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ERRATUM

Erratum to: Identification and mapping in spring wheat of genetic factors controlling stem rust resistance and the study of their epistatic interactions across multiple environments

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Erratum to: Theor Appl Genet (2013) 126:1951–1964 DOI 10.1007/s00122-013-2109-6

In the original article, chromosome 6B was erroneously listed as 5A. This led to the propagation of the error from Figure 4 to Table 1 and four locations within the text. The overall scope of research and interpretation are not impacted by the error.

Revision #1 in Abstract (page no. 1951)

Incorrect: Carberry contributed resistance QTL on 4B and 5A.

Corrected to: Carberry contributed resistance QTL on 4B and 6B.

The online version of the original article can be found under doi:10.1007/s00122-013-2109-6.

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Revision #2 in Results (page no. 1955)

Incorrect: Those QTL that appeared only for traits measured in Canada were *QSr.spa-3B.1*, *QSr.spa-5A*, *QSr.spa-5B.1* and *QPbc.spa-6A* and those QTL that appeared for traits measured in Kenya and Canada were *QPbc.spa-3B.1*, *QSr.spa-4B.1* and *QSr.spa-6D*.

Corrected to: Those QTL that appeared only for traits measured in Canada were *QSr.spa-3B.1*, *QSr.spa-6B*, *QSr.spa-5B.1* and *QPbc.spa-6A* and those QTL that appeared for traits measured in Kenya and Canada were *QPbc.spa-3B.1*, *QSr.spa-4B.1* and *QSr.spa-6D*.

Revision #3 in Results (page no. 1957)

Incorrect: AC Cadillac contributed resistance at the *QSr.spa-2B.1*, *QSr.spa-3B.1*, *QSr.spa-5B.1*, *QSr.spa-6D*, *QSr.spa-7B* and *QSr.spa-7D* loci while Carberry contributed resistance at the *QSr.spa-4B.1* and *QSr.spa-5A* (Table 1).

Corrected to: AC Cadillac contributed resistance at the *QSr.spa-2B.1*, *QSr.spa-3B.1*, *QSr.spa-5B.1*, *QSr.spa-6D*, *QSr.spa-7B* and *QSr.spa-7D* loci while Carberry contributed resistance at the *QSr.spa-4B.1* and *QSr.spa-6B* (Table 1).

Revision #4 in Discussion (page no. 1962)

Incorrect: We detected a number of less impressive main effect QTL, such as *QSr.spa-5A* on chromosome 5A which appeared only in the Canadian environment suggesting the gene is only effective to North American races. Njau et al. (2012) recently reported a QTL on chromosome 5A, but due to differences in markers between linkage maps it is difficult to ascertain whether their marker is the same as *QSr.spa-5A*.

Table 1 Parental-type molecular variant mean values for each marker, most significant marker or marker interval, LOD, measure of additive effects and percent regression effect explained from Multiple QTL Mapping using MapQTL in the Carberry/AC Cadillac doubled haploid population for DArT® and SSR markers with stem rust severity and infection response from the field in Njoro, Kenya and Swift Current, Canada, and for seedling stem rust infection type against race TTKSK from containment growth chamber trials in Morden, Canada

