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CANADIAN PATENT APPLICATION

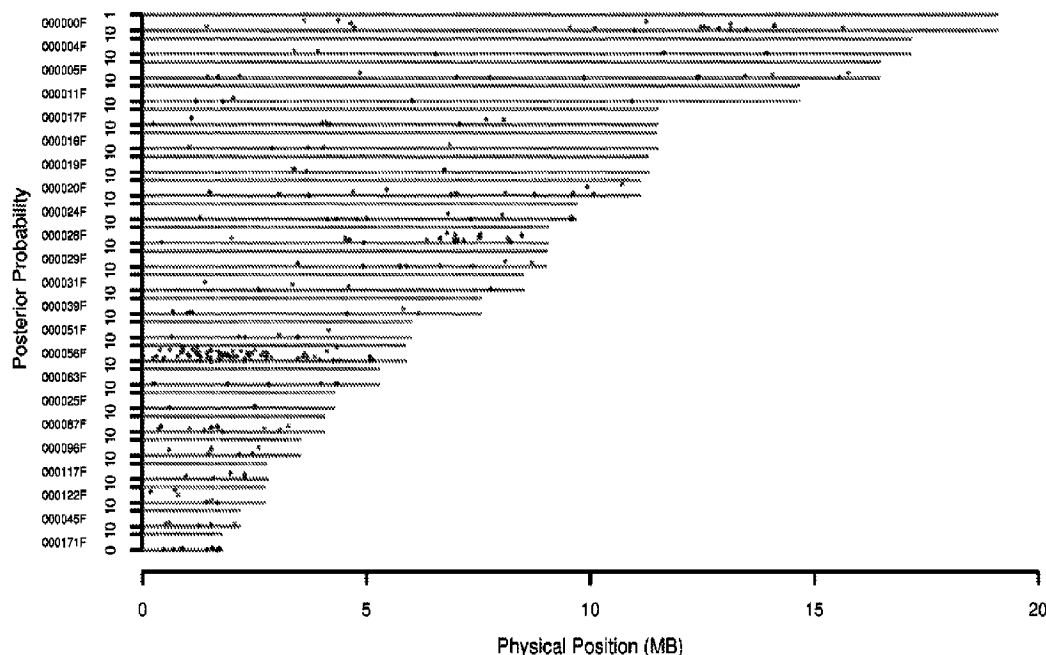
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(54) Titre : LOCI GENETIQUES ASSOCIES A LA RESISTANCE CONTRE DES MALADIES DU SOJA
(54) Title: GENETIC LOCI ASSOCIATED WITH DISEASE RESISTANCE IN SOYBEANS

FIG. 3: Depiction of *Glycine canescens* PI440935 SNPs Associated with ASR Resistance (i.e. each dot equals 1 SNP that associates with ASR resistance)



(57) **Abrégé/Abstract:**

The present invention relates to methods and compositions for identifying, selecting and/or producing a disease resistant soybean plant or germplasm using markers, genes and chromosomal intervals derived from *Glycine canescens* PI440935, PI483193, PI595799, or a progeny thereof, or *Glycine tomentella*, or a progeny thereof. A soybean plant or germplasm that has been identified, selected and/or produced by any of the methods of the present invention is also provided. Disease resistant soybean seeds, plants and germplasms are also provided.

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Abstract:

The present invention relates to methods and compositions for identifying, selecting and/or producing a disease resistant soybean plant or germplasm using markers, genes and chromosomal intervals derived from *Glycine canescens* PI440935, PI483193, PI595799, or a progeny thereof, or *Glycine tomentella*, or a progeny thereof. A soybean plant or germplasm that has been identified, selected and/or produced by any of the methods of the present invention is also provided. Disease resistant soybean seeds, plants and germplasms are also provided.

GENETIC LOCI ASSOCIATED WITH DISEASE RESISTANCE IN SOYBEANS**FIELD OF THE INVENTION**

5 The present invention relates to compositions and methods for identifying, selecting and producing enhanced disease and/or pathogen resistant soybean plants.

