ZeroParasitic

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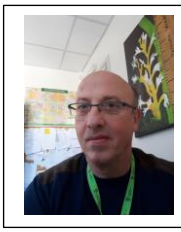
December 2020

NEWSLETTER *ZeroParasitic*



Dr D. Chachalis,coordinator

Word from the Coordinator

INSIDE THIS NEWSLETER:

ZeroParasitic is a Prima 2018, Section 2, funded innovation project.

The main goal of **ZeroParasitic** is to integrate innovative solutions into a realistic framework through a trans-disciplinary, multi-actor effort targeting broomrapes, which is one of the most critical weed in Mediterranean countries, posing a significant threat to various key cropping systems in the region.

Worldwide parasitic weeds represent one of the most destructive and intractable problems to agricultural production in both developed and developing countries.

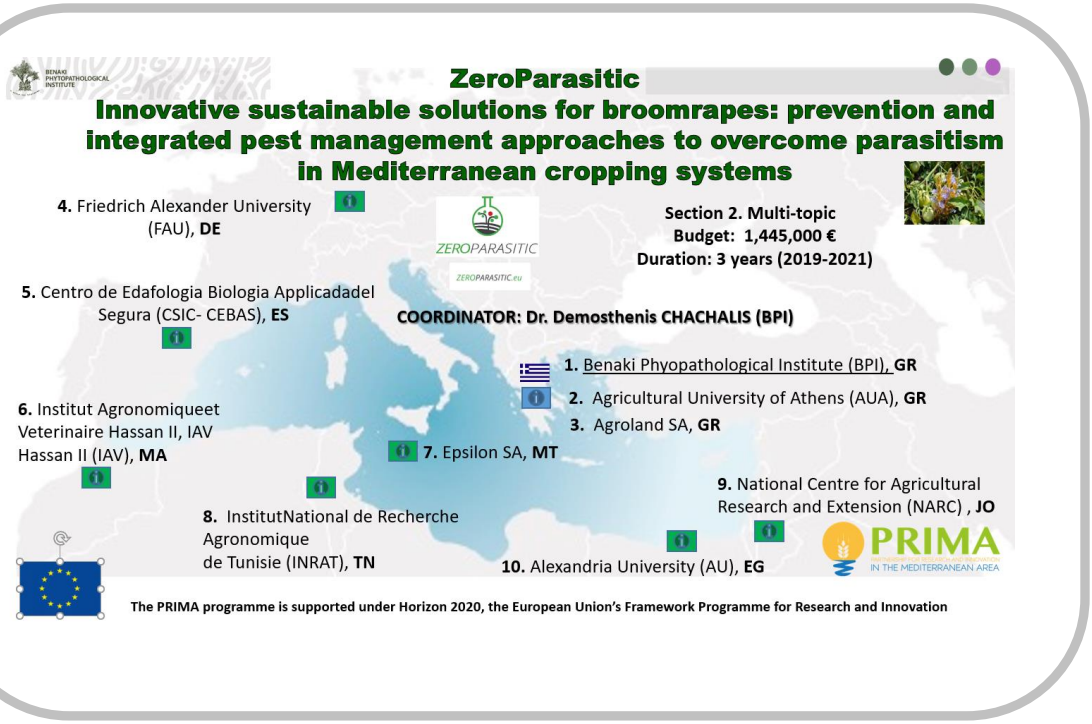
Broomrapes are holoparasitic weeds that cause significant yield and quality losses ranging from 5% to 100% depending on host susceptibility, level of infestation and environmental conditions.

Genetic and molecular approaches will be used at three critical levels to gain new insights on potential regulatory targets of the infection: the broomrapes *per se*, the host plants and their interaction (host-parasite).

The dissemination of the outputs will be based on a systems-thinking approach.

Key points:

- Ten partners
- Eight countries (4 EU, 4 Med Non EU)
- Multi-actor and trans-disciplinnary approach
- Strong socio-economic evaluation of solutions



ZeroParasitic Kick-off meeting (photo)

Kick-off meeting

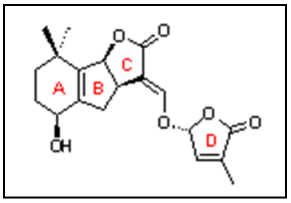
ZeroParasitic Kick-off meeting took place in Benaki Phytopathological Institute, in Athens, 12-13 December 2019. It was a full 2-day meeting aiming to draw the roadmap for the project implementation.

The importance of tackling the problem of the parasitic weeds in the Mediterranean region was highlighted.

All partners have presented the workflow actions particularly for the 1st year of the project. Inter-related actions and task leaders were finalized; discussion about the germplasm and techniques were made. Additionally, the organizational management structure of the project was confirmed by the partners.

