



# The recent *neophyte Opuntia aurantiaca* Lindl.: distribution and potential invasion in Spain



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## Opuntia

Cacti, and especially its most emblematic genus, *Opuntia* Mill., of American origin, have become one of the groups of plants with the greatest invasive potential in Spain. In fact, recent studies (Novoa et al., 2015, AoB PLANTS 7: plu078) consider Spain as one of the three global hotspots of cacti invasion, along with South Africa and Australia.

## Opuntia aurantiaca Lindl.

Small cactus with an enormous capacity for dispersion by means of cladodes and sterile fruits (which can produce sprouts) that detach very easily and adhere to animals, clothing or footwear and vehicle wheels. Probably native to the Southern Cone (eastern Argentina and southern Uruguay), it behaves like a very aggressive invader in South Africa and Australia. Some authors consider this plant a hybrid of *O. discolor* and *O. salmiana* (Moran et al., 1976, *Taxon* 25: 281-287; Van de Venter et al., 1984, *S.-Afr. Tydskr. Plantk.* 3: 331-339; Moran & Zimmermann, 1991, *Agric. Ecosys. Environ.* 37: 5-27), the typical form (morphotype A2, related to the *discolor* parental) being naturalized.

## Causes of its introduction

The introduction in the different continents was due to the trade of the plant as ornamental. It is estimated that it arrived in Europe through England around 1840 and later in South Africa in 1858.

## Consequences and problems

Harmful to people and animals (cattle and dogs). Impact on the local flora due to its ability to cover the soil densely. Economic impact due to reduction of cultivation and grazing areas, as well as due to the prevention and eradication actions on the plant.

## European distribution

In Europe, its presence is only known on the Mediterranean areas of the Iberian Peninsula. There was no news of its presence until recently, with the first reports coming from the Valencian Community (in 2002 from Navajas, where it had been confused with *O. pestifer*), and later from Catalonia (in 2008 from Tivenys).

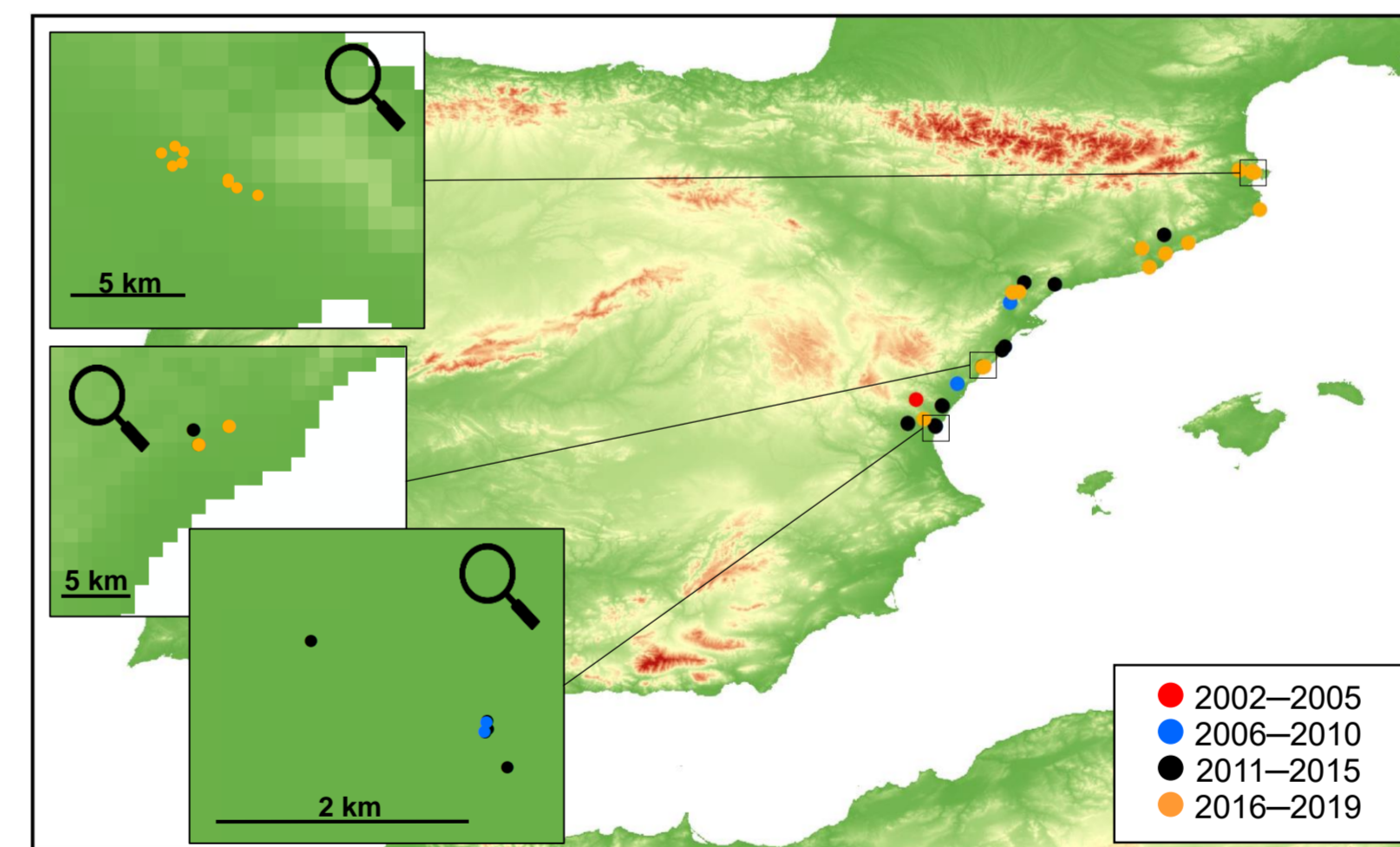
## Chorological update

A literature search has been done (including online databases such as GBIF or iNaturalist), while extensive field work has been carried out by the authors of this contribution. Up to 40 occurrences have been detected, mostly discovered in the last decade (see the map).

## Ecological niche modelling

With the chorological data, its potential distribution has been determined. For this, the maximum entropy algorithm implemented in the MaxEnt program has been used, and the models have been developed for both current climatic conditions and different climate change scenarios for the year 2070 (RCP 2.6 and 8.5).

Selected variables (with a correlation below 0.8): 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. Additionally, for the present we also built a model including the Human Footprint (HF) variable, to evaluate the possible effect of human action on the invasive potential of this species.



## Results and conclusions

- Opuntia aurantiaca* shows a very aggressive invasive behavior in other areas of the world. In our territory it is in an initial invasion stage.
- For the present, in the two models (with and without Human footprint) new potential areas appear where the species is not yet present: the north coast of the province of Tarragona, small areas of the Alicante coast, the Ebro Delta, and some parts of Majorca Island. The two models for the present (with and without HF) are very similar, with suggest that HF has a relatively small role in the potential distribution of this species.
- Although some models show a considerable increase in the potential distribution area (GFDL), in general the current potential areas in the Mediterranean coast are more or less maintained for the year 2070. For both GFDL scenarios, in addition to MPI 8.5, new potential areas appear in the northern Iberian coasts (Cantabrian coasts).
- Eradication of existing populations at this initial stage and monitoring of possible regrowths from the underlying propagules are necessary. Experience in other countries suggest an integrated control with chemical, biological and removal techniques.
- Both state and regional legislation should consider the prohibition of trade and transportation of this plant.

