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Electronic Supplementary File 1.

Supplementary Text S1. Extended methodology on ecological niche modelling

The maximum entropy algorithm implemented in MaxEnt v.3.4.1 (Phillips & al. 2006) was used to determine the potential distribution for *Opuntia aurantiaca*. For modelling we used all the occurrences detected (see **Appendix**); for some of them, more than one unique geographic coordinate has been considered to cover the total area where the species is found in that locality (e.g. Vilajuiga and Pau populations). As these occurrences were recent and accurate, the resolution used was 30 arc-sec (i.e. ca. 1 km). The 19 bioclimatic variables and altitude, also at 30 arc-sec resolution, were downloaded from the WorldClim website (www.worldclim.org; Hijmans & al. 2005). The Human Footprint (HF) (Sanderson & al. 2002) was also chosen because the establishment and spread of *O. aurantiaca* is related to human disturbance. A small set of eight relatively uncorrelated variables ($r < |0.8|$) were selected after performing a pairwise Pearson correlation analysis using all cells of the study area, with the "SDM Toolbox" (Brown 2014), an extension for ArcGIS: bio2 (mean of the daytime temperature range); bio4 (seasonality of the temperature); bio8 (average temperature of the wettest quarter); bio11 (mean temperature of the coldest quarter); bio15 (precipitation seasonality); bio18 (precipitation of the warmest quarter); bio19 (precipitation of the coldest quarter); and altitude. These variables were selected on the basis of the shape of their response curves as well as their relative contribution (values of percent contribution, permutation importance, and jackknife) to a preliminary model run with all the 21 variables (**Figs. S3-S5**).

Niche models have been developed for both current climatic conditions and different climate change scenarios for the year 2070. For the present conditions, we have built two models, one including the variable HF and the other excluding it. For the future, we used the three general circulation models with the best performance among those that participated in the 5th Coupled Model Inter-Comparison Project (CMIP5) experiment (McSweeney & al. 2015): (1) the Community Climate System Model v.4 (CCSM454; Gent & al. 2011); (2) the NOAA Geophysical Fluid Dynamics Laboratory Coupled Model 3 (GFDL-CM355; Donner & al. 2011); and (3) the New Earth System Model of the Max Planck Institute for Meteorology (MPI-ESM-P: www.mpimet.mpg.de/en/science/models/mpi-esm/). The three future projections were run in two different representative concentration pathways (RCPs) that were used in the Fifth Assessment IPCC report, RCP 2.6 and RCP 8.5 (Collins & al. 2013). All 2070-year variable datasets were also downloaded from the WorldClim website. The HF variable was not considered for the future models as it is not available for the year 2070.

Replicate runs (100) of MaxEnt using the "subsample" method were performed to ensure reliable results. Model performance was assessed using: (1) the area under the curve (AUC) of the receiver operating characteristic plot, with 25% of the localities randomly selected to test the model; and (2) the true skill statistic (TSS). According to Swets (1988), AUC values > 0.9 indicate high accuracy, whereas values with a TSS higher than 0.5 are considered as optimal results in terms of power prediction (Allouche & al. 2006). The maximum sensitivity plus specificity (MSS) logistic threshold, which is very robust with all types of data (Liu & al. 2016), was applied to obtain a map of absence/presence (with the probability of presence shown as continuous values from the threshold to 1). In order to see possible changes of the potential distribution under climate change conditions, the gained or lost areas in respect to the present distribution was geographically characterized by employing the function "gIntersection" from "rgeos" package (Bivand & al. 2017) in the RStudio platform (Racine 2012) run with R version 3.6.3. All ENM predictions were visualized in ArcGIS 10.2 (ESRI, Redlands, CA, USA).

Fig. S1. Examples of human dispersion of *Opuntia aurantiaca*. (A) several cladodes adhered to a vehicle wheel Torreblanca (Castelló, 2015); (B) and (C), cladode adhered to the footwear and clothes of one of us in Collserola Mountain (Barcelona, 2017) and in Gavà (Barcelona, 2016), respectively. Photographs: (A), P. Pérez Rovira; (B) and (C), C. Gómez-Bellver.

