 ± 1.41	9.55 ± 0.18
	5	0	100	10.25 ± 0.32
	6	4 ± 2.83	100	8.15 ± 0.32
	7	2 ± 1.41	100	7.70 ± 0.14
	8	20 ± 5.66	83 ± 7.42	9.70 ± 0.56
	9	0	100	7.25 ± 0.03
	10	14 ± 7.07	100	8.95 ± 0.03
	11	4 ± 2.83	93 ± 1.77	8.80 ± 0.42
	12	18 ± 1.41	95 ± 3.53	7.75 ± 0.11
	13	14 ± 1.41	90 ± 3.18	10.15 ± 0.25
	P	0.0001	0.0633	0.0001
SAN01	1	44 ± 5.66	74 ± 4.95	8.85 ± 0.25
	2	8 ± 2.83	100	8.00 ± 0.35
	3	2 ± 1.41	91 ± 3.18	7.75 ± 0.25
	4	0	96 ± 0.00	10.15 ± 0.25
	5	0	98 ± 1.41	7.55 ± 0.11
	6	2 ± 1.41	98 ± 1.41	7.65 ± 0.25
	7	10 ± 4.24	96 ± 2.83	7.70 ± 0.07
	8	2 ± 1.41	94 ± 1.41	8.15 ± 0.18
	9	0	86 ± 4.24	6.50 ± 0.07
	10	10 ± 4.24	96 ± 2.83	8.90 ± 0.07
	11	2 ± 1.41	94 ± 1.41	7.90 ± 0.07
	12	8 ± 5.66	89 ± 3.89	9.00 ± 0.85
	P	0.0007	0.0589	0.0028