Plant resistance parasitizes “Orobanche cumana” in sunflower: Genotypic selection of resistant plants and phenotype confirmation

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Introduction

CROPS OF SUNFLOWER OIL

The crops of sunflowers dates back according to archaeological studies to 3,000 BC in Arizona and New Mexico.

Thanks to the crops of sunflowers, we can obtain the famous sunflower oil.

Of this oil, 155 million liters were exceeded in 2021 in Spain, this being the lowest figure in the last 5 years (2.98 liters per person per year being consumed).

CROPS OF SUNFLOWER OIL

Sunflower seeds are characterized by being rich in vitamin E (antioxidant, and anti-inflammatory effects), in addition, this vitamin reduces the risk of developing colon cancer, as well as complications in people with diabetes mellitus.
In women in the menopausal stage it has been seen to decrease the severity and frequency of hot flashes.
They are rich in minerals that promote bone health.The type of fats it contains is one of the healthiest, as well as being rich in fiber and with a high caloric content (but of good quality).

CROPS OF SUNFLOWER OIL

Today, there are 6 types of sunflowers that are divided into two large categories, with the Big Smile being the most popular and the most used, either for decoration, for own consumption of the seeds they produce, etc.

Teddy Bear

Giant sunflowers

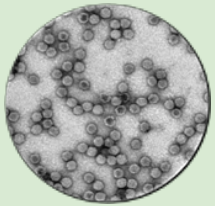
Velvet Queen

Moon Walker

Russian Giant

Big Smile

PLANT DISEASES



Virus

Nematodos

Pathonegic fungi

Powdery Mildew

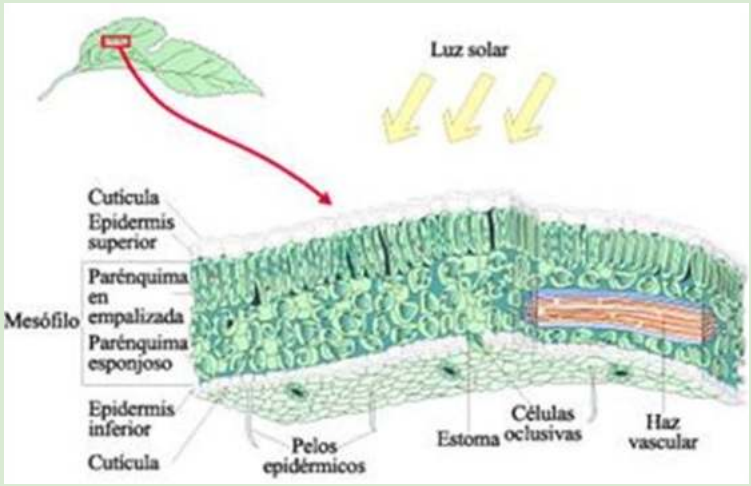
Rust

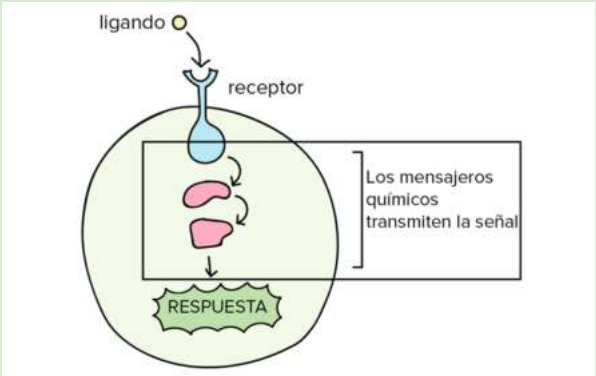
Bacterias

Plants (jopo)

Defense mechanisms

- Plant barriers:
  - ·antimicrobian substances exerted in response to tissue damage.
  - ·kind of epidermis in leaves
  - ·defense mechanisms induced by the presence of pathogens.
  - ·**presence and selection of resistent gen in plant DNA.**





In this project, It was obtained an unknown quantity of sunflowers with the "jopo del girasol" (*Orobanche cumana Wallr.*), without adequate knowledge of them being reached.

This being the unknown that we must solve in the experiment.

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Hypothesis and objectives

HYPOTHESIS

Plants that have the jopo resistance gene are resistant to it.

OBJECTIVES

The main objectives of the projects are:

- To carry out a study on this genetic resistance.
- To recognize the jopo as a pathogen and consequently trigger the defense mechanisms that prevent its parasitism.
- To use specifically molecular markers associated with a resistance gene in order to genotypically select resistant and susceptible plants, and confirm their phenotype.