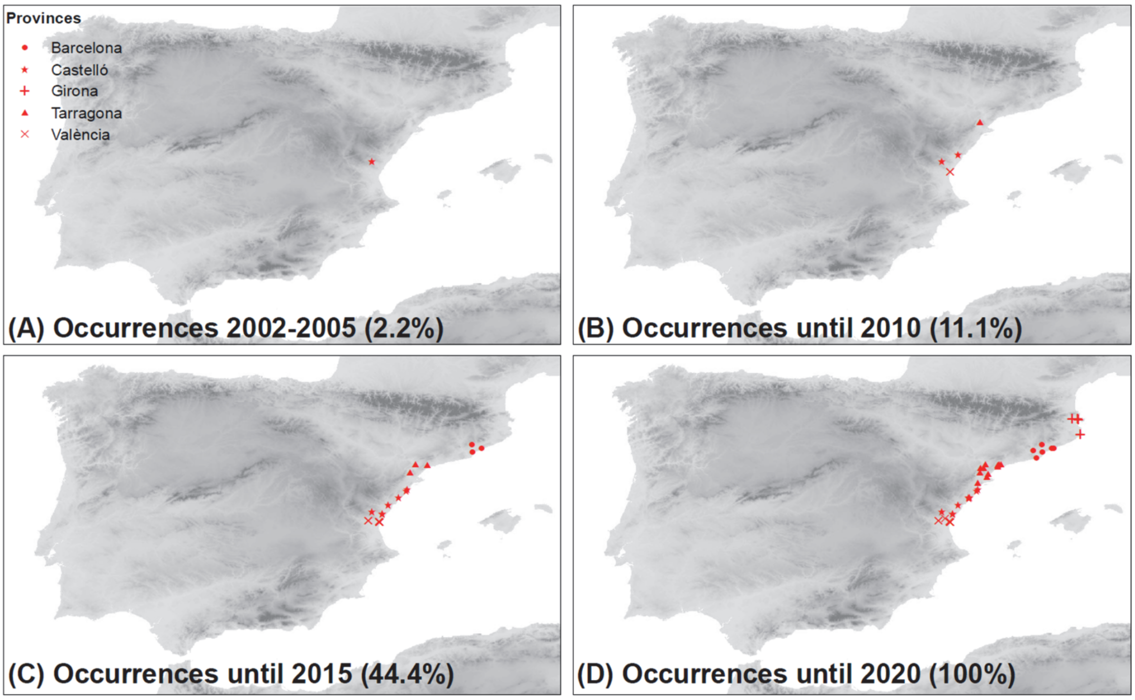

Fig. S2. Geographic representation of the temporal evolution of occurrences recorded for *Opuntia aurantiaca* since 2002 to present in the Iberian Peninsula, with the indication of the cumulative percentage of occurrences for each time period considered.

