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Resistance Reactions of Sunflower against the Parasitic Weed *Orobanche cumana*

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Abstract

Sunflower broomrape (*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. This causes severe yield loss and sunflower broomrape has become the most serious threat to sunflower cultivation from the Mediterranean region to China. Resistant sunflower genotypes were used to control the parasite, but all yet available resistance genes were rapidly overcome by more virulent *O. cumana* races. To find new measures to control the problem, it is important to better understand the mechanisms of susceptibility and resistance. Hence, early infection stages of resistant and susceptible host-parasite-combinations cultivated in root chambers were examined microscopically. In both combinations, *O. cumana* seeds were induced by the host to germinate. The germtubes of the highly reduced seedlings attached themselves to the host roots. In the susceptible interaction, *O. cumana* penetrated the host root and formed a tubercle, which developed into a shoot. In the resistant interaction, the development of *O. cumana* stopped after attachment to the host root. Semi-thin sections of *O. cumana* seedlings attached to resistant host roots revealed that penetration stops at the host rhizodermis. There was no resistance reaction of the rhizodermis cells visible with light and fluorescence microscopy. This suggests rather a biochemical than an anatomically based type of resistance. A possible explanation for this phenomenon could be the presence of inhibitors for enzymes of the parasite that degrade middle lamellae and cell walls of host cells, thus preventing the parasite from penetrating host root tissue. Further studies to unravel the biochemical and molecular mechanisms in this resistance will guide breeding to improve sunflower germplasm and to secure crop yield.

Keywords: Broomrape, *Helianthus annuus*, microscopy, *Orobanche cumana*, resistance, sunflower

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