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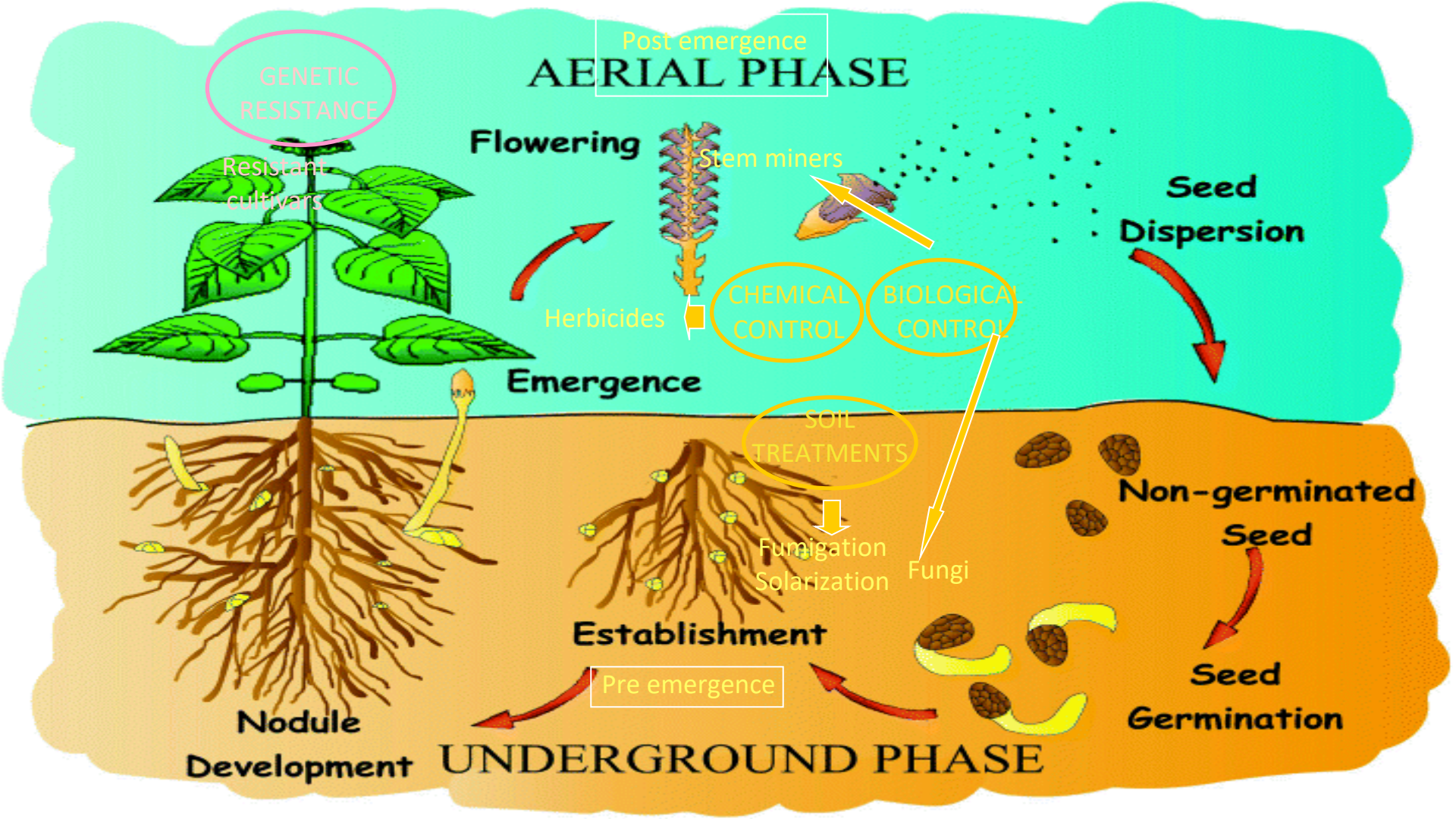
Materials and methods

TYPES OF PLANTS USED

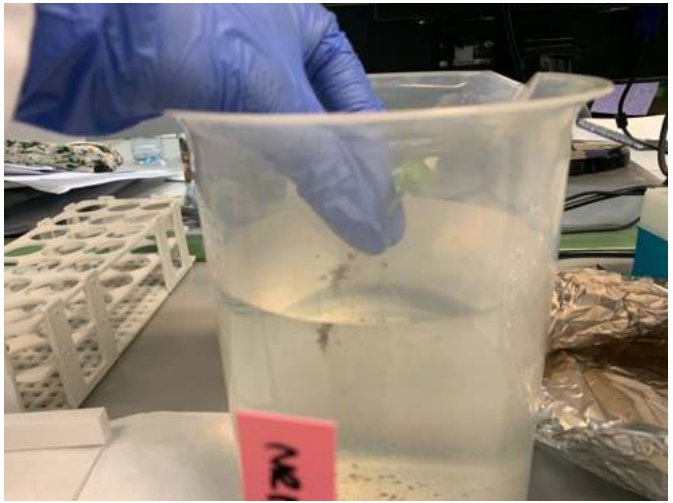
Sunflower: the sunflower (*Helianthus annuus*) has been the selected plant to check which is the gene for resistance against jopo,

