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Analysis of the resistance breaking ability of different beet necrotic yellow vein virus isolates loaded to a single *Polymyxa betae* population in soil

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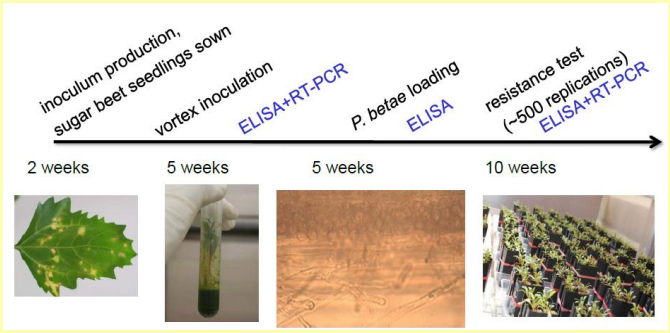
Introduction

Beet necrotic yellow vein virus (BNYVV) is vectored by *Polymyxa betae* and causes rhizomania in sugar beet. By cultivating partial resistant genotypes the disease can be controlled. Resistance genes like *Rz1* and *Rz*2 reduce virus replication and prevent virus spread from infected hair roots into the tap root. The RNA 3 encoded pathogenicity factor P25 is responsible for symptom expression and virus translocation in the root system. P25 has a highly variable amino acid composition at amino acid tetrad 67-70. The uniformly applied *Rz1* resistance is suggested to exert a positive selection on the P25 tetrad composition because isolates with the ability to overcome *Rz1* display a valine at amino acid position 67 (V67) (Koenig *et al*., 2009). However, direct comparison of aggressive isolates has remained impossible due to varying vector population densities and other soil-borne pathogens.

Material and Methods

A method to load a virus-free *P. betae* population was developed (Fig. 1). Three different BNYVV isolates with different tetrad compositions (A-ACHG, IV-VCHG, P-SYHG) were used. Vortex inoculation method was adapted and modified after Koenig and Stein (1990).

Fig. 1: Material and methods used to load a *P. betae* population



Results

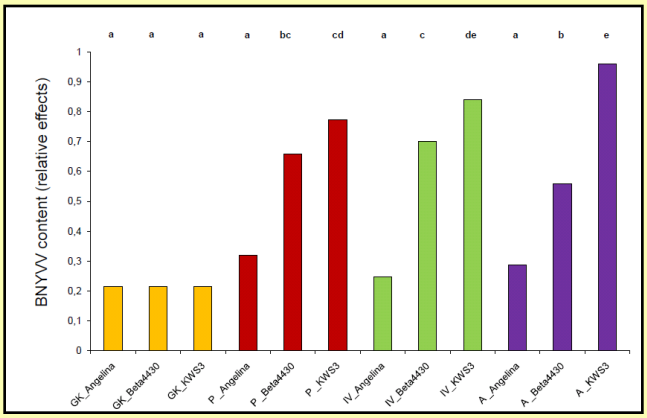
Tab. 1: Number of infected plants (%) after vortex inoculation and resistance test

BNYVV isolate	Genotype	Vortex inoculation	Resistance test
		% infected plants[a]	% infected plants[b]
A	*rz1rz1*	96	100
A	*Rz1rz1*	na[c]	45
A	*Rz1rz1+Rz2rz2*	na	4.5
IV	*rz1rz1*	96	100
IV	*Rz1rz1*	na	87.5
IV	*Rz1rz1+Rz2rz2*	na	2.2
P	*rz1rz1*	84	92.1
P	*Rz1rz1*	na	73.7
P	*Rz1rz1+Rz2rz2*	na	7.5

[a] mixed sample obtained from seven plants per pot; [b]mixed sample obtained from four plants per pot; [c] na = not applicable

- **A virus-free *Polymyxa betae* population from a naturally infested field soil was loaded.**
- **A high infection efficiency was achieved (Tab. 1).**
- **In order to evaluate the data properly, nonparametric analyses was performed and results shown as relative effects (Fig. 2).**

Fig. 2: Total virus contents induced by three BNYVV isolates (A, IV, P) on different sugar beet genotypes shown as relative effects



- **No influence of vector population or vector concentration on resistance breaking BNYVV isolates was observed.**
- **BNYVV isolates from soils of different geographic origin retain their increased aggressiveness when loaded to the same vector population.**
- **A loss of fitness was observed concerning the P and IV isolates infecting susceptible sugar beets.**

References: Koenig, R. and Stein, B. (1990). *Schriftenreihe der Deutschen Phytomedizinischen Gesellschaft,* vol. 1. *Proceedings of the First Symposium of the International Working Group on Plant Viruses with Fungal Vectors, Braunschweig, Germany, August 21-24,* pp. 87-90.
Koenig, R., Loss, S., Specht, J., Varrelmann, M., Lüddecke, P., and Deml, G. (2009). J. Gen. Virol. 90:759-763.

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