

# Is the observed differential reaction of rose powdery mildew on *Rosa* 'Yesterday' correlated with pathotype groups?

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## Introduction

In rose powdery mildew (*Podosphaera pannosa*) two pathotype groups can be discriminated based on the differential reaction in rose (Fig. 1) and *Prunus avium*. Isolates from both groups can be identified by a one basepair difference in their ITS sequence (Leus et al., 2006). The pathotype groups were named R-E and R-P, after isolate R-E, only infectious on rose, and isolate R-P, infectious on both rose and *Prunus*. A specific resistance response characterized by a complete stop of development of germinated conidia was found on *Rosa* 'Yesterday' for pathotype R-E, while R-P could develop on 'Yesterday' by growing mycelium and the formation of new conidia (Hosseini Moghaddam et al., 2014). In current research we investigated whether the observed resistance response in 'Yesterday' could be correlated with the different pathotype groups.



Fig. 1: Powdery mildew on a rose leaf.

## Material and Methods

Seven isolates of powdery mildew were established as monoconidial isolates on rose plants in tissue culture. The isolates were characterized by their ITS sequence and assigned to group R-E or group R-P. Detached leaves of 'Yesterday' were inoculated to observe the response of this rose cultivar upon the different isolates by use of microscopy. The development of the conidia (n = 30) was defined by three different responses: (1) not germinated, (2) germinated and stop of further development, (3) germination followed by normal development. Also the number of cell reactions was counted for 30 conidia per leaf. Fungal development was evaluated after lactophenol blue staining and callose plugs were observed under UV-light after staining with Fluorescent Brightener.

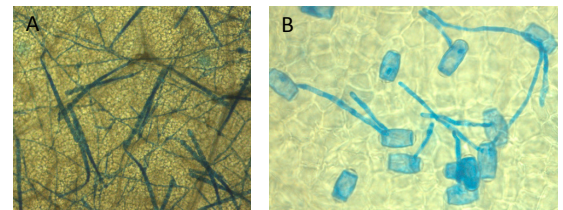


Fig. 2: Normal development of powdery mildew with mycelium and conidiophores (A) Not germinating conidia and conidia with stopped growth after germination (B) Fungal structures are blue through leaf discoloration and lactophenol blue staining.

## Results

Three isolates belonged to the R-P type, while the other four were R-E type. For all seven isolates between 40 and 57% of the conidia didn't germinate after inoculation (Table 1). Germination followed by a complete stop of further development was only seen in the isolates belonging to the R-E pathotype group, and not in the isolates belonging to the R-P pathotype group. However in the new isolates of the R-E type also normal conidia development was observed. These results indicate that the specific response of conidia germinating followed by a stop of development is specific for the pathotype group R-E, although in most isolates this response is not absolute for all conidia.

Table 1: Per pathotype is given: the group according to the ITS sequence and the percentage of conidia (n=30) with normal development, not germinated and stopped development after germination. Also the number of cell reactions observed for 30 conidia was counted.

Isolate of <i>P. pannosa</i>	Pathotype group (ITS)	Number of conidia (%)			Number of cell reactions
		Normal development	Germinated and stopped	Not germinated	
R-P	R-P	57	0	43	5
PM9	R-P	43	0	57	8
PM10	R-P	57	0	43	4
N42	R-P	53	0	47	5
R-E	R-E	0	46	53	0
Laev	R-E	10	46	43	3
Afd 7	R-E	33	14	53	21
S2	R-E	30	30	40	19
Aalst	R-E	23	27	50	3

## Typical resistance responses

Powdery mildew mycelium grows on the leaf epidermis. The fungus tries to penetrate the leaf by use of an appressorium. Before we described different resistance responses in the rose leaves and cells (Dewitte et al., 2007). Now we observed the response on the rose leaf surface through: a reinforcement of the cell wall, a cell reaction leading to cell death in the penetrated cell and by the formation of callose plugs (Fig. 3).

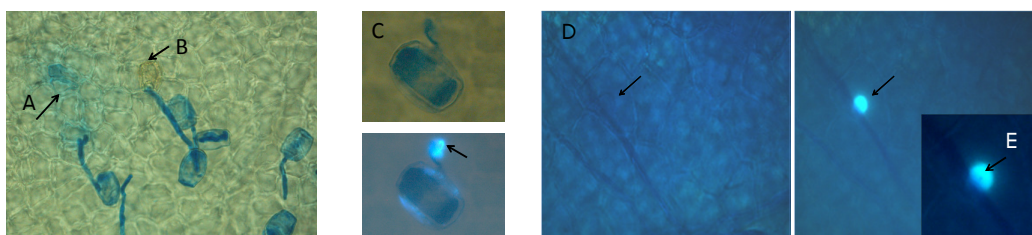


Fig. 3: Resistance responses in rose leaves upon penetration by reinforcement of the cell walls (A), a single cell reaction (B), formation of callose plugs: as a response to a germinated conidium (C) and as a response to an appressorium formed on hyphae (D), the callose plug is circumvented by the fungus by penetration through the plug (E).

## Is the observed differential reaction of rose powdery mildew on *Rosa* 'Yesterday' correlated with pathotype groups?

Yes, only the pathotypes having the the ITS sequence of the R-E type show the typical response with conidia that germinate and stop all further development. Although this response is seen in 100% of the conidia for isolate R-E, it is not absolute for the other isolates belonging to this group.

## References

- Dewitte, A., Leus, L., Van Huylenbroeck, J., Van Bockstaele, E. & Hofte, M. 2007 JCharacterization of reactions to powdery mildew (*Podosphaera pannosa*) in resistant and susceptible rose genotypes journal of Phytopathology, 155: 264-272.
- Hosseini Moghaddam, H., Dewitte, A., Van Bockstaele, E., Van Huylenbroeck, J. & Leus, L. 2014 Roses exhibit pathotype-specific resistance responses to powdery mildew. Journal of Phytopathology, 162: 107-115.
- Leus, L., Dewitte, A., Van Huylenbroeck, J., Vanhoutte, N., Van Bockstaele, E. & Hofte, M. 2006 *Podosphaera pannosa* (syn. *Sphaerotheca pannosa*) on *Rosa* and *Prunus* spp.: Characterization of pathotypes by differential plant reactions and ITS sequences. Journal of Phytopathology, 154: 23-28.



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