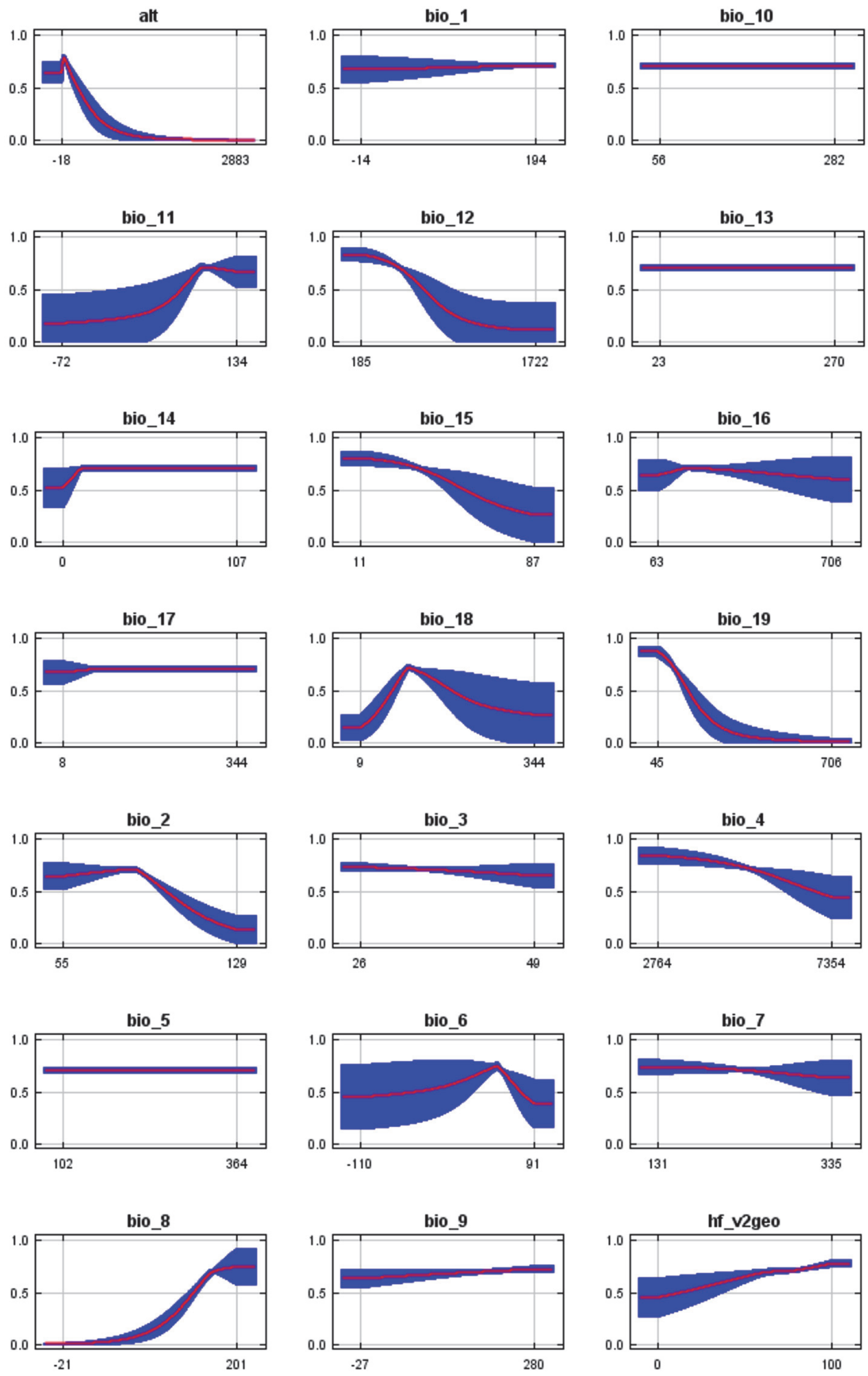

Fig. S3. Response curves of the preliminary model run for *Opuntia aurantiaca* with all 21 variables (bioclim variables plus altitude and Human Footprint). The curves show the mean response of the 20 replicate MaxEnt runs (red) and the mean ± one standard deviation (blue, two shades).

Variable	Percent contribution	Permutation importance
bio_8	43.5	6.5
alt	21.9	36.6
bio_18	7.1	8.1
hf_v2geo	6.7	0.3
bio_14	6.3	1
bio_2	5.4	7.4
bio_19	2.6	22.4
bio_11	2.4	7.4
bio_15	1.9	2.3
bio_6	1	4.6
bio_12	0.5	2.3
bio_7	0.2	0.2
bio_9	0.1	0
bio_17	0.1	0.2
bio_4	0.1	0.8
bio_10	0.1	0
bio_1	0.1	0
bio_16	0	0
bio_3	0	0.1
bio_13	0	0
bio_5	0	0

Fig. S4. Analysis of variable contributions (values of percent contribution, permutation importance) of the preliminary model run for *Opuntia aurantiaca* with all 21 variables (bioclim variables plus altitude and Human Footprint).