Chromosome	QTL	Trait	Environments	Marker[a]/Marker interval	LOD[b] score	Mean AC Cadillac molecular variant	Mean Carberry molecular variant	Additive[c] effect	PV[d] %
2B	*QSr.spa-2B.1*	Stem rust severity	Kenya 2010	*wPt-6832*	7.4	6.4	14	−3.8	10.3
	QSr.spa-2B.1	Stem rust severity	Kenya 2011	*tPt-9065*	7	10.3	12.6	−1.1	9.7
	QSr.spa-2B.1	Stem rust infection response	Kenya 2011	*wPt-6832*	3.7	1.7	3.4	−0.8	6.3
	QPbc.spa-2B	PBC	Kenya 2010	*Xwmc770*	3.2	1.7	1.5	0.1	4.9
	QPbc.spa-2B	PBC	Kenya 2011	*Xwmc770*	7.1	1.3	1.1	0.1	11.7
3B	*QSr.spa-3B.1*	Stem rust infection response	Canada 2011	*Xbarc147*	3	1.9	2.4	−0.2	4.6
	QPbc.spa-3B	PBC	Kenya 2010	*X3B042G11*	8.1	1.8	1.4	0.2	13.7
	QPbc.spa-3B	PBC	Canada 2012	*wPt-744251*	12	1.3	1	0.2	18
4B	*QSr.spa-4B.1*	Stem rust infection type	Morden 2012	*wPt-744434–Xwmc617*	3.1	5.9	4.2	0.8	2.8
	QSr.spa-4B.1	Stem rust infection response	Kenya 2009	*wPt-744434–Xwmc617*	2.9	4.8	3.7	0.5	2.4
	QSr.spa-4B.1	Stem rust severity	Kenya 2009	*wPt-744434*	4	12.3	7.9	2.2	5.8
	QSr.spa-4B.1	Stem rust severity	Kenya 2010	*wPt-744434*	4.5	13.4	7	3.2	6.1
	QSr.spa-4B.1	Stem rust severity	Canada 2011	*wPt-744434–Xwmc617*	3.4	14.3	9	2.6	5.3
	QSr.spa-4B.1	Stem rust infection response	Canada 2011	*wPt-744434–Xwmc617*	3	2.6	2	0.3	4.7
	QSr.spa-4B.1	Stem rust infection type	Morden combined	*wPt-733745*	3	6.3	4.8	0.8	5.1
5B	*QSr.spa-5B.1*	Stem rust severity	Kenya 2009	*wPt-9205*	3.6	8.2	12	−1.9	4.9
	QSr.spa-5B.1	Stem rust infection response	Canada 2011	*wPt-5792*	3.6	2	2.5	−0.3	5.4
6A	*QPbc.spa-6A*	PBC	Canada 2012	*wPt-2014 - tPt-8557*	3.2	1.1	1.3	−0.1	4.4
6B	*QSr.spa-6B*	Stem rust infection response	Canada 2011	*wPt-5408*	2.9	2.5	2	0.2	4.5
	QSr.spa-6B	Stem rust severity	Canada 2012	*wPt-2175*	3.2	3.7	2.1	0.8	5.5
	QSr.spa-6B	Stem rust severity	Canada Combined	wPt-666793	3.1	8.2	6	1.1	5.3
	QSr.spa-6B	Stem rust infection response	Canada combined	wPt-5256	3.4	2	1.6	0.2	5.9
6D	*QSr.spa-6D*	Stem rust infection type	Morden 2012	*wPt-741955*	34.7	2.5	7.5	−2.5	42.8
	QSr.spa-6D	Stem rust infection type	Morden 2009	*wPt-1695*	39.2	2.7	7.5	−2.4	48.8
	QSr.spa-6D	Stem rust infection response	Kenya 2009	*wPt-1695*	39.8	2.3	6.1	−1.9	47.8
	QSr.spa-6D	Stem rust severity	Kenya 2009	*wPt-664770*	8.5	7	13.2	−3.1	12.8
	QSr.spa-6D	Stem rust severity	Kenya 2010	*wPt-741955*	2.9	7.8	12.6	−2.4	3.9
	QSr.spa-6D	Stem rust infection response	Kenya 2010	*wPt-741955*	13.4	1.6	3.4	−0.9	21.1
	QSr.spa-6D	Stem rust infection response	Canada 2012	*wPt-1695*	3.4	1.1	1.4	−0.2	5.8
	QSr.spa-6D	Stem rust infection type	Morden combined	*wPt-741955*	9.4	3.8	6.4	−1.3	15
	QSr.spa-6D	Stem rust infection response	Kenya combined	*wPt-741955*	6.7	2.6	3.7	−0.5	11.1

