

Article

Homoelogenous chromosome pairing and alien introgression in backcrossing progenies derived from hybrids *Solanum tuberosum* (+) Mexican 2x (1 EBN) B-genome potato species

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Supplementary Material

Table S1. Primers used in this study for the marker-assisted selection

Target resistance gene (chromosome)	Source of intro-gre-ssion	Pathogen	Marker	Primer sequence	Annealing temperature	Restrictase	Expected size of amplified frag-ment (bp)	References
<i>Rpi-blb1</i> (VIII)	blb	<i>Phytophthora infestans</i>	BLB1F/R	F: AACCTGTATGGCAGTGGCATG R: GTCAGAAAAGGGCACTCGTG	58	--	821	[66]
			1/1'	F: CACGAGTGCCCTTTTCTGAC R: ACAATTGAATTTTAGACTT	50	--	213	[65]
<i>Rpi-blb3</i> (IV)	blb	<i>Phytophthora infestans</i>	Blb3F/R	F: TGTCGCTGAAAGAGTAGGCC R: TCCTGAGGTTTTATGACTCATC	50	--	757	[67]
			Rpi-blb3	F: AGCTTTTGTAGTGTGTAATTGG R: GTAACACGGACTCGAGGG	62	--	305	[68]
<i>R8</i> (IX)	dms	<i>Phytophthora infestans</i>	184-81/RsaI	F: CCACCGTATGCTCCGCCGTC R: GTTCCACTTAGCCTTGCTTGCTCA	60	Rsa I	480	[64]

RMc1 (XI)	blb	<i>Meloidogyne chitwoodi</i>	193I9	F: GCATGAGGTTGTTGGTGTG R: TGGCTAAATTCCGCACTACC	48	--	~300	[43]
			39E18	F: ATCGGATTGCCACGTTATGT R: CCGAAAGAATTGGCTCACTC	60	--	~400	[43]

Table S2. Molecular screening of hybrid genotypes with DNA markers that are associated with resistance genes conferring resistance to Columbia root-knot nematode (*Meloidogyne chitwoodi*) and to *P. infestans*

#	Genotype	Gene / Diagnostic marker						
		<i>RMc1(blb)</i> / 193I9	<i>RMc1(blb)</i> / 38E18	<i>Rpi-blb1</i> / 1/1'	<i>Rpi-blb1</i> / blb1 F/R	<i>Rpi-blb3</i> / Rpi-blb3	<i>Rpi-blb3</i> / blb3 F/R	<i>R8</i> / 184-81/RsaI
Parental accessions:								
	<i>S. tarnii</i> , GLKS 2870	+	+	–	–	–	–	+
	<i>S. pinnatisectum</i> , GLKS 1607	+	–	–	–	–	–	+
	<i>S. bulbocastanum</i> , GLKS 31741	+	+	+	+	+	+	+
	<i>S. tuberosum</i> , cultivars : Delikat, Rasant, Romanze, Sonate, Quarta	–	–	–	–	–	–	–
1a. Interspecific combination: <i>S. tarnii</i> , GLKS 2870 (+) <i>S. tuberosum</i> , cv. Delikat								
Offsprings of the SH 838/2: <i>trn</i> (+) <i>Delikat</i>								
1	SH 838/2	+	+	–	–	–	–	+
2	BC ₁ 838/2/80 <i>trn</i> (+) <i>Delikat</i> x <i>Delikat</i>	–	–	–	–	–	–	+
3	BC ₂ 838/2/80/5 <i>trn</i> (+) <i>Delikat</i> x <i>Delikat</i> x <i>Sonate</i>	–	–	–	–	–	–	–
4	BC ₁ 838/2/25 <i>trn</i> (+) <i>Delikat</i> x <i>Delikat</i>	–	–	–	–	–	–	–
5	BC ₂ 838/2/25/1 <i>trn</i> (+) <i>Delikat</i> x <i>Delikat</i> x <i>Sonate</i>	–	–	–	–	–	–	–
6	SBC ₃ 838/2/25/1/3/13 <i>Self-pollinated</i> BC ₃ <i>trn</i> (+) <i>Delikat</i> x <i>Delikat</i> x <i>Sonate</i> x <i>Sonate</i>	–	–	–	–	–	–	–
7	SBC ₃ 838/2/25/1/3/15 <i>Self-pollinated</i> BC ₃ <i>trn</i> (+) <i>Delikat</i> x <i>Delikat</i> x <i>Sonate</i> x <i>Sonate</i>	–	–	–	–	–	–	–
Offsprings of the SH 838/7: <i>trn</i> (+) <i>Delikat</i>								
8	SH 838/7	+	+	–	–	–	–	+