**STATEMENT REGARDING ELECTRONIC SUBMISSION OF A
SEQUENCE LISTING**

10 A Sequence Listing in ASCII text format, submitted under 37 C.F.R. § 1.821, entitled “81922-WO-REG-ORG-NAT-1_SequenceList_ST25” generated on 31 July 2019 and filed via EFS-Web is provided in lieu of a paper copy. This Sequence Listing is hereby incorporated by reference into the specification for its disclosures.

BACKGROUND

15 Plant pathogens are known to cause considerable damage to important crops, resulting in significant agricultural losses with widespread consequences for both the food supply and other industries that rely on plant materials. As such, there is a long felt need to reduce the incidence and/or impact of agricultural pathogens on crop production.

Several pathogens have been associated with damage to soybeans, which individually and
20 collectively have the potential to cause significant yield losses in the United States and throughout the world. Exemplary pathogens include, but are not limited to fungi (*e.g.*, genus *Phytophthora* and Asian Soybean rust *Phakopsora pachyrhizi*), nematodes (*e.g.*, genus *Meloidogyne*, particularly, *Meloidogyne javanica*), and soybean stem canker. Given the significant threat to global food supplies that these pathogens present and the time and expense associated with treating soybean crops to
25 prevent loss, new methods for producing pathogen resistant soybean cultivars are needed. What is needed is novel resistance genes (herein, “R-Genes”) that can be introduced into commercial soybean plants to control soybean pathogens

SUMMARY OF THE INVENTION

30 This summary lists several embodiments of the presently disclosed subject matter, and in many cases lists variations of these embodiments.

Embodiments are disclosed of elite *Glycine max* plants, progeny plants, seeds, plant cells, or plant parts derived from a plant, having introduced into its genome a chromosomal interval from a *Glycine canescens* line selected from an accession line group consisting of PI440935, PI483193,
35 PI595799 or a progeny thereof, wherein said chromosomal interval confers increased resistance to Asian soy rust (ASR) as compared to a control plant not comprising said chromosomal interval. In some embodiments, the chromosomal interval comprises SEQ ID NOs: 1, 2, or 3 or a portion of SEQ

ID Nos: 1, 2, or 3. In some embodiments, the chromosomal interval comprises a SNP marker associated with increased ASR resistance wherein said SNP marker corresponds with any one of the favorable SNP markers as listed in Tables 1-3. The chromosomal interval may be derived from *Glycine canescens* chromosome 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, or 20.

- 5 The chromosomal interval may correspond to a position within the *Glycine canescens* genome that corresponds to SEQ ID NOs: 1-3.

In further embodiments, plants of the disclosed invention show increased resistance, relative to a control plant, to any one of the stresses selected from: diseases (such as powdery mildew, *Pythium ultimum*, *Phytophthora* root rot, leaf spot, blast, brown spot, root-knot nematode, soybean
10 cyst nematode, soybean vein necrosis virus, soybean stem canker, soybean sudden death syndrome, leaf and neck blast, rust, frog-eye leaf spot, brown stem rot, *Fusarium*, or sheath blight); insect pests (such as whitefly, aphid, grey field slug, sugarcane borer, green bug, or aphid); abiotic stress (such as drought tolerance, flooding, high level of salinity, heavy metal, aluminum, manganese, cadmium, zinc, UV-B, boron, iron deficiency chlorosis or cold tolerance (i.e. extreme temperatures)).

15 Embodiments are also disclosed for an elite soybean plant comprising an ASR resistant allele which confers increased resistance to ASR, and wherein the ASR allele comprises at least one single nucleotide polymorphism (SNP) selected from the group of "favorable" SNPs described in any one of Tables 1-3. The elite soybean plant may comprise a chromosomal interval from *Glycine canescens* comprising at least one favorable SNP marker selected from any one of Tables 1-3. Further, the
20 *Glycine canescens* may be any one of accession lines PI440935, PI483193, PI595799, or a progeny thereof.