Table 1 continued

Chromosome	QTL	Trait	Environments	Marker[a]/Marker interval	LOD[b] score	Mean AC Cadillac molecular variant	Mean Carberry molecular variant	Additive[c] effect	PV[d] %
7B	*QSr.spa-7B*	Stem rust infection type	Morden 2012	*wPt-3939*	8.6	3.8	5.8	−1	7.1
	QSr.spa-7B	Stem rust infection type	Morden 2009	*wPt-3939*	3.6	3.4	6.8	−1.7	3.2
	QSr.spa-7B	Stem rust severity	Kenya 2009	*wPt-3939*	3.2	8.1	11.6	−1.8	4.3
7D	*QSr.spa-7D*	Stem rust infection type	Morden 2012	*Xwmc273*	4.4	4.4	6	−0.8	3.8

[a] Marker interval described by the markers which immediately flank the peak QTL response, or in the case of a single marker, the marker which is at the peak QTL response

[b] The threshold to declare LOD scores significant ranged from 2.9 to 3.0. All LOD scores reported are significant

[c] A positive additive effect indicates Carberry contributed to stem rust resistance and a negative additive effect indicates AC Cadillac contributed to stem rust resistance

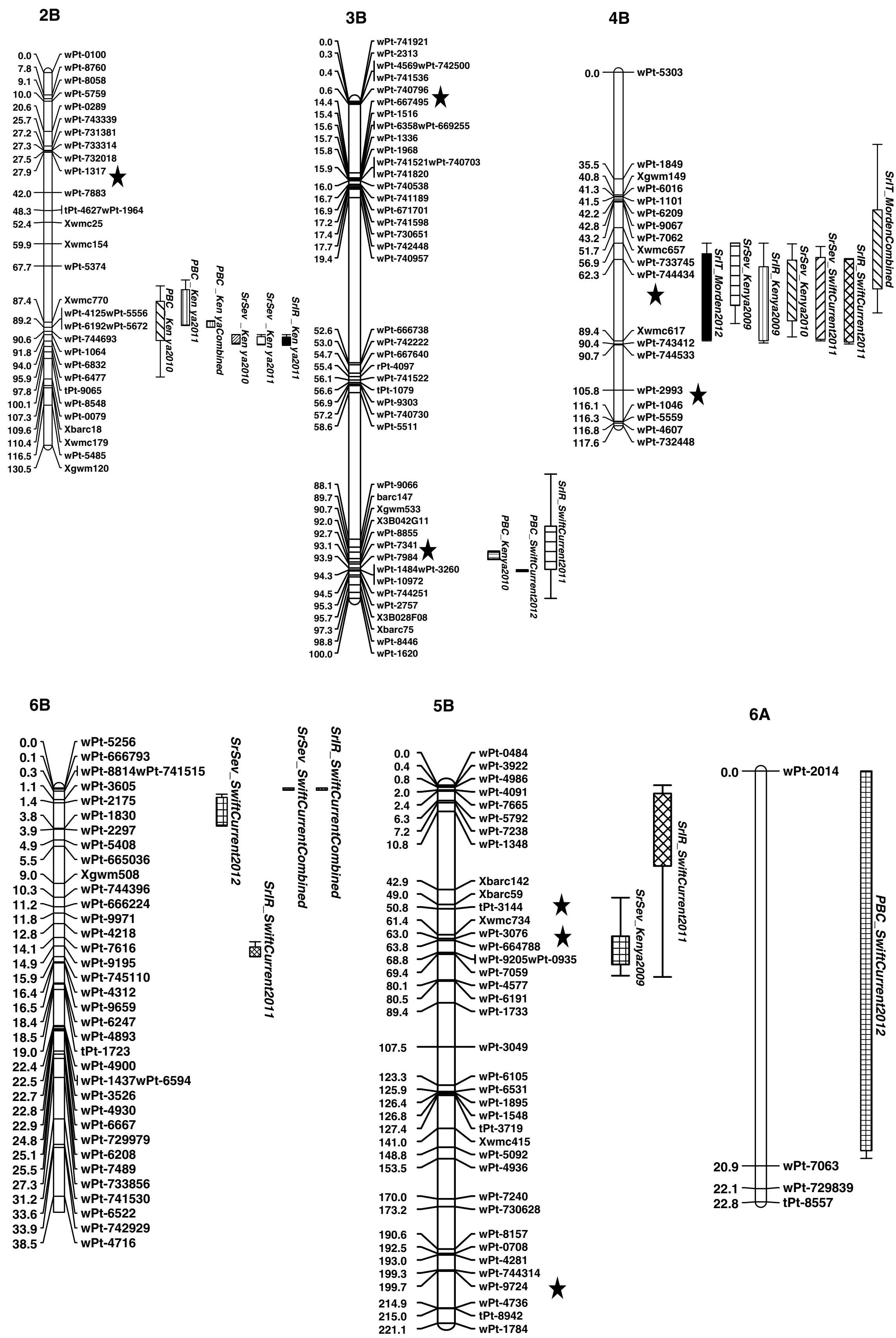
[d] PV is the proportion of the phenotypic variance explained by the QTL