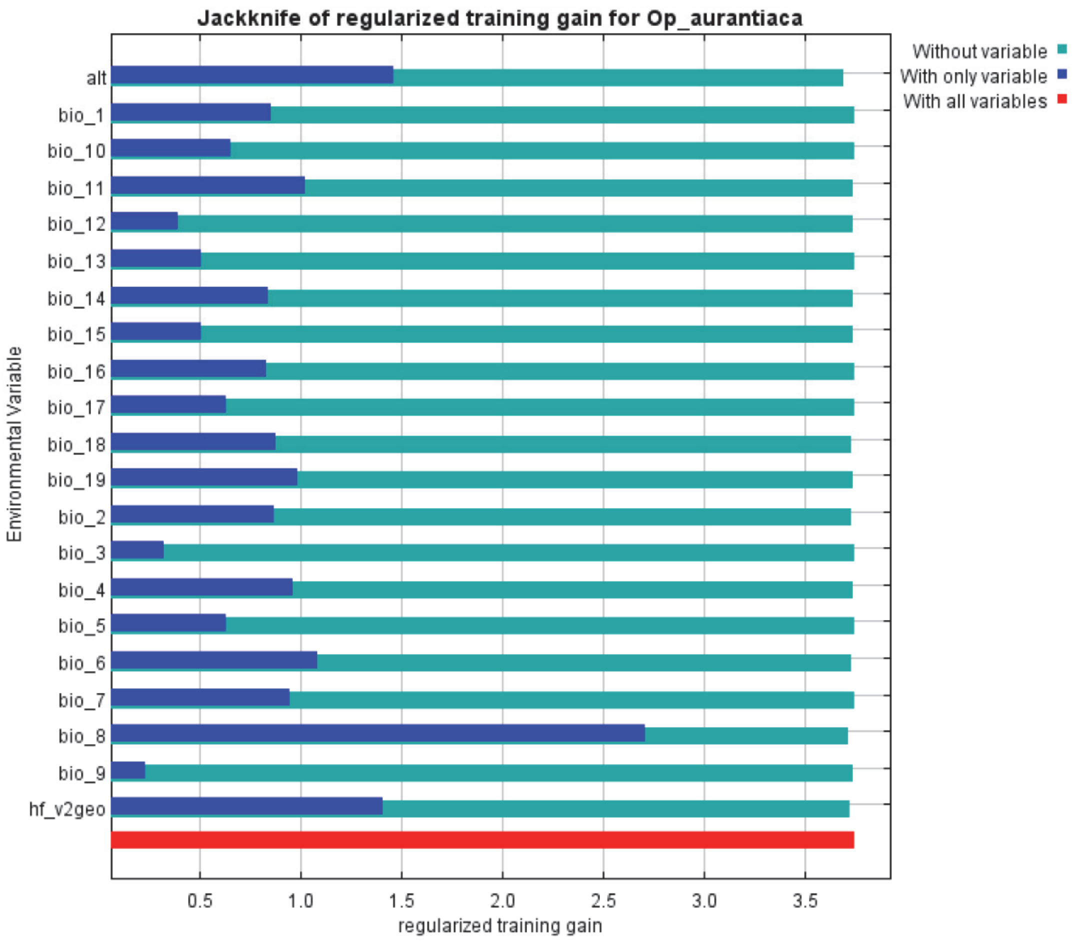

Fig. S5. Analysis of variable contributions (jackknife) of the preliminary model run for *Opuntia aurantiaca* with all 21 variables (bioclim variables plus altitude and Human Footprint).