9	BC ₁ 838/7/18 <i>trn(+)</i> Delikat x Delikat	-	-	-	-	-	-	+
10	BC ₂ 838/7/18/3 <i>trn(+)</i> Delikat x Delikat x Sonate	-	-	-	-	-	-	+
11	BC ₁ 838/7/53 <i>trn(+)</i> Delikat x Delikat	-	-	-	-	-	-	+
12	BC ₂ 838/7/53/3 <i>trn(+)</i> Delikat x Delikat x Sonate	-	-	-	-	-	-	+
13	BC ₄ 838/7/53/3/23/6 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate	-	-	-	-	-	-	-
14	BC ₄ 838/7/53/3/23/7 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate	-	-	-	-	-	-	-
15	BC ₄ 838/7/53/3/23/9 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate	-	-	-	-	-	-	-
16	BC ₄ 838/7/53/3/23/4 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate	-	-	-	-	-	-	-
17	BC ₅ 838/7/53/3/23/4/15 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate x Rasant	-	-	-	-	-	-	-
18	BC ₅ 838/7/53/3/23/4/7 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate x Rasant	-	-	-	-	-	-	-
19	BC ₅ 838/7/53/3/23/1/18 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate x Quarta	-	-	-	-	-	-	-
20	BC ₅ 838/7/53/3/23/1/3 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate x Quarta	-	-	-	-	-	-	-
21	BC ₅ 838/7/53/3/23/19/14 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate x Quarta	-	-	-	-	-	-	-
22	BC ₅ 838/7/53/3/23/19/5 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate x Quarta	-	-	-	-	-	-	-
23	BC ₅ 838/7/53/3/23/19/6 <i>trn(+)</i> Delikat x Delikat x Sonate x Sonate x Sonate x Quarta	-	-	-	-	-	-	-

1b. Interspecific combination: *S. pinnatisectum*, GLKS 31607 (+) *S. tuberosum*, cv. Rasant

Offsprings of the SH 45/2: <i>pnt</i> (+) Rasant								
24	BC ₃ 45/2/7/17/7 <i>pnt(+)</i> Rasant x Delikat x Romanze x Baltica	-	-	-	-	-	-	-
25	BC ₄ 45/2/7/17/7/1 <i>pnt(+)</i> Rasant x Delikat x Romanze x Baltica x Quarta	-	-	-	-	-	-	-

BC ₄	45/2/7/17/7/26 pnt(+)Rasant x Delikat x Romanze x Baltica x Quarta	-	-	-	-	-	-
1c'. Interspecific combination: S. bulbocastanum, GLKS 31741 (+) S. tuberosum, cv. Delikat							
Offsprings of the SH 82/4: blb (+) Delikat							
27	BC ₁ 82/4/13 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
28	BC ₁ 82/4/43 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
29	BC ₁ 82/4/46 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
30	BC ₁ 82/4/68 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
31	BC ₂ 82/4/46/14 blb(+) <i>Delikat x Quarta x Quarta</i>	+	+	+	+*	+	+
32	BC ₂ 82/4/68/2 blb(+) <i>Delikat x Quarta x Quarta</i>	-	-	-	-	-	-
33	BC ₂ 82/4/68/7 blb(+) <i>Delikat x Quarta x Quarta</i>	+	+	-	-	-	-
34	BC ₂ 82/4/68/8 blb(+) <i>Delikat x Quarta x Quarta</i>	+	+	-	-	-	-
35	BC ₂ 82/4/68/29 blb(+) <i>Delikat x Quarta x Quarta</i>	+	+	+	+*	+	+
36	BC ₃ 82/4/68/32/7 blb(+) <i>Delikat x Quarta x Quarta x Quarta</i>	-	-	-	-	-	-
37	BC ₃ 82/4/68/32/27 blb(+) <i>Delikat x Quarta x Quarta x Quarta</i>	-	-	-	-	+	-
Offsprings of the SH 83/9: blb (+) Delikat							
38	BC ₁ 83/9/11 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
39	BC ₁ 83/9/35 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
40	BC ₁ 83/9/44 blb(+) <i>Delikat x Quarta</i>	+	+	+	+	+	+
41	BC ₁ 83/9/47 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
42	BC ₁ 83/9/63 blb(+) <i>Delikat x Quarta</i>	+	+	+	+*	+	+
Offsprings of the SH 95/1: blb (+) Delikat							
43	BC ₁ 95/1/4 blb(+) <i>Delikat x Baltica</i>	+	+	+	+*	+	+
44	BC ₂ 95/1/4/59 blb(+) <i>Delikat x Baltica x Romanze</i>	-	-	+	+*	-	+
1c''. Interspecific combination: S. bulbocastanum, GLKS 31741(+) S. tuberosum, cv. Rasant							
Offsprings of the SH 1508/5: blb (+) Rasant							

