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Biotic and abiotic factors affecting *Cistus ladanifer* production in cultivated plots from Mainland Spain

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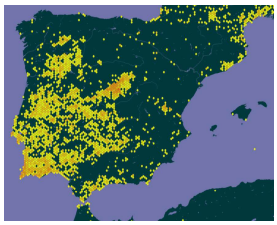
INTRODUCTION & AIM



C. ladanifer - Spain

GBIF - Global Biodiversity Information Facility https://www.gbif.org/es/

The sustainable production of rockroses is being actively encouraged due to their contribution to rural development and circular economy. Particularly, rockrose (*Cistus ladanifer* L.) exploitation has great potential, since it is not only a source of essential oils and labdanum gum but also of residual products involved in biomass generation. Very few pests and diseases are known to affect it, as plant extracts and essential oils have been described to have biocide properties. However, in cultivated rockrose plots from Mainland Spain, a high number of plants were observed with general yellowing and decline, eventually resulting in death.

The aim of this study was to determine the causes that led to the general decline observed in *C. ladanifer* plants in production plots in the Community of Madrid. To this end, the abiotic and biotic factors involved were studied, as well as any additional information that could be related to this event.

Symptomatic *C. ladanifer* plant

METHOD

The crop was planted using rooted and potted nodal cuttings from 24 selected clones. Preliminary tillage was carried out using a rototiller, row cultivation in a 1.60 x 0.30 m² frame, with foot-operated irrigation and no fertilizers, phytosanitary products, or biostimulants. Weed control was carried out manually and with a rototiller between rows. The 1,300 m² plot had a tillage sole at 25 cm and in some areas at 15 cm. No subsoiling or chisel work was ever carried out to break up the tillage sole.

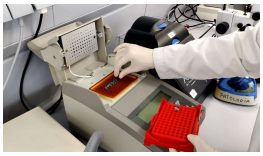
ANALYSIS OF PHYSICAL-CHEMICAL FACTORS

Soil analysis were performed on composite samples taken at about 25 cm. Foliar analysis were performed on 200 g of leaves taken from plants randomly distributed throughout the area. Infiltration measurements were made either with a double or a single-ring infiltrometer. Test pits were dug with a mini-excavator to a depth of 1.40 m, and the profile was conditioned manually. Soil samples in the test pit for bulk density were taken every 5 cm, using a 5 cm diameter and depth cylinder. The samples were kept in an oven at 105 °C until constant weight.

ANALYSIS OF SYMPTOMATIC PLANT MATERIAL

Representative plants were selected from the affected field. Isolations were performed on culture medium (PDA with streptomycin) from decontaminated crowns and stems. Plates were incubated, and the fungal colonies of interest were microscopically observed after staining.

To molecularly identify the fungal species, genomic DNA was extracted and a semi-nested PCR was performed for amplification of the ITS (*Internal Transcribed Spacer*) DNA regions. The obtained sequences were compared to those deposited in the NCBI GenBank database.



RESULTS & DISCUSSION

ANALYSIS OF PHYSICAL-CHEMICAL FACTORS

Table 1. Foliar analysis.

Parameter (% w/w)		Parameter (mg·kg⁻¹)	
Nitrogen	2.17	Iron	456.6
Phosphorus	0.40	Manganese	86.6
Potassium	1.00	Copper	6.10
Calcium	1.47	Zinc	94.3
Magnesium	0.21	Boron	96.9

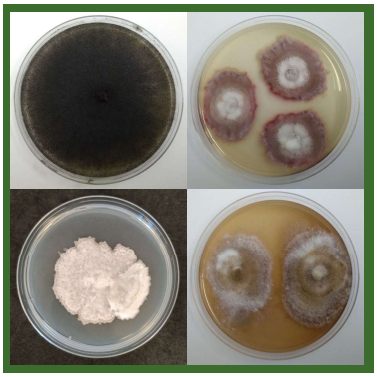
Environmental data suggested the contribution of a prolonged period of rain (> 20 days) in late spring with increasing temperatures, a crop field that was not subsolated, and plants from staking, which might be limiting the development of the root system in the soil

Table 2. Apparent soil density.

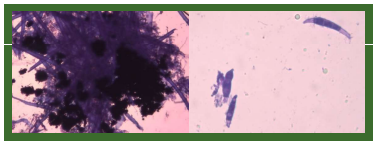
Apparent Density (g·cm⁻³)												
Depth (cm)	0-6	12	18	24	30	36	42	48	54	60	66	70
C-1	1.14	1.43	1.41	1.38	1.51	1.36	1.46	1.56	1.40	1.49	1.52	1.46
C-2	1.18	1.20	1.56	1.39	1.42	1.39	1.61	1.61	1.71	1.62	1.66	1.60

ANALYSIS OF SYMPTOMATIC PLANT MATERIAL

Sequencing revealed the presence of the pathogenic fungal species *Macrophomina phaseolina* (above, left), *Fusarium acuminatum* (above, right), *F. equiseti* (below, left), and *F. tricinctum* (below, right), isolated from the crowns of the plant material



Microscopic observations confirmed the presence of microsclerotia in the *M. phaseolina* colonies (left) and macroconidia in the *Fusarium* colonies (right)



Results indicated a combined effect of deleterious biotic and abiotic factors as the cause of the unexpected symptoms and damage on the rockrose crop production.

CONCLUSIONS

Most likely, the time of year, the type of soil and the climate factors, as well as the management and handling, and the species' specific nature have influenced the development of symptoms, with the isolation of various microorganisms identified as causing damage to many plant species. In this case, all the factors seem to be decisive, and the magnitude of each has been determined, which has led to the appearance of clear symptoms of disease in *C. ladanifer*.

ACKNOWLEDGMENTS

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