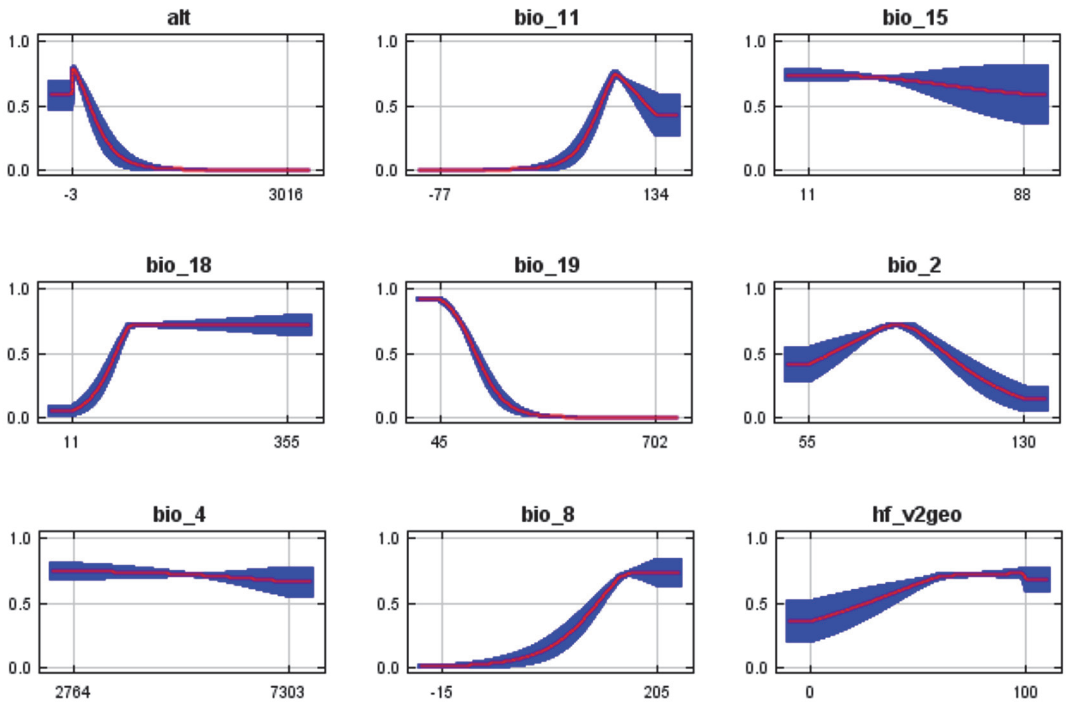

Fig. S6. Response curves showing the effects of each variable in the present MaxEnt prediction for *Opuntia aurantiaca*. The curves show the mean response of the 100 replicate MaxEnt runs (red) and the mean ± one standard deviation (blue, two shades).

Table S1. Parameters for present and future ecological niche models (ENM) performed for *Opuntia aurantiaca*. For each model is presented: the AUC scores ± standard deviation (sd), in which values higher than 0.9 are optimal results in terms of power prediction (Swets 1988); the sensitivity or percentage of occurrences used for modeling that are predicted inside suitable areas; the TSS (true skill statistics) ± standard deviation (sd), in which values higher than 0.5 are optimal results in terms of power prediction (Allouche & al. 2006); the maximum sensitivity plus specificity (MSS) logistic threshold (th); and the variables in order of importance according to the jackknife test, with values of percent contribution and permutation importance of each variable within parentheses.

Model	**AUC ± SD**	**Sensitivity (%)**	**TSS ± SD**	**MSS th**	**Variables**
Present (without HF)	0.991 ±0.002	95 %	0.932 ±0.056	0.1406	bio8 (48.6%, 3.2%) > alt (23.4%; 38.3%) > bio4 (0.4%, 0.3%) > bio11 (2.6%; 7.1%) > bio19 (4.3%, 41.5%) > bio2 (5.7%, 1.7%) > bio18 (11.9%; 6.6%) > bio15 (3.1%; 1.2%)
Present (with HF)	0.992 ±0.002	95 %	0.887 ±0.076	0.2066	bio8 (43.3%; 3.2%) > alt (22.1%; 33.9%) > HF (8.1%; 0.1%) > bio11 (1.7%; 15.8%) > bio4 (0.2%; 0.2%) > bio19 (2.8%; 34.8) > bio2 (5.9%; 3.3%) > bio18 (12.6%; 8.2%) > bio15 (3.2%; 0.2%)
Future 2070 CCSM (RCP 2.6)	0.992 ±0.002	97.5 %	0.910 ±0.073	0.1466	bio8 (46%, 6.7%) > alt (25.3%; 45.1%) > bio4 (0.3%, 0.1%) > bio11 (1.6%; 9.5%) > bio19 (3.3%, 31%) > bio2 (7.6%, 2.6%) > bio18 (12.3%; 4.5%) > bio15 (3.5%; 0.5%)
Future 2070 CCSM (RCP 8.5)	0.993 ±0.002	87.5 %	0.940 ±0.055	0.1268	bio8 (46.8%, 4.9%) > alt (23.4%; 26.4%) > bio11 (2.3%; 17.2%) > bio4 (0.4%, 0.1%) > bio19 (3.5%, 44.2%) > bio2 (7%, 2.5%) > bio18 (12.9%; 4.3%) > bio15 (3.6%; 0.4%)
Future 2070 GFDL (RCP 2.6)	0.992 ±0.002	67.5 %	0.923 ±0.069	0.2058	bio8 (47.7%, 3.8%) > alt (23.4%; 24.9%) > bio4 (0.5%, 0.1%) > bio11 (3.2%; 31.3%) > bio19 (3%, 22.7%) > bio2 (5.6%, 3.8%) > bio18 (13.2%; 8.9%) > bio15 (3.4%; 4.5%)
Future 2070 GFDL (RCP 8.5)	0.992 ±0.002	75 %	0.931 ±0.069	0.2069	bio8 (50.6%, 20%) > alt (22.6%; 21.4%) > bio4 (0.4%, 0.1%) > bio11 (3.4%; 26.5%) > bio19 (2.8%, 15%) > bio2 (5.3%, 4.6%) > bio18 (12%; 4.4%) > bio15 (2.9%; 8.2%)
Future 2070 MPI (RCP 2.6)	0.993 ±0.002	100 %	0.927 ±0.06	0.1669	bio8 (47.8%, 5.8%) > alt (23%; 31.11%) > bio11 (2.2%; 29.4%) > bio4 (0.3%, 1%) > bio19 (3.5%, 17.4%) > bio2 (7.7%, 3.3%) > bio18 (11.8%; 9.8%) > bio15 (3.6%; 2.2%)
Future 2070 MPI (RCP 8.5)	0.993 ±0.002	60 %	0.922 ±0.062	0.1640	bio8 (49.5%, 15.1%) > alt (23%; 29.9%) > bio4 (0.4%, 0.1%) > bio11 (2.8%; 31%) > bio19 (3.2%, 11.8%) > bio2 (5.9%, 5.1%) > bio18 (11.9%; 4%) > bio15 (3.3%; 3.1%)