45	BC ₂ 1508/5/1/10 <i>blb(+)</i> Rasant x Quarta x Quarta	-	-	+	+	-	-	-
46	BC ₂ 1508/5/1/13 <i>blb(+)</i> Rasant x Quarta x Quarta	-	-	+	+	-	-	-
47	BC ₂ 1508/5/1/20 <i>blb(+)</i> Rasant x Quarta x Quarta	+	+	+	+	-	-	-
48	BC ₂ 1508/5/1/24 <i>blb(+)</i> Rasant x Quarta x Quarta	-	-	-	-	-	-	-

* For these 12 BC genotypes, we confirm here the presence of two markers - *blb1* F/R and *blb3* F/R, that have been shown previously [16].

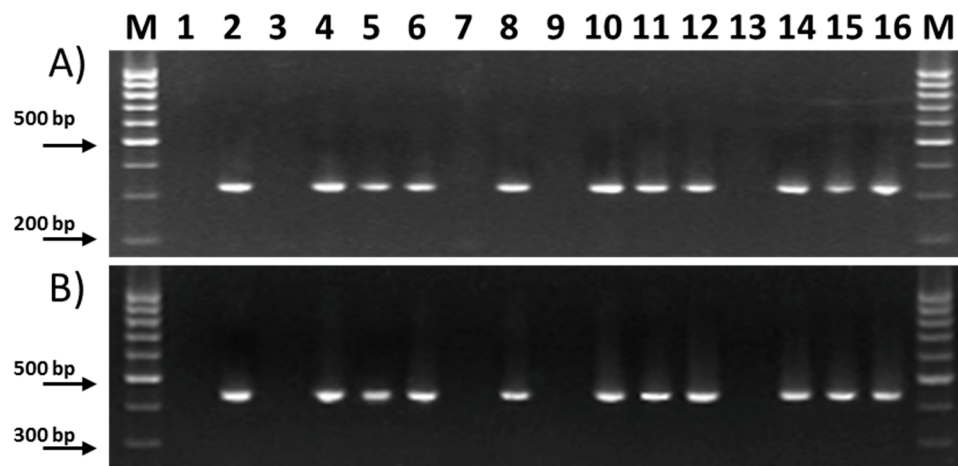


Figure S1. The diagnostic marker of the *R_{Mc1}(blb)* gene conferring resistance to Columbia root-knot nematode. A) Marker 193I9; B) Marker 39E18. 1 – cv. Delikat; 2 – *S. bulbocastanum*, GLKS 31741; 3 – cv. Rasant; 4 – *S. tarnii*; 5 – SH 838/2; 6 – SH 838/7; 7 – cv. Sonate; 8 – *S. pinnatisectum*, GLKS 31607; 9 – BC₄ 838/2/25/1/3/15; 10 – BC₁ 82/4/43; 11 – BC₁ 83/9/11; 12 – BC₂ 82/4/46/14; 13 – BC₄ 838/2/25/1/3/13; 14 – BC₂ 82/4/68/7; 15 – BC₁ 83/9/35; 16 – BC₁ 83/9/35. M - molecular marker “100 bp DNA Ladder” (SibEnzyme, [71]).