Jopo of the sunflower: the jopo of the sunflower (*Orobanche cumana*) is the plant selected as a parasite and to be able to observe if it affects the sunflower or not

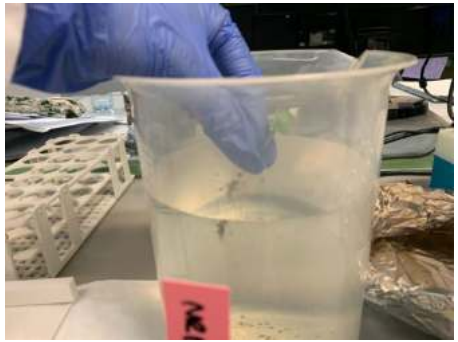
The most sustainable method of jopo control involves the use of sunflowers crops which provide genetic resistance to this parasitic plant.

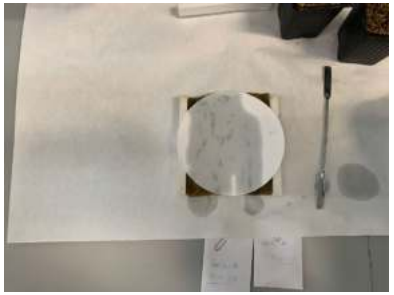

Post emergence
AERIAL PHASE
GENETIC RESISTANCE
Resistant cultivars
Flowering
Stem miners
Seed Dispersion
Herbicides
CHEMICAL CONTROL
BIOLOGICAL CONTROL
Emergence
SOIL TREATMENTS
Fumigation
Solarization
Fungi
Non-germinated Seed
Establishment
Pre emergence
Seed Germination
Nodule Development
UNDERGROUND PHASE

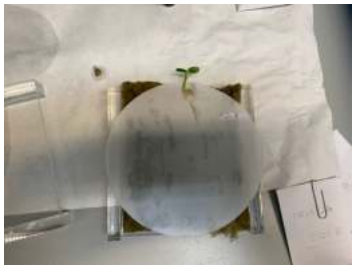
RHIZOTRONS



INOCULATION

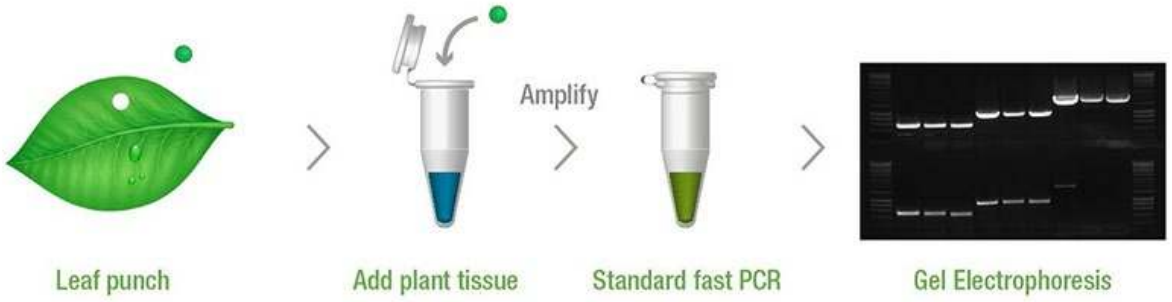






Molecular identification of the resistance

The test used in our research is the PCR that its function is to amplify the DNA of the sunflower to find the resistance genes against the sunflower jopo, to be able to find out which of the samples we have are resistant and which are susceptible.

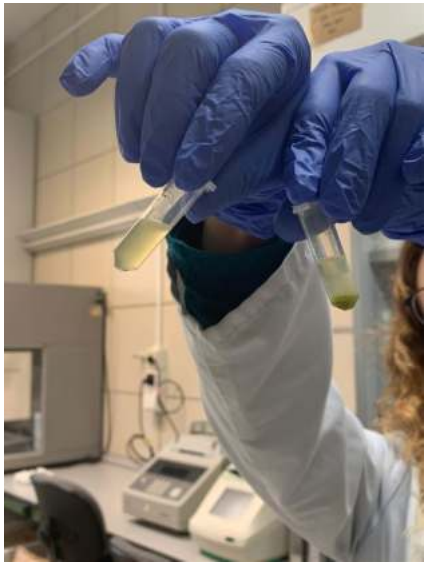


Physiological identification of resistance by observing the jop

To check if the jopo has affected the sunflower or not, what we have done has been to plant the sunflowers in rhizotrons and we have put jopo seeds in their roots and then check which are resistant and which are not.