Embodiments are also disclosed for a method for producing a *Glycine max* plant having increased resistance to ASR, the method comprising the steps of (a) Providing a *Glycine canescens* plant line, or progeny thereof comprising a chromosomal interval corresponding to any one of SEQ
25 ID NOs 1-3; (b) Carrying out the embryo rescue method essentially as described in Example 3 or as described in US 7,842,850; (c) Collecting the seeds resulting from the method of b) and regenerating the seeds of c) into plants.

Embodiments are also disclosed for a method of identifying or selecting a soybean plant having a ASR resistance allele derived from *Glycine canescens*, the method comprising the steps of:
30 Isolating a nucleic acid from a soybean plant; Detecting in the nucleic acid the presence of a molecular marker that associates with increased ASR resistance, wherein the molecular marker is located within 20cM, 10cM, 5cM, 1cM, 0.5cM of a marker as described in any one of Tables 1-3; and thereby Identifying or selecting a soybean plant having a ASR resistance allele derived from *Glycine canescens*.

35 Embodiments are also disclosed of a method of identifying or selecting a soybean plant having a ASR resistance allele derived from *Glycine tomentella*, the method comprising the steps of: isolating a nucleic acid from a soybean plant; detecting in the nucleic acid the presence of a molecular

marker that associates with increased ASR resistance wherein the molecular marker is located within an interval corresponding to SEQ ID NO: 4 or SEQ ID NO: 5; and identifying or selecting a soybean plant having an ASR resistance allele derived from *Glycine tomentella*.

5 In some embodiments, a plant, progeny plant, or plant part of the species *Glycine max* is disclosed, wherein a portion of a genome of the plant is obtained from a wild glycine species through the use of chemically induced chromosome doubling, and wherein said portion confers the plant with increased resistance to ASR as compared to a control plant not comprising the portion.

10 In other embodiments, a plant, progeny plant, or plant part of the species *Glycine max* is disclosed, wherein a genome of the plant comprises a chromosomal interval that confers increased resistance to ASR as compared to a control plant not comprising the interval, wherein said chromosomal interval is introduced into the plant from a wild glycine species, and wherein said plant with said chromosomal interval is obtained through chemically induced chromosomal doubling. The chromosomal interval may be derived from *Glycine tomentella* or *canescens*.

15 Thus, it is an object of the presently disclosed subject matter to provide methods for conveying pathogen resistance into non-resistant soybean germplasm, which object is achieved in whole or in part by the presently disclosed subject matter.

BRIEF DESCRIPTION OF THE SEQUENCE LISTING

20 SEQ ID NO: 1 is a chromosomal interval derived from *Glycine canescens* line accession PI440935 referred to herein as “Scaffold 000056F”. Scaffold 000056F has been mapped to *G. canescens* chromosome 14. SEQ ID NO: 2 is a chromosomal interval derived from *Glycine canescens* line accession PI595799 referred to herein as “Scaffold 000090F”. Scaffold 000090F has been mapped to *G. canescens* chromosome 14. SEQ ID NO: 3 is a chromosomal interval derived from *Glycine canescens* line accession PI 483193 referred to herein as “Scaffold 132F”. Scaffold 25 132F has been mapped to *G. canescens* chromosome 14. These chromosomal intervals or portions thereof may be introduced (i.e. introgressed through use of embryo rescue and/or marker assisted breeding (MAB)) into *Glycine max* lines to create *Glycine max* lines resistant to disease (e.g. Asian Soybean Rust (ASR)). Tables 1-3 indicate single nucleotide polymorphisms (SNP) within SEQ ID NOs 1-3 that associate with ASR resistance. Table 1 displays SNP associations for SEQ ID NO: 1 (Scaffold 000056F) and Table 2 displays SNP associations for SEQ ID NO: 2 (Scaffold 000090F). 30 Table 3 displays SNP associations for SEQ ID NO: 3 (Scaffold 132F) All alleles for the SNPs identified in Tables 1-3 were determined to be significantly linked with resistance or susceptibility ($p < 0.05$).