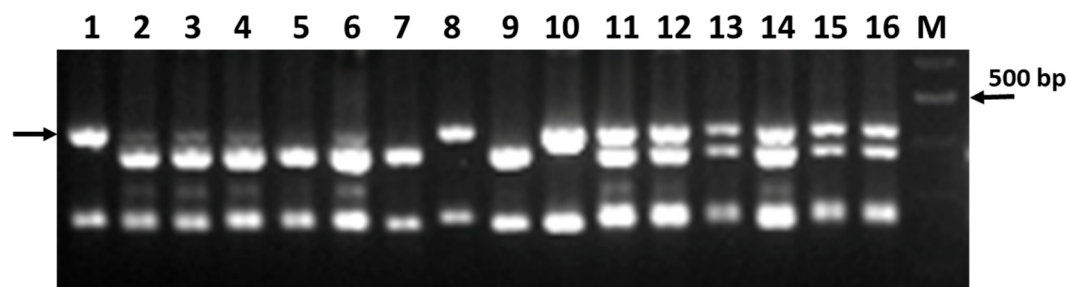


Figure S2. Diagnostic bands of the marker 184-81 (indicated by an arrow) for the *R8* gene conferring late blight resistance. 1 – *S. pinnatisectum*, GLKS 31607; 2 – BC₃ 45/2/7/17/7; 3 – BC₄ 45/2/7/17/7/1; 4 – cv. Rasant; 5 – cv. Romanze; 6 – cv. Quarta; 7 – cv. Sonate; 8 – *S. bulbocastanum*,

GLKS 31741; 9 – cv. Delikat; 10 – *S. tarnii*, GLKS 2870; 11 – BC₁ 83/9/11; 12 – BC₂ 95/1/4/59; 13 – SH 838/2; 14 – SH 838/7; 15 – BC₁ 838/7/18; 16 – BC₁ 838/7/53. M - molecular marker “100 bp + 1.5 Kb DNA Ladder” (SibEnzyme, [71]).



Figure S3. The diagnostic marker 1/1' for identification of the *Rpi-blb1* gene conferring broad-spectrum late blight resistance. 1 – *S. bulbocastanum*, GLKS 31741; 2 – *S. tarnii*, GLKS 2870; 3 – BC₁ 82/4/13; 4 – BC₁ 82/4/43; 5 – BC₁ 82/4/46; 6 – BC₁ 83/9/44; 7 – BC₁ 83/9/47; 8 – BC₁ 83/9/63; 9 – cv. Rasant; 10 – cv. Delikat; 11 – BC₁ 95/1/4; 12 – BC₂ 82/4/46/14; 13 – BC₂ 82/4/68/29; 14 – BC₂ 1508/5/1/10; 15 – BC₂ 1508/5/1/13; 16 – BC₂ 1508/5/1/20. M - molecular marker “50+ bp DNA Ladder” (Evrogen, [70]).

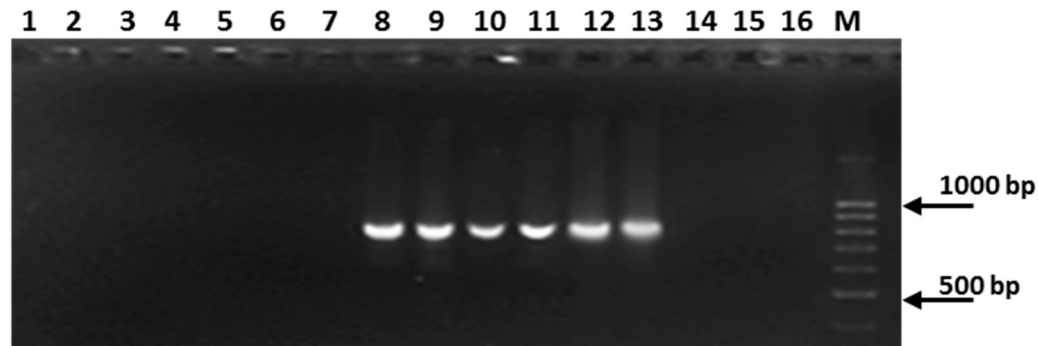


Figure S4. The diagnostic fragment of the blb1 F/R -marker specific for the *Rpi-blb1* gene conferring broad-spectrum late blight resistance. 1 – cv. Delikat; 2 – cv. Quarta; 3 – cv. Sonate; 4 – cv. Rasant; 5 – *S. tarnii*, GLKS 2870; 6 – SH 838/2; 7 – SH 838/7; 8 – *S. bulbocastanum*, GLKS 31741; 9 – BC₁ 83/9/11; 10 – BC₁ 83/9/35; 11 – BC₁ 83/9/44; 12 – BC₂ 95/1/4/59; 13 – *S. bulbocastanum*, GLKS 31741; 14 – BC₃ 82/4/68/32/7; 15 – BC₃ 82/4/69/2/1; 16 – the negative control – H₂O. M - molecular weight marker “100 bp+1.5 Kb DNA Ladder” (SibEnzyme, [71]).

