**Hypersensitive response of *Brassica* plants against cabbage white butterfly eggs is specifically induced by egg-associated secretions**

## **Abstract**

Our understanding of cell death in plant immunity remains incomplete. This is especially true for cell death developed in response to herbivorous insects and in particular to their eggs. Here, we characterize at cellular and molecular level a few plant immunity responses associated with a hypersensitive response (HR)-like cell death induced by butterfly eggs in Brassicaceae plants. Specifically, we compared two lepidopteran species, *Pieris brassicae* and *Mamestra brassicae* and two host plants, *Brassica nigra* and *B. rapa*.We show that the macroscopic HR-like cell death is preceded by an accumulation of ROS, callose deposition, cell death, ethylene induction and *PR1* gene expression in both plant species. These plant immunity responses are specifically induced in response to eggs of *P. brassicae*, which are specialist herbivores on Brassicaceae, while they are absent under eggs of *M. brassicae*, a generalist moth. We show that secretions surrounding *Pieris* eggs are sufficient to induce plant immune responses and cell death, unlike the previously described egg elicitor phosphatidylcholines (PCs). Finally, we investigated the specificity of plant intraspecific variation in egg-induced cell death. We show that plant genetic variation in egg-induced cell death is independent from canonical HR as a *B. nigra* accession not displaying a HR-like cell death is still able to develop HR when challenged with pathogenic bacteria and fungi. At molecular level, a *B. nigra* accession developing a macroscopic cell death show an early and more sustained induction of SA-related defense genes compared to the accession lacking cell death, while ROS and cell death are instead equally present regardless of plant intraspecific variation in macroscopic HR-like cell death. Our study is the first one to decipher an insect egg-induced cell death at the cellular and molecular level in the butterflies’ natural hosts. A further identification of genetic and molecular components of plant immunity is needed to understand to which extent plants make use of the plant immune system to recognize eggs and anticipate insect attack.

**Keywords**

Plant-insect interactions, hypersensitive response, egg-associated molecular patterns, oviposition-induced plant responses, *Pieris*, Brassicaceae, plant immune system