Appendix. Occurrences of *Opuntia aurantiaca* in the Iberian Peninsula.

Location		Geographic coordinates and elevation	Date of observation	Approximate no. of invididuals and/or affected area*	Collectors/observers	Type of observation	Source
State/First-level division/Second-level division	Municipality (details)						
Spain, Catalonia, Girona	Vilarnadal	42.340399 N, 2.954125 E; ca. 50 m	2018	25–30 m^2	E. Fàbregas	Pers. obs.	Present work
Spain, Catalonia, Girona	Vilajuïga	42.33 N, 3.10 E; 30-60 m [1]	2017	ca. 24,000 m^2	Technical Office of Cap de Creus Natural Park (2017); E. Fàbregas (2018)	Pers. obs.	Fàbregas (2018)
Spain, Catalonia, Girona	Pau	42.31 N, 3.12 E; 35-55 m [2]	2018	1663 m^2	E. Fàbregas	Pers. obs.	Present work
Spain, Catalonia, Girona	Palafrugell, Ponç hill	41.914913 N, 3.179060 E; 65-75 m	2017	ca. 185 m^2	E. Fàbregas	Pers. obs. [3]	Present work
Spain, Catalonia, Barcelona	Caldes de Montbui, Camí de Foment	41.646 N, 2.15 E; 230-245 m	24.12.2015	ca. 50 individuals; ca. 350 m^2	L. Guàrdia Valle	Pers. obs.	Guàrdia (2016)
Spain, Catalonia, Barcelona	Mataró, Vallveric ravine	41.555 N, 2.457 E; 70 m	10.11.2017	—	M. Guardiola	Herbarium voucher (BCN 147400)	Guardiola & Petit (2020)

Spain, Catalonia, Barcelona	Argentona, Sant Jaume de Traià	41.555133 N, 2.414238 E; ca. 130 m	2015	—	E. Fàbregas	Pers. obs.	Present work
Spain, Catalonia, Barcelona	Mataró, near Mata castle	41.554 N, 2.469 E; 75 m	04.03.2018	—	M. Guardiola	Pers. obs.	Guardiola & Petit (2020)
Spain, Catalonia, Barcelona	Abrera, Can Bros Vell	41.500 N, 1.916 E; 86 m	29.08.2019	ca. 20 individuals; >100 m^2	D. Pérez-Prieto	Pers. obs.	Present work
Spain, Catalonia, Barcelona	Barcelona, Collserola Park [4]	41.449 N, 2.172 E; 194 m	2011?, 24.05.2017 [4]	12–15 individuals; 30–35 m^2	C. Gómez-Bellver	Pers. obs.	Present work
Spain, Catalonia, Barcelona	Gavà, near Can Torrents	41.296 N, 1.998 E; 6 m	22.12.2016	ca. 250 m^2	C. Gómez-Bellver & H. Àlvarez	Herbarium voucher (BC 990399)	GBIF (2020)
Spain, Catalonia, Tarragona	Riudoms, Maspujols dry riverbed	41.141 N, 1.061 E; 115 m	07.09.2018	"On the verge of conifer plantation, numerous individuals but only locally"	F. Verloove	Pers. obs.	Verloove & Guiggi (2019)
Spain, Catalonia, Tarragona	Boratell, Riudecols dry riverbed	41.139 N, 1.010 E; 174 m	10.09.2018	ca. 200 m^2	F. Verloove	Pers. obs.	Verloove & Guiggi (2019)

