

HIP WP3.3: Insect resistance

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Potato cultivation is suffering from a range of insect pests, including the Colorado potato beetle (CPB), various aphids, fleas and psyllids. Next to direct damage caused by feeding, insects can also cause indirect damage by transmitting virus and bacterial diseases which can lead to additional yield losses. Combating insects mainly takes place by chemical means, which is undesirable from an environmental perspective and is increasingly facing societal opposition. In In Buildingblock 3 worpackage 3.1 we explore the use of host plant resistance as an environmental friendly solution to the insect problems in potato.

Highlights:

In 2020 the evaluation of 335 clones (128 species) of potato wild relatives with the Colorado potato beetle (*Leptinotarsa decemlineata*, CPB, figure 1) was completed. It resulted the identification of 62 clones on which no CPB survived and an additional 17 on which CPB showed a very poor development, indicating that also these are highly resistant. The set of highly resistant materials consisted of diploid and tetraploid species, both EBN1 and EBN2. Correlating CPB resistance data with metabolite data collected in BB2 indicated that there was a negative correlation between larval weight and the tomatine concentration. The set of materials is a good starting point for further investigations on CPB resistance.



Figure 1: Larvae of the Colorado

Materials that in 2019 were identified as putatively resistant to the aphid (*Myzus persicae*) and whitefly (*Trialeurodes vaporariorum*) in detached leaf assays, were validated in 2020 using a whole plant assays. In this case the whitefly *Bemisia tabaci* was used. Highly significant differences ($P < 0.001$) among the 20 accessions tested were found for both insects and also variation within species was shown to be present. All clones showing full resistance to aphid and whitefly were densely populated with type IV glandular trichomes. Some clones were highly resistant to the sucking insects, and also to the CPB. These clones were selected for further studies.

Bottlenecks: None

Planning:

CPB resistance

In 2021 we will study the effect of plant age on CPB resistance and the response of resistant clones to different CPB isolates. As there are a large number of clones resistant to CPB, it is important to know which ones are most easy to use in breeding; from which clones can resistance most easily be introgressed into *S. tuberosum*. To study this we will create 10 small populations of CPB resistant di- and tetraploids with *tuberosum*.

Aphid and whitefly resistance

We will focus our efforts on trichome based resistance. Here the important issue is: how genetically complex is this resistance? We will study this by creating a segregating population of a type IV producing clone with diploid *tuberosum*, produce a small in vitro population of approx. 50 individuals, and analyze segregation of whitefly and CPB resistance, as well as segregation of trichomes type IV.