

# Crossability of wild potato species and advanced breeding lines resistant to late blight

B. U. Carlson-Nilsson, Plant Breeding and Biotechnology, Swedish University of Agricultural Sciences, P.O. Box 101, SE-230 53 Alnarp, SWEDEN, [ulrika.carlson@ltj.slu.se](mailto:ulrika.carlson@ltj.slu.se)  
N. M. Zoteyeva, N.I. Vavilov Institute of Plant Industry,(VIR), RUSSIA

## INTRODUCTION

The most effective and environmentally friendly way to defeat *Phytophthora infestans* is by incorporation of resistance genes from new sources like wild potato species and advanced breeding lines. Resistance can be determined by single genes (vertical resistance, race specific) or quantitative trait loci (horizontal resistance). In the 1970s, potato breeding with emphasis on vertical resistance was replaced with breeding for horizontal resistance (Wastie, 1991). Several authors have examined the relationship between race specific and field resistance in potato and have found evidence for a beneficial effect of R-genes (Steward et al., 2003). The main aim for this present study is to examine the crossability of wild species and breeding lines resistant to *P. infestans* for use in the breeding program at SLU, Sweden. Initially accessions from different species and breeding lines were evaluated for leaf and tuber resistance.

## MATERIALS AND METHODS

Evaluations for resistance were performed in laboratory inoculation tests on detached leaflets and decapitated tubers with a suspension of *P. infestans* (25 000 zoospores/ml). Fig. 1 and 2.

*Solanum demissum* Lindl. and the phylogenetically close species *S. guerreroense* Corr. were used as genetic sources of extreme resistance to *P. infestans*. Accessions that showed a hypersensitivity reaction (HR) were identified in leaflet inoculation tests performed earlier. These accessions were pollinated with pollen of cultivar (cv.) Superb and *S. tuberosum* subsp. *andigena* Hawkes respectively. One accession from the species *S. ruiz-ceballosii* Card. (VIR-7370) was identified as highly resistant in both leaves and tubers (Zoteyeva, 1999). Plants from this accession were hybridized with selections of the cv. Aurora.

Advanced breeding lines from the collection at the plant breeding program at SLU, Sweden, are promising parental material combining resistance to *P. infestans* and good consumer qualities. These lines were evaluated in the field under severe infection pressure as well as in laboratory tests.

Hybridizations were performed on decapitated branches in the summer of 2009. The branches were kept in jars with water in a greenhouse, Fig. 3.



Figure 3. Hybridizations performed in a greenhouse.

Table 1. Results of evaluation of resistance to *P. infestans* performed in 2008 and 2009

Parental accessions	Resistance to <i>P. infestans</i>		Consumer qualities	Parental accessions	Resistance to <i>P. infestans</i>		Consumer qualities
	foliar	tuber			foliar	tuber	
Kiva	S*	R	Good	04-2081	M	R	Satisfying
Ora	M	R	Good	04-2662	R	R	Satisfying
Rosamunda**	not tested	R	Good	04-3262	M	R	Satisfying
Superb	S	M	Very high	<i>S. demissum</i> L.	R	M	Wild type
08-9-Aurora	R	M	High	<i>S. guerreroense</i> Corr.	R	M	Wild type
05-A3 adg	M	R	Satisfying	<i>S. ruiz-ceballosii</i> Card.	R	R	Wild type
93-1015	ER	S	Satisfying				

\*) Levels of resistance, ER – extreme, R- high, M – medium, S - susceptible

\*\*) Immune to wart, resistant to *Globodera rost.*, race 5

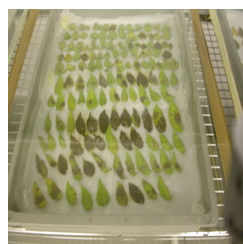


Figure 1. Inoculation test on detached leaflets



Figure 2. Inoculation of tubers.

## RESULTS AND DISCUSSION

Results from the evaluation of resistance is shown in Tab. 1.

Hybrid seeds were obtained from hybridizations between *S. demissum* and *S. guerreroense* on one hand and cv. Superb and *S. tuberosum* subsp. *andigena* on the other hand (Tab. 2).

The results from the study of the hybridization ability showed that cv. Superb was an effective pollinator and yielded a high number of seeds in hybridizations with advanced breeding lines. High number of seeds was obtained in a single cross with cv. Rosamunda (female) with the breeding line 04-3262. In reciprocal crosses between cv. Ora and the breeding line 04-3262 the number of seeds found was twice as high when cv. Ora was the female parent.

The results from the hybridizations between the breeding lines 04-2081 and 04-2662, showed that seed production was lower in combinations with cv. Ora, compared to with cv. Kiva. In opposite, in combinations with the breeding line 93-1015 (female parent), number of seeds was higher in the crosses with cv. Ora compared to cv. Kiva. Number of seeds obtained in interspecific crosses was much lower than in crosses between *S. tuberosum* L. accessions.

Seeds were sown in 2010 and the germination percent was high.

Table 2. Hybridization combinations and number of seeds per fruit

Combination	Nr of seeds per 1 fruit	Combination	Nr of seeds per 1 fruit
04-2081* × Kiva	110,3	93-1015 × Kiva	94
04-2081 × Ora	80	93-1015 × Ora	120
04-2662 × Kiva	65,7	08-A3 adg** × Kiva	102
04-2662 × Ora	47,5	08-A3 adg × Superb	206
04-2662 × Superb	102	08-9-Aurora × rcb VIR-7370	29
04-3262 × Ora	68,8	dms VIR-3355 × Superb	45,5
Ora × 04-3262	120	grr VIR-18407 × Superb	40
Ora × Superb	144,7	dms VIR-3355 × 05-A3-adg	33,7
Rosamunda × 04-3262	170	grr VIR-18407 × 05-A3-adg	54

\*) genotypes belonging to *S. tuberosum* (green)

\*\*) Abbreviations acc. to the Centre for Genetic Resources, Wageningen, The Netherlands: adg – *S. tuberosum* spp. *andigenum*, rcb – *S. ruiz-ceballosii*, dms – *S. demissum*, grr – *S. guerreroense*

## Literature cited:

Stewart H. E., J. E. Bradshaw\*† and B. Pande, 2003. The effect of the presence of R-genes for resistance to late blight (*Phytophthora infestans*) of potato (*Solanum tuberosum*) on the underlying level of field resistance. *Plant Pathology*: 52, 193–198.  
Wastie, R.L., 1991. *Phytophthora infestans*, the cause of late blight of potato—Breeding for resistance. Academic Press, San Diego, CA. Agrios, G.N. 1997. Plant pathology. 4th ed. Academic Press, San Diego, CA.  
Zoteyeva N.M., 1999. Reconstruction of the potato wild species collection from VIR and Late Blight research. CEEM Collaborative Project in Potato Late Blight Control, Progress Report, Cornell University, July, 1999, App. 4.