Spain, Catalonia, Tarragona	Garcia	41.137 N, 0.648 E; 34 m	22.03.2015, 13.09.2018	<50 m^2 (J. López-Pujol); "gravelly roadside, scattered individuals escaped from abandoned plantation"	J. López-Pujol (2015); F. Verloove (2018)	Pers. obs.	Present work; Verloove & Guiggi (2019)
Spain, Catalonia, Tarragona	Montbrió del Camp, Riudecanyes dry riverbed	41.113 N, 0.976 E; ca. 130 m	31.05.2015	<100 m^2	J. López-Pujol	Pers. obs.	Present work
Spain, Catalonia, Tarragona	Mont-roig del Camp, Vilanova dry riverbed	41.078 N, 0.981 E; 59-67 m	12.09.2018	"Gravelly track alongside dry riverbed, very common"	F. Verloove	Pers. obs.	Verloove & Guiggi (2019)
Spain, Catalonia, Tarragona	Miravet, Camí del Castell	41.038131 N, 0.596403 E; ca. 60 m	2019	2 m^2	E. Fàbregas	Pers. obs.	Present work
Spain, Catalonia, Tarragona	El Pinell de Brai, Granja de Tonyo	41.025459 N, 0.521398 E; ca. 170 m	2019	10 m^2	E. Fàbregas	Pers. obs. [3]	Present work
Spain, Catalonia, Tarragona	Tivenys, near Xerta dam	40.920 N, 0.502 E; ca. 15 m	04.12.2008	≥20 individuals; ca. 25 m^2	S. Pyke, A. Romo & M. Very	Herbarium voucher (BC 907242)	GBIF (2020); S. Pyke (pers. comm.)

Spain, Catalonia, Tarragona	El Perelló, Salt ravine	40.878 N, 0.712 E; 139 m	17.09.2018	“On top of steep slope, locally”	F. Verloove	Pers. obs.	Verloove & Guiggi (2019)
Spain, Catalonia, Tarragona	L’Ampolla, Copenhagen Street	40.791 N, 0.687 E; 13 m	11.09.2018	“Dry gravelly roadside, common for ca. 200 m”	F. Verloove	Pers. obs.	Verloove & Guiggi (2019)
Spain, Catalonia, Tarragona	Ulldecona, Godall Mountains, la Coloma [5]	40.627 N, 0.440 E; 270 m	23.05.2020	ca. 10,000 m^2	S. Cardero	Pers. obs.	Present work
Spain, Valencian Community, Castelló	Vinaròs, Aiguadoliva ravine	40.450 N, 0.439 E; 10 m	11.04.2015	1 individual	R. Senar	Pers. obs.	Senar (2016), Senar & Cardero (2019) [6]
Spain, Valencian Community, Castelló	Benicarló, el Barranquet	40.406 N, 0.409 E; 8 m	20.07.2015, 05.11.2015	“Growing parallel to a ravine, as a band of ca. 20 × 1–3 m”	R. Senar	Pers. obs. (20.07.2015); herbarium vouchers (05.11.2015: pers. herb. RS 5751, VAL 228544)	Senar (2016), Senar & Cardero (2019) [6]
Spain, Valencian Community, Castelló	Alcalà de Xivert, Seguet ravine	40.234 N, 0.222 E; 45 m	21.03.2016	≥100 individuals; 6 m^2	R. Senar	Herbarium voucher (pers. herb. RS 6009)	Senar & Cardero (2019)

