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Impact of TuYV isolate diversity and abiotic factors for the assessment of existing R54-based TuYV resistance

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Background:

Turnip yellows virus (TuYV), which is widespread in various winter oilseed rape growing regions and is transmitted by the aphid species *Myzus persicae*, leads to considerable yield losses after infection. TuYV and its vector show a high genetic diversity between different isolates/biotypes. So far, the only way to control the viral disease associated with TuYV is to use resistant varieties.

Objective:

With the aim of investigating how the diversity of virus isolates and the characteristics of the established but only available R54 resistance in terms of sensitivity to abiotic stress limit the functionality of resistance in the future, we conducted a number of different experiments.

Methods:

For this purpose, we investigated up to 10 different virus isolates from Germany and surrounding European countries with regard to their genetic diversity (next generation sequencing), infectivity (infection rate, relative virus titre) and symptom expression after infection (leaf colouration) under field and controlled environmental conditions. In addition, we simulated climate scenarios expected for the future autumn season in eastern Germany and investigated the impact on previous parameters taking resistance into account in a number of 14 different approved and candidate varieties. Quality parameters (thousand grain weight, seed size, oil content and quality) were measured in connection with susceptibility/resistance and virus infection.

Results:

We observed for two oilseed rape genotypes (resistant and susceptible) that six weeks after infection measured extinction values are in general smaller on a resistant variety but vary between isolates. In a set of isolates, one with a particularly high relative virus titre and no significant difference between a resistant and a susceptible genotype was detected. An increase of the number of resistant plant genotypes tested indicates that this isolate was not able to overwhelm resistance in all genotypes. In case of a simulated increase of temperature, an increased virus titre can be observed in susceptible and resistant varieties but not for all virus isolates tested. Symptom expression is reduced or absent when temperature increases indicating no correlation between virus titre and symptom expression. Quality parameters were differently affected as a consequence of TuYV infection with effects observed for susceptible as well as resistant genotypes. Based on the limited genetic data, an attempt was made to find explanations for differences of isolate virulence under conditions described above.

Conclusions:

We could show that the efficiency of R54 resistance strongly depends on the genetic background of the tested varieties and candidate varieties. R54-based resistance may lose its functionality depending on the virus isolate and as a consequence of increasing temperatures. A lack of correlation between virus titre and symptom was found, the latter being completely absent at higher temperatures. This may lead to misinterpretations of a possible infection status of plants in the field. Especially with regard to the occurrence of virus isolates that can overcome the only existing resistance, it seems necessary to use genetic information to screen for critical isolates in the field. This information should be implemented in resistance management as long as no other sources of resistance are available.