

Glycoalkaloid content in potato tubers with different levels of resistance to *P. infestans*

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Introduction

Many Solanaceae family members synthesize steroidal glycoalkaloids. α -chaconine and α -solanine are the most abundant (95%) in potatoes and are often referred to as Total Glycoalkaloids (TGA). The average ratio of α -solanine to α -chaconine is 40:60, but deviations have been reported. Glycoalkaloid content varies depending on tissue and expression is determined by both genetic and environmental factors. Many of the *Solanum* species of interest to breeders may contain levels in excess of 200 mg/kg (fresh weight) which is the standard maximum level allowed by international health regulation.

It has been assumed that glycoalkaloids are a part of the natural defence against some pests as well as diseases like late blight. However, some studies have concluded that tuber TGA content may not be responsible for observed tuber resistance to late blight. In a study of late blight resistance in progenies from the species *Solanum vernei* no consistent relationship could be observed between resistance and α -chaconin. However, a low, but statistically significant, correlation was found between concentration of α -solanin and the two late blight resistance components studied (incubation period and spore production per unit lesion area).

Aims

To investigate if a relationship exists between the *P. infestans* tuber resistance components mycelium growth and lesion size on one hand and TGA, α -chaconin and α -solanin concentrations in tubers on the other hand.

To study if the proportion of α -solanin and α -chaconin varies between tubers from different types of potato (*Tuberosum* contra wild species) or between different resistance groups.

Materials and Methods

Tubers of 12 *Tuberosum* breeding lines, 4 cultivars, 15 accessions from different *Solanum* species (*S. andigenum*, *S. neoantipoviczii*, *S. papita* and *S. ruiz-ceballosii*) and 12 interspecific hybrids (derived from crosses using *S. microdontum*, *S. neoantipoviczii*, *S. tarijense* and *S. phureja*) were evaluated for resistance to *P. infestans* as well as for TGA, α -solanin and α -chaconine contents.

Five tubers from each genotype were selected for analysis of TGA, α -solanine and α -chaconine content by HPLC.

Resistance to *P. infestans* was evaluated by inoculating tubers with an aggressive isolate (SE 03058, A1, virulence genes 1.3.4.7.10.11). Inoculum comprised 20,000 sporangia/ml. Mycelium growth was scored 0-3 (3=very abundant growth) and lesion size 1 - 9 (9=highest resistance).

Spearman 1-tailed analyses of correlation was performed with SPSS 15.0, Windows Evaluation Version.

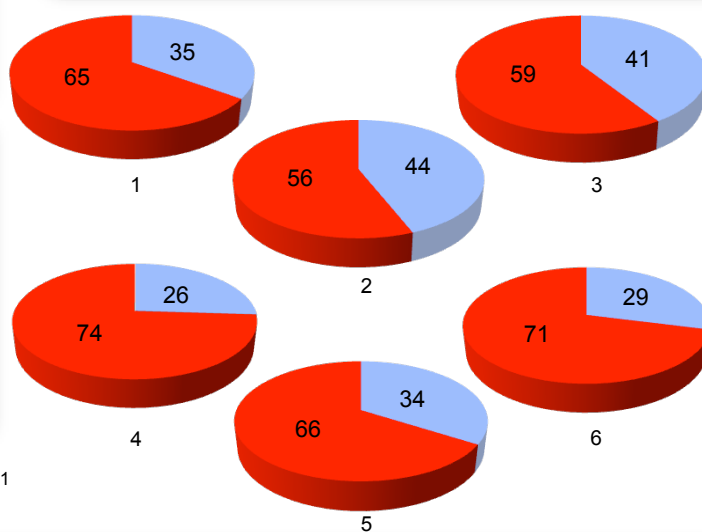


Figure 1. Ratio of α -solanin and α -chaconin in tubers from accessions originating from wild species and interspecific hybrids (1–3) and genotypes of *Tuberosum* type (4–6). S=1 and 4, MR=2 and 5 HR=3 and 6. Blue = α -solanin, red = α -chaconin.

Result

Average TGA content found in tubers from accessions of wild species and interspecific hybrids from wild parents (838 mg/kg fresh weight) highly exceeded the one in the *Tuberosum* group (114 mg/kg fresh weight).

No significant correlations were found neither between TGA or α -solanin and the two evaluated resistant factors nor between α -chaconin and mycelium growth. A significant correlation (Spearman's $\rho=0.224$, $p=0.03$) was however observed between lesion size and α -chaconine in the *Tuberosum* material but not for the accessions originating from the wild species.

The material was sorted in 3 resistance groups (HR=high resistance (grades 7.0-9.0), MR=moderate resistance (5.0 to 6.9) and S=susceptible (1.0 to 4.9)) depending on results in the tuber inoculation test (lesion size). The HR-group consisted of 5 breeding lines, 12 wild species accessions/interspecific hybrids. Five breeding lines and cv. Bintje were found susceptible together with 4 wild accessions/interspecific hybrids. The rest of the material, including cv. Asterix, Matilda and Superb, had moderate resistance levels.

α -chaconin was predominant in all cases in both groups (Fig. 1, 1–6) but the ratios were higher in the *Tuberosum* group (4–6). However, the different resistance groups showed slightly different proportions between the two glycoalkaloids and the domination of α -chaconin was most evident for the most sensitive genotypes in both groups (1 and 4).