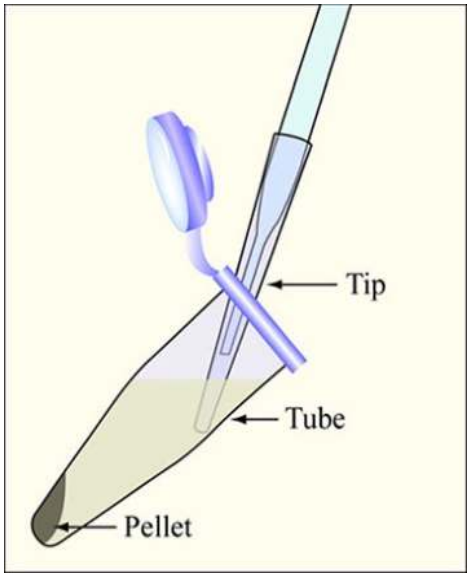
Experimental design

We start by powdering some sunflower leaves using small titanium balls, to later be able to extract the DNA from that plant. We add chloroform with a pipette and centrifuge them using a small centrifugation machine, since we with our hands are not able to centrifuge at the necessary speed.



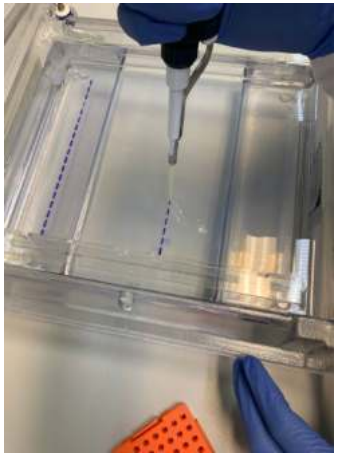
Experimental design

When the required time passes, we extract the eppendorf, which are the containers where we when we extract them, we observe a small solid layer where the DNA is located. We must extract it and repeat the process until the DNA is visible.



Experimental design

Once this happens, then we will check the quality of the DNA using a Nanodrop spectrophotometer, which will check the quality and quantity of DNA of each sample. Afterwards, we must perform the PCR to observe the resistant and susceptible together with an electrophoresis test to corroborate the information. Finally we must plant some sunflower specimens to which we inoculate seeds of the jopo to corroborate that the previous tests have come out correct. To finish we check the three tests and we can see that they have been carried out successfully and that there are no failures in our theories.



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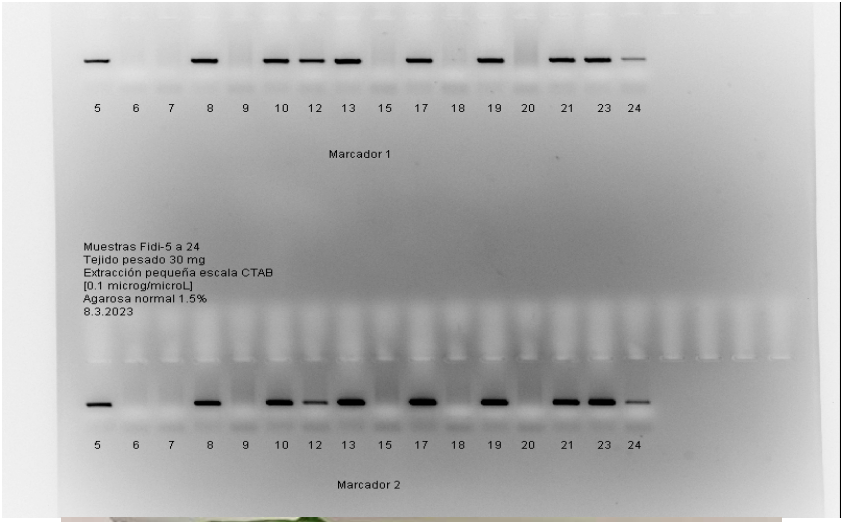
Results

As we were able to verify, thanks to the rhizotrons and the study using the gel, we were able to determine that: fidi 5,8,10,12,13,17,19,21 and 23 were resistant since the gene is present. Once the gel study was carried out, we verified it by planting some plants that coincide with the previous tests and we were able to verify the results visually.



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Conclusion

Observing the results, it can be seen which sunflowers are susceptible to jopo (2) and which ones have recognized jopo as a pathogen (1).

As we have said before, some sunflowers have been susceptible, which are fidi 5, 8, 10, 12, 13, 17, 19, 21 and 23, 1) *this means that they have the gene that determines that the sunflower is resistant* .

And the sunflowers that have accepted jopo as a pathogen are the remaining ones, being fidi 6, 7, 9, 15, 18, 20, 24, 2) *this indicates that they lack the gene to be resistant to jopo.*

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Acknowledgements

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