35 SEQ ID NO: 4 is a chromosomal intervals derived from *Glycine tomentella* line accession PI509501 referred to herein as “Scaffold 4269. SEQ ID NO: 5 is a chromosomal intervals derived from *Glycine tomentella* line accession PI509501 referred to herein as “Scaffold 1509”. Scaffolds

4269 and 1509 have been mapped to *G. tomentella* chromosome 14. These chromosomal intervals or portions thereof may be introduced (i.e. introgressed through use of embryo rescue and/or marker assisted breeding (MAB)) into *Glycine max* lines to create *Glycine max* lines resistant to disease (e.g. Asian Soybean Rust (ASR)).

5

Table 1: SNP Positions within SEQ ID NO: 1 that are associated with increased resistance to ASR

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1398398_SNP	1398398	G	T
000056F_3532467_SNP S_36197326	3532467	T	C
000056F_933497_SNP S_35940036	933497	A	G
000056F_1130698_SNP S_35956971	1130698	T	C
000056F_1300738_SNP S_35974210	1300738	G	A
000056F_927781_SNP S_35939489	927781	C	T
000056F_523835_SNP S_35902147	523835	A	G
000056F_1421109_SNP S_35985399	1421109	A	T
000056F_1524664_SNP S_35998517	1524664	A	G
000056F_1749083_SNP S_36018652	1749083	A	C
000056F_3527033_SNP S_36196837	3527033	A	C
000056F_3265198_SNP S_36169378	3265198	T	A
000056F_2478667_SNP S_36089637	2478667	G	A
000056F_1251674_SNP S_35969092	1251674	T	A
000056F_1649222_SNP S_36010143	1649222	G	A
000056F_894882_SNP S_35936608	894882	G	A
000056F_1179807_SNP S_35962392	1179807	G	C
000056F_1656197_SNP S_36010770	1656197	A	G
000056F_2791262_SNP S_36118262	2791262	C	T
000056F_2319597_SNP S_36074694	2319597	T	A
000056F_3174386_SNP S_36159482	3174386	A	C
000056F_3230966_SNP S_36166064	3230966	C	T
000056F_3001073_SNP S_36139886	3001073	T	C
000056F_1258302_SNP	1258302	T	A
000056F_834355_SNP S_35931082	834355	T	G
000056F_941706_SNP S_35940565	941706	A	G
000056F_389180_SNP S_35889062	389180	A	T
000056F_3581712_SNP S_36201833	3581712	C	T
000056F_3581709_SNP S_36201832	3581709	C	T
000056F_2790200_SNP S_36118180	2790200	C	T
000056F_2069275_SNP S_36049800	2069275	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1641446_SNP S_36009474	1641446	T	A
000056F_2045362_SNP S_36047360	2045362	G	T
000056F_949978_SNP S_35941291	949978	T	A
000056F_321868_SNP S_35883024	321868	G	C
000056F_2021334_SNP S_36045139	2021334	T	G
000056F_160039_SNP	160039	C	A
000056F_4037812_SNP S_36267630	4037812	A	T
000056F_1920586_SNP S_36033712	1920586	T	A
000056F_160032_SNP S_35868048	160032	T	C
000056F_726970_SNP S_35920778	726970	A	C
000056F_2417777_SNP S_36083872	2417777	C	G
000056F_969947_SNP S_35942779	969947	A	C
000056F_1708959_SNP S_36015565	1708959	A	C
000056F_408120_SNP S_35890809	408120	G	A
000056F_1862273_SNP S_36028641	1862273	A	T
000056F_4735307_SNP S_36335772	4735307	T	C