Corrected to: We detected a number of less impressive main effect QTL, such as *QSr.spa-6B* on chromosome 6B which appeared only in the Canadian environment suggesting the gene is only effective to North American races.

Revision # 5 in Figure 4 caption (page no. 1959)

Incorrect title: Fig. 4 Stem rust resistance QTL identified on chromosome 2B, 3B, 4B, 5, 5B, 6, 7B and 7D and pseudo-black chaff (PBC) QTL identified on chromosome 2B, 3B and 6A, using DArT and SSR markers in a doubled haploid population derived from Carberry/AC Cadillac. Disease reactions for stem rust severity, infection response and PBC were assessed near Njoro, Kenya (2009, 2010 and 2011) and near Swift Current, Canada (2011 and 2012), and seedling stem rust infection type was assessed in Morden, Canada (2009 and 2012). Location of a QTL involved in epistasis is depicted with the symbol *asterisk*

Corrected to: Fig. 4 Stem rust resistance QTL identified on chromosome 2B, 3B, 4B, 5B, 6B, 6D, 7B and 7D and pseudo-black chaff (PBC) QTL identified on chromosome 2B, 3B and 6A, using DArT and SSR markers in a doubled haploid population derived from Carberry/AC Cadillac. Disease reactions for stem rust severity, infection response and PBC were assessed near Njoro, Kenya (2009, 2010 and 2011) and near Swift Current, Canada (2011 and 2012), and seedling stem rust infection type was assessed in Morden, Canada (2009 and 2012). Location of a QTL involved in epistasis is depicted with the symbol *asterisk.*