Spain, Valencian Community, Castelló	Torreblanca, near la Xurra cave	40.233 N, 0.201 E; ca. 80 m	15.07.2014	>250 m^2	P. San Lázaro Pardo	Pers. obs. [3]	BDBCV (2020)
Spain, Valencian Community, Castelló	Torreblanca, near Remei pool	40.224040 N, 0.204366 E; ca. 40 m	20.07.2018	>50 individuals; >100 m^2	C. Burguera, C. Gómez-Bellver, J. López-Pujol, E. Mestre & N. Nualart	Pers. obs.	Present work
Spain, Valencian Community, Castelló	Borriol, la Moreria	40.044 N, 0.072 W; ca. 230 m	09.10.2010; 07.07.2014	ca. 200 m^2	A. Agut, S. Francisco	Pers. obs. [3]	BDBCV (2020)
Spain, Valencian Community, Castelló	Navajas	39.879 N, 0.507 W; 375 m	12.06.2002	≥12 individuals; the population is not increasing its size over the years	J. R. Vázquez Mora	Pers. obs.	Vázquez (2009), Vázquez & Albiach (2016) [7]; J. R. Vázquez Mora (pers. comm., 2020)
Spain, Valencian Community, Castelló	la Vall d'Uixó, la Corona hill	39.818 N, 0.229 W, 100 m	20.06.2014	>20 individuals	J. R. Vázquez Mora	Pers. obs.	Vázquez & Albiach (2016)
Spain, Valencian Community, Castelló	la Vall d'Uixó, close to Carmadai	39.807 N, 0.228 W; 78 m	20.06.2014	"a few isolated individuals"	J. R. Vázquez Mora	Pers. obs.	Vázquez & Albiach (2016)
Spain, Valencian Community, València	Nàquera	39.670 N, 0.429 W; 375 m	12.06.2016	—	D. Guillot	Pers. obs.	Present work

Spain, Valencian Community, València	Llíria	39.627 N, 0.602 W; ca. 200 m	2013	ca. 1000 m^2	Natura 2000 Brigade of Valencia Province [3]	Pers. obs.	BDBCV (2020)
Spain, Valencian Community, València	Llíria, Sant Miquel	39.621 N, 0.599 W; ca. 250 m	04.06.2013 [8]	5150 m^2	V. Deltoro	Pers. obs. [3]	BDBCV (2020)
Spain, Valencian Community, València	el Puig de Santa Maria, el Cabeçolet	39.597924 N, 0.310868 W; ca. 20 m	29.09.2014	400 m^2	G. Ballester, J. E. Oltra, S. Fos	Pers. obs. [3]	BDBCV (2020)
Spain, Valencian Community, València	el Puig de Santa Maria, Muntanya de Santa Bàrbara	39.59 N, 0.30 W; 10–40 m [9]	10.09.2010, 07.10.2011, 2012, 2013, 29.09.2014, 09.2019	5000 m^2	G. Ballester & S. Fos (2010, 2011); G. Ballester (2012); Natura 2000 Brigade of Valencia Province (2013) [3]; G. Ballester, J. E. Oltra, S. Fos (2014); Brigade of Biodiversity (2019) [3]	Pers. obs.	BDBCV (2020)

[*] Comments by observers are also provided when population size or area of affected areas are unknown.

[1] This population is consisting of several patches, distributed within an area delimited by the following coordinates: 42.327204N/3.092667E, 42.327815N/3.100603E, 42.322706N/3.096689E, 42.329690N/3.097529E, and 42.323817N/3.100022E. Eradication activities began in 2019.

[2] This population is consisting of several patches, distributed within an area delimited by the following coordinates: 42.318007N/3.116638E, 42.316870N/3.116607E, 42.314975N/3.119640E, and 42.312346N/3.127126E.

[3] Eradicated population.

[4] We believe that this population was the same reported in Guàrdia (2016) as probably occurring in Collserola Mountains around 2011 and later presumably eradicated.

[5] This occurrence has not been included in the ecological niche modelling (ENM) as this population was observed after the models were built ENM analyses were completed in April 2020).

[6] Reported as *O. pestifer* in Senar (2016), this observation was attributed to *O. aurantiaca* in Senar & Cardero (2019).
[7] Reported as *O. pestifer* in Vázquez (2009), this observation was attributed to *O. aurantiaca* in Vázquez & Albiach (2016).
[8] One of us (E. Laguna) believes that the plant would be present here since the mid-1990s.
[9] This population is consisting of several patches, distributed within an area delimited by the following coordinates: 39.589702N to 39.592703N, and 0.297992W to 0.299525W.

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