



PPP Project Annual Report 2018

The PPP-projects that have been established under the direction of the top sectors must submit an annual report on their technical and financial progress. This format is to be used for reporting the technical progress. A separate format ('PPP final report') is available for PPP-projects that have been completed in 2018.

The annual reports will be published in full on the websites of the TKIs/top sector, excluding the blocks 'Approval coordinator/consortium' and 'Planning and progress'. Please ensure that no confidential matters are left in the remaining blocks.

The PPP Project Annual Reports must be submitted to the TKI's before March 1st 2019. For Wageningen Research this will be coordinated via a central point.

General information	
PPP number	KV 1409-029
Title	Genetics and mechanism of Aphid resistance in <i>Capsicum</i>
Theme	Topsector Tuinbouw & Uitgangsmaterialen, Meer met Minder
Executive knowledge institution(s)	Plant Breeding Wageningen University and Research
Research project leader (name + e-mail address)	Dr. Ben Vosman (ben.vosman@wur.nl)
Coordinator (on behalf of private parties)	Dhr. R. Linders (rico.linders@syngenta.com)
Government contact person	Annet Zweep
Total project size (k€)	1045 k€, excl. btw
Address projectwebsite	-
Start date	June 1, 2015
End date	December, 31 2019

Approval coordinator/consortium

The annual report should be discussed with the coordinator/the consortium. The TKIs appreciate being informed of possible feedback on the annual report.

The coordinator has assessed the annual report on behalf of the consortium:	<input checked="" type="checkbox"/> approved <input type="checkbox"/> rejected
Possible feedback on the annual report:	

Planning and progress (if there are changes to the project plan, please explain)

Is the PPP going according to plan?	Yes, but one of the industrial partners experienced some difficulties that caused some delay.
Have there been changes in the consortium/project partners?	no
Is there a delay and/or deferred delivery date?	No, but materials produced by one of the industrial partners will be less advanced
Are there any substantive bottlenecks? Provide a brief description	no
Are there any deviations from the projected budget?	no

Short content description/aim PPS

What is going on and how is this project involved?

What will be delivered by the project and what is the effect of this?

Aphids can cause severe problems in pepper cultivation. We have identified a resistance source on which *M. persicae* shows a strongly reduced reproduction rate. In this project we analyze the genetics of the resistance and study the resistance mechanism to facilitate its use in breeding aphid resistant pepper varieties.

Results in 2018/ so far

Give a short description of the high-lights and project deliverable in 2018 / so far

Several aphids can cause problems in pepper cultivation. They produce all kinds of damage, such as chlorosis, necrosis, wilting, defoliation and fruit loss. Also they produce honeydew, but the most important damage is caused indirectly by the viruses that are transmitted by the aphids. During the last years we (Plant Breeding Wageningen University and Research (WUR-PB)) together with leading Dutch pepper breeding companies have evaluated wild relatives of the cultivated pepper for resistance against the aphid *Myzus persicae*. This has resulted in the identification of a resistance source on which *M. persicae* shows a strongly reduced reproduction rate (Sun et al., 2018a).

In this project we analyze the genetics of the resistance and study the resistance mechanism to facilitate its use in breeding aphid resistant pepper varieties.

Fine mapping of the previously identified major aphid resistance QTL, was continued with a new round of recombinant selection in 2500 plants. This resulted in the identification of a 66 kb region still containing 4 candidate genes, based on the recently released *C. baccatum* genome.

Of these 2 are expressed in leaves, making them prime candidates for the resistance gene.

Last year we already showed that different *M. persicae* populations cause different responses in the pepper accession resistant to a population originating from the Netherlands (NL). The NL population induced an increased production of reactive oxygen species (ROS) and callose deposition, compared to a population originating from Switzerland (SW), suggesting that the SW population had (partly) overcome the resistance (Sun et al., 2018b). This year we analyzed the overall gene-expression in response to both aphid populations. An RNA-seq experiment was carried out to identify differentially expressed genes in response to feeding by either (NL or SW) aphid population. More genes were significantly up or down regulated in response to the SW than to the NL aphid population. Only a small portion of the differentially expressed genes was regulated by both aphid populations. Most of the up regulated genes, like peroxidases, are genes known to be involved in the defense response. Interestingly the gene most significantly up regulated in the interaction with the SW aphids was a catalase. This enzyme is known to be involved in the breakdown of ROS.

This year we also collected a number of new *M. persicae* populations from commercial (organic) paprika growers. The response of these populations towards the resistance source will be studied, which will provide information on the effectiveness of the resistance source in Dutch greenhouses.

Furthermore the companies involved in the project continued their efforts to introduce the major resistance gene from *C. baccatum* into *C. annuum*, which is not a trivial task as the species are poorly crossable. From one of the companies BC2S1 seeds will be available for testing the effectiveness of the resistance in the *C. annuum* background in 2019.

Number of delivered products in 2018 (in an appendix, please provide the titles and/or description of the products or a link to the products on public websites)

Academic articles	Reports	Articles in journals	Introductions/workshops
	-	2	5
Titles/ description of the most important products in 2018 (5 at max) and their target group			
See appendix			

Appendix: Names of the products or a link to the products on a public website including the link to the project summary on Kennisonline

Peer reviewed papers:

Sun, M., R.E. Voorrips, G. Steenhuis-Broers, W. van 't Westende & B. Vosman (2018a) Reduced phloem uptake of *Myzus persicae* on an aphid resistant pepper accession. *BMC Plant Biology* 18:138. <https://doi.org/10.1186/s12870-018-1340-3>

Sun, M., R.E. Voorrips & B. Vosman (2018b) Aphid populations showing differential levels of virulence on *Capsicum* accessions. *Insect Science* <https://doi.org/10.1111/1744-7917.12648>

Abstracts/ Lectures:

Vosman, B. (2018) Enrichment of Crop Genepools with Wild Relative and Landrace Diversity. 4th International Conference "Plant Genetics & Breeding Technologies" July 12-13, 2018, Vienna.

Vosman, B. (2018) Different Mechanisms of Insect Resistance in tomato and pepper. 15th *Solanaceae* Conference, Sept 30th - Oct 4th 2018, Chiang Mai, Thailand.

Vosman, B. (2018) Bladluis resistentie in paprika. Onderzoekersdag groene veredeling. 13 december 2018, Wageningen.

Posters:

Sun, M. (2018) Phloem-based resistance to aphids in pepper leaves', International CRC 973 Symposium, April 8-11, Berlin.

Sun, M. (2018) Aphid populations show differential levels of virulence on *Capsicum*', EPS retreat, July 3-6, Utrecht.