2B
0.0 wPt-0100
7.8 wPt-8760
9.1 wPt-8058
10.0 wPt-5759
20.6 wPt-0289
25.7 wPt-743339
27.2 wPt-731381
27.3 wPt-733314
27.5 wPt-732018
27.9 wPt-1317
42.0 wPt-7883
48.3 tPt-4627wPt-1964
52.4 Xwmc25
59.9 Xwmc154
67.7 wPt-5374
87.4 Xwmc770
89.2 wPt-4125wPt-5556
wPt-6192wPt-5672
90.6 wPt-744693
91.8 wPt-1064
94.0 wPt-6832
95.9 wPt-6477
97.8 tPt-9065
100.1 wPt-8548
107.3 wPt-0079
109.6 Xbarc18
110.4 Xwmc179
116.5 wPt-5485
130.5 Xgwm120
PBC_Kenya2010
PBC_Kenya2011
PBC_KenyaCombined
SrSev_Kenya2010
SrSev_Kenya2011
SrIR_Kenya2011
3B
0.0 wPt-741921
0.3 wPt-2313
0.4 wPt-4569wPt-742500
wPt-741536
0.6 wPt-740796
14.4 wPt-667495
15.4 wPt-1516
15.6 wPt-6358wPt-669255
15.7 wPt-1336
15.8 wPt-1968
15.9 wPt-741521wPt-740703
wPt-741820
16.0 wPt-740538
16.7 wPt-741189
16.9 wPt-671701
17.2 wPt-741598
17.4 wPt-730651
17.7 wPt-742448
19.4 wPt-740957
52.6 wPt-666738
53.0 wPt-742222
54.7 wPt-667640
55.4 rPt-4097
56.1 wPt-741522
56.6 tPt-1079
56.9 wPt-9303
57.2 wPt-740730
58.6 wPt-5511
88.1 wPt-9066
89.7 barc147
90.7 Xgwm533
92.0 X3B042G11
92.7 wPt-8855
93.1 wPt-7341
93.9 wPt-7984
94.3 wPt-1484wPt-3260
wPt-10972
94.5 wPt-744251
95.3 wPt-2757
95.7 X3B028F08
97.3 Xbarc75
98.8 wPt-8446
100.0 wPt-1620
PBC_Kenya2010
PBC_SwiftCurrent2012
SrIR_SwiftCurrent2011
4B
0.0 wPt-5303
35.5 wPt-1849
40.8 Xgwm149
41.3 wPt-6016
41.5 wPt-1101
42.2 wPt-6209
42.8 wPt-9067
43.2 wPt-7062
51.7 Xwmc657
56.9 wPt-733745
62.3 wPt-744434
89.4 Xwmc617
90.4 wPt-743412
90.7 wPt-744533
105.8 wPt-2993
116.1 wPt-1046
116.3 wPt-5559
116.8 wPt-4607
117.6 wPt-732448
SrIT_Morden2012
SrSev_Kenya2009
SrIR_Kenya2009
SrSev_Kenya2010
SrSev_SwiftCurrent2011
SrIR_SwiftCurrent2011
SrIT_MordenCombined
6B
0.0 wPt-5256
0.1 wPt-666793
0.3 wPt-8814wPt-741515
1.1 wPt-3605
1.4 wPt-2175
3.8 wPt-1830
3.9 wPt-2297
4.9 wPt-5408
5.5 wPt-665036
9.0 Xgwm508
10.3 wPt-744396
11.2 wPt-666224
11.8 wPt-9971
12.8 wPt-4218
14.1 wPt-7616
14.9 wPt-9195
15.9 wPt-745110
16.4 wPt-4312
16.5 wPt-9659
18.4 wPt-6247
18.5 wPt-4893
19.0 tPt-1723
22.4 wPt-4900
22.5 wPt-1437wPt-6594
22.7 wPt-3526
22.8 wPt-4930
22.9 wPt-6667
24.8 wPt-729979
25.1 wPt-6208
25.5 wPt-7489
27.3 wPt-733856
31.2 wPt-741530
33.6 wPt-6522
33.9 wPt-742929
38.5 wPt-4716
SrSev_SwiftCurrent2012
SrSev_SwiftCurrentCombined
SrIR_SwiftCurrentCombined
SrIR_SwiftCurrent2011
5B
0.0 wPt-0484
0.4 wPt-3922
0.8 wPt-4986
2.0 wPt-4091
2.4 wPt-7665
6.3 wPt-5792
7.2 wPt-7238
10.8 wPt-1348
42.9 Xbarc142
49.0 Xbarc59
50.8 tPt-3144
61.4 Xwmc734
63.0 wPt-3076
63.8 wPt-664788
68.8 wPt-9205wPt-0935
69.4 wPt-7059
80.1 wPt-4577
80.5 wPt-6191
89.4 wPt-1733
107.5 wPt-3049
123.3 wPt-6105
125.9 wPt-6531
126.4 wPt-1895
126.8 wPt-1548
127.4 tPt-3719
141.0 Xwmc415
148.8 wPt-5092
153.5 wPt-4936
170.0 wPt-7240
173.2 wPt-730628
190.6 wPt-8157
192.5 wPt-0708
193.0 wPt-4281
199.3 wPt-744314
199.7 wPt-9724
214.9 wPt-4736
215.0 tPt-8942
221.1 wPt-1784
SrIR_SwiftCurrent2011
SrSev_Kenya2009
6A
0.0 wPt-2014
20.9 wPt-7063
22.1 wPt-729839
22.8 tPt-8557
PBC_SwiftCurrent2012