Particular attention was given to the main tasks of the project which were: 1) Integrated Pest Management (IPM) strategies; 2) Genetic and molecular approaches for breeding resistance; 3) Surveillance tools for monitoring resistance; 4) Models for prediction of parasitism emergence; 5) Utilizing pattern recognition receptors (PRRs); 6) Socio-economic analysis

Stimulants: effectiveness on populations



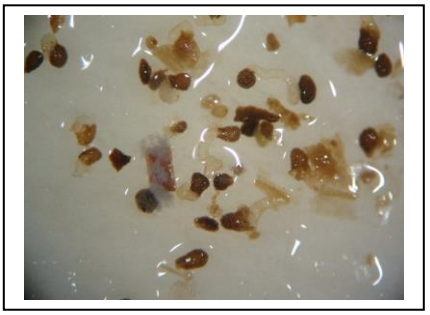
Strigolactones

Experiments were conducted in the Weed Science Laboratory, Benaki Phytopathological Institute. Current synthetic stimulants (e.g. GR-24) are difficult to handle under controlled conditions, they are very expensive and they are not suitable for field experiments.

A new stimulant (e.g. NE-1) that provided in an aqueous formulation suitable for spraying application and having a relatively low cost was tested. The ultimate aim was to develop the most effective suicidal germination strategy targeting the depletion of the soil seed bank.

The germinability were tested in a high number of different Orobanche populations (more than 20 populations) collected from tomato parasitized fields. Developing a protocol for the best conditions during the pre-conditioning and the germination phase is a key factor for such screening. At the same time, it is important to check the effectiveness of the stimulants under different growing soil media. Further, studies will be done to address the above issues.

Studies will continue utilizing more stimulants (e.g. strigolactones mimics) and biocontrol agents under controlled conditions. At the final stage, a field experiment will be established to test the suicidal strategy under real field conditions.



Orobanche spp. seed germination

Drones for mapping

Surveillance tools to map broomrape parasitism are needed. In addition, digital tools (UAV's, remote and satellite images) would help to monitor, record and measure the success of the proposed solutions at various spatial scales.

In summer 2020, a plum tomato field in Central Greece (Domokos region) was selected to test the drone mapping. The drone was equipped with a multi-spectral camera, and two flights in the growing season were made. Groundtruthing consisted of a specific colour marking of free & parasitized areas.

The aim was to develop GIS maps to correlate NDVI index with parasitism in the crop.

UAV mapping of parasitized plum tomato field (Domokos, GR, 2020)

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Tomato Introgression Lines (ILs) and self-pollination experiments

Greenhouse experiment under controlled environmental conditions has been designed at the facilities of Benaki Phytopahological Institute. The plant material, had been sent from our partners, Centro de Edafologia Biologia Applicadadel Segura (CSIC- CEBAS), in Spain. Seeds from different tomato introgression lines (ILs) were put in pots in greenhouse-controlled conditions. The purpose of the above experimental procedure is to self-pollinate the tomato plants in order to obtain satisfactory number of seeds for our future experiments. Self-pollination takes place under totally controlled conditions to avoid any cross pollination.

Fig1.Seedling growth in growth cabin

Fig2. Seedling transplantation in the greenhouse

Fig3. Last transplantation and self-pollination procedure with all the safety measures

Use of UAS for monitoring weed parasitism

With the use of UAS (Unmanned Aerial Systems) and the accomplishment of high spatial resolution aerial imagery, it is possible to achieve more accurate monitoring of tomato crops against weed parasitism.

In the summer of 2020, repetitive flights of a small quadcopter drone were conducted over a plum tomato field in different stages of the growing season, in the region of Domokos in Central Greece. During the flights, aerial photography carried out with the use of a multispectral camera offering images in the Red, Green, Red-Edge and Near-Infrared spectral regions.

The missions were taken place in order to test the optical requirements and determine the flight and imagery parameters for the optimal aerial monitoring of the crop and its broomrape parasitism.

"UAS aerial imagery are used to recognize weed parasitism in tomato fields."

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The goal is the creation of orthophoto maps (Fig.4) with a high spatial resolution of less than 10cm/pixel and the calculation of vegetation index maps, such as NDVI. These essential remote sensing data will be combined with GIS techniques in order to be correlated with the ground data of the recorded parasitized areas.

Fig4.Orthophoto image of the tomato field

ZEROPARASITIC

ZEROPARASITIC

@zeroparasitic

ZEROPARASITIC
PRIMA

Zeroparasitic@epsilon.gr

ZeroParatitic.eu

ZEROPARASITIC PRIMA
COORDINATOR: BPI
8 St. Delta str 14561 Kifisia
Attica

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