



Host recognition and resistance reactions in the interaction of the parasitic weed *Orobanche cumana* and cultivated sunflower



Anna Krupp¹, Annerose Heller¹, Joachim Sauerborn², Otmar Spring¹

¹ University of Hohenheim, Institute of Botany, Garbenstraße 30, 70599 Stuttgart, Germany

² University of Hohenheim, Institute of Plant Production and Agroecology in the Tropics and Subtropics, Garbenstraße 13, 70599 Stuttgart, Germany

E-mail address: anna.krupp@uni-hohenheim.de



Figure 1: Flowering *O. cumana* plant.

Introduction

Orobanche cumana WALLR. is a holoparasitic plant that specifically attaches itself to the roots of cultivated sunflower (*Helianthus annuus* L.) and drains them of water and nutrients. Mass infections cause severe yield loss of 50 - 90% and endanger the cultivation of the important oil crop from the mediterranean region to China, particularly in summer dry areas. To control this weed, resistant sunflower genotypes are used. This resistance is rapidly overcome by more virulent *O. cumana* races, so that new strategies for crop protection must be developed. To accomplish this, a detailed understanding of the interaction of host and parasite is crucial.

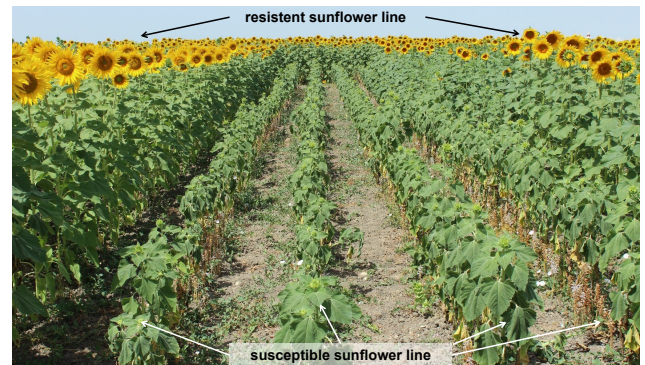


Figure 2: Sunflower field infested with *O. cumana* in Córdoba (Spain). In contrast to the flowering resistant sunflower plants, the susceptible plants are wilted and show heavy *O. cumana* infection.

Objectives

A) Identification of bioactive substances that influence germination and rhizotropism of *O. cumana*.

B) Identification of cellular processes leading to the success or failure in penetrating the host's vascular system.

C) Detection of defense reactions involved in the resistance of sunflower.

Materials and Methods

Germination bioassay

- to test if substances have an inducing or inhibiting effect on germination of *O. cumana* seeds



Figure 3: Experimental setup of a germination bioassay.

Rhizotropism bioassay

- to identify substances that lead to a bending of the *O. cumana* seedling towards the host root

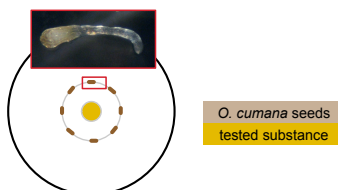


Figure 4: Experimental setup of a rhizotropism bioassay.

Root chamber cultivation technique

- to observe the interaction of *O. cumana* and its host sunflower

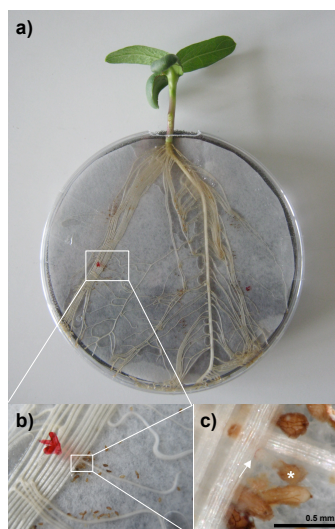


Figure 5: *O. cumana* is cultivated on the roots of sunflower. Enlarged sections b) and c) show the tiny brown *O. cumana* seeds (*) with the reduced hyaline seedling that connects to the host root (→).

Microscopic techniques

- to observe the cellular interaction of *O. cumana* and its host sunflower
- Interaction stages as seen in Fig. 5c) are prepared, fixed, dehydrated and embedded in resin. Then the sample is sectioned with a microtome, stained and analyzed.

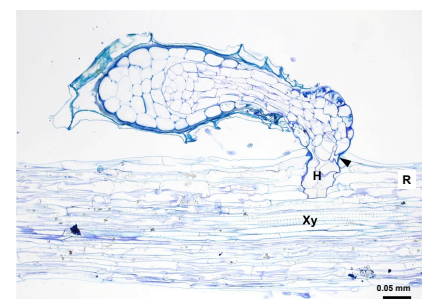


Figure 6: Longitudinal section of an *O. cumana* seedling that penetrates the sunflower root (R) and connects via a haustorium (H) to the host's water supply (Xylem, Xy). Semi-thin section, stained with toluidin blue.



This study is conducted within the framework of the Anton & Petra Ehrmann-Stiftung Research Training Group „Water – People – Agriculture“ at the University of Hohenheim.

www.water4use.info