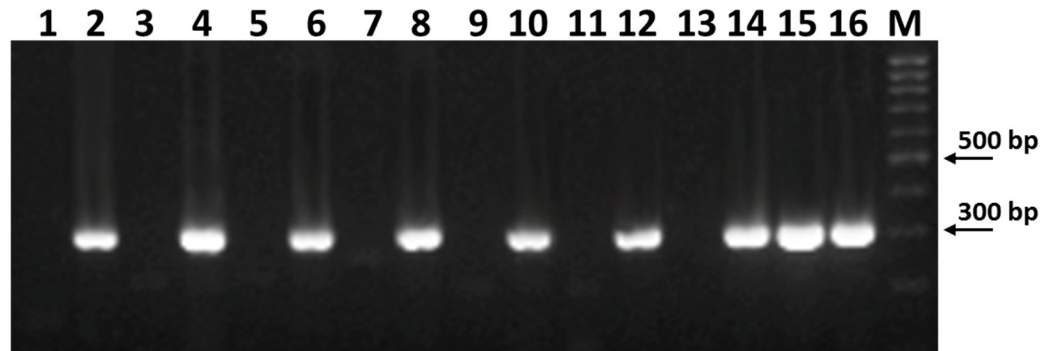


Figure S5. The diagnostic bands of the marker Rpi-blb3 specific for the *Rpi-blb3* gene conferring broad-spectrum late blight resistance. 1 – *S. tarnii*, GLKS 2870; 2 – *S. bulbocastanum*, GLKS 31741; 3 – *S. pinnatisectum*, GLKS 31607; 4 – BC₁ 82/4/13; 5 – cv. Delikat; 6 – BC₁ 82/4/43; 7 – cv. Rasant; 8 – BC₁ 82/4/46; 9 – cv. Quarta; 10 – BC₁ 82/4/68; 11 – BC₂ 07.1508/5/1/10; 12 – BC₁ 83/9/11; 13 – BC₂ 07.1508/5/1/13; 14 – BC₁ 83/9/35; 15 – BC₁ 83/9/44; 16 – BC₁ 95/1/4. M - molecular marker “100 bp + 1.5 Kb DNA Ladder” (SibEnzyme, [71]).

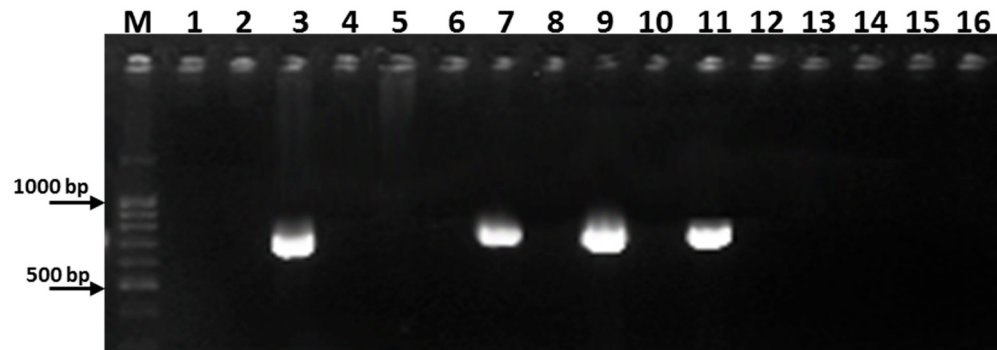


Figure S6. The diagnostic fragment of the blb3F/R-marker specific for the *Rpi-blb3* gene conferring broad-spectrum late blight resistance. 1 – cv. Delikat; 2 – cv. Quarta; 3 – *S. bulbocastanum*, GLKS 31741; 4 – *S. tarnii*, GLKS 2870; 5 – SH 838/2; 6 – SH 838/7; 7 – BC₁ 83/9/44; 8 – BC₂ 82/4/68/2; 9 – BC₃ 82/4/68/32/7; 10 – BC₃ 82/4/68/32/7; 11 – BC₁ 83/9/47; 12 – BC₂ 82/4/68/2; 13 – BC₂ 1508/5/1/24; 14 – cv. Sonate; 15 – cv. Rasant; 16 – the negative control – H₂O. M - molecular marker “100 bp + 1.5 Kb DNA Ladder” ((SibEnzyme, [71]).