000056F_1316091_SNP S_35975635	1316091	T	C
000056F_2070734_SNP S_36049919	2070734	T	G
000056F_3608002_SNP S_36204020	3608002	T	A
000056F_2696400_SNP	2696400	C	T
000056F_4722233_SNP S_36334567	4722233	T	C
000056F_930097_SNP S_35939672	930097	T	C
000056F_780892_SNP S_35926402	780892	A	G
000056F_1856106_SNP S_36028068	1856106	C	A
000056F_1074700_SNP S_35951798	1074700	T	C
000056F_902904_SNP S_35937182	902904	A	T
000056F_253395_SNP S_35876662	253395	G	C
000056F_5339958_SNP S_36399121	5339958	C	T
000056F_1884085_SNP S_36030530	1884085	T	C
000056F_1842153_SNP S_36026692	1842153	C	G
000056F_3176203_SNP S_36159617	3176203	G	A
000056F_2259043_SNP S_36068269	2259043	A	G
000056F_1777427_SNP S_36021116	1777427	T	A
000056F_2256882_SNP S_36068069	2256882	T	C
000056F_1897226_SNP S_36031783	1897226	T	C
000056F_1897227_SNP S_36031784	1897227	T	G
000056F_2619712_SNP S_36102482	2619712	T	C
000056F_2479047_SNP S_36089663	2479047	G	A
000056F_10095_SNP	10095	T	C
000056F_1199510_SNP S_35963818	1199510	A	G
000056F_2373183_SNP S_36079702	2373183	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1230337_SNP S_35966968	1230337	T	A
000056F_3163569_SNP S_36158346	3163569	A	G
000056F_1838427_SNP S_36026435	1838427	T	A
000056F_3057486_SNP S_36148178	3057486	T	C
000056F_2538190_SNP S_36095127	2538190	C	T
000056F_1620476_SNP S_36007331	1620476	G	A
000056F_1337216_SNP S_35977865	1337216	T	C
000056F_1704521_SNP S_36015276	1704521	G	A
000056F_2592443_SNP S_36100158	2592443	A	C
000056F_3822851_SNP S_36228027	3822851	T	A
000056F_2551248_SNP S_36096430	2551248	T	C
000056F_4753269_SNP S_36338213	4753269	G	T
000056F_5146366_SNP	5146366	G	C
000056F_4741741_SNP	4741741	G	C
000056F_1431159_SNP S_35986485	1431159	A	T
000056F_3968031_SNP S_36243786	3968031	G	A
000056F_829831_SNP S_35930742	829831	T	G
000056F_2402384_SNP S_36082541	2402384	A	C
000056F_1935021_SNP S_36034930	1935021	G	T
000056F_1935022_SNP S_36034931	1935022	T	C
000056F_5016136_SNP S_36367639	5016136	G	T
000056F_4599572_SNP S_36322873	4599572	T	C
000056F_2145796_SNP S_36057138	2145796	C	A
000056F_151696_SNP S_35867311	151696	T	A
000056F_3591329_SNP S_36202615	3591329	G	A
000056F_947813_SNP S_35941115	947813	A	G
000056F_1753759_SNP S_36019129	1753759	A	T
000056F_1879773_SNP S_36030181	1879773	A	G
000056F_2272344_SNP S_36069304	2272344	C	T
000056F_2165434_SNP S_36058947	2165434	T	G
000056F_915520_SNP S_35938288	915520	G	A
000056F_1138587_SNP S_35957553	1138587	G	T
000056F_2256787_SNP S_36068067	2256787	G	T
000056F_1739313_SNP S_36017863	1739313	A	G
000056F_1166920_SNP S_35960427	1166920	G	C
000056F_3387835_SNP S_36182905	3387835	A	T
000056F_1254897_SNP S_35969358	1254897	A	C
000056F_884968_SNP S_35935693	884968	A	G
000056F_953428_SNP S_35941550	953428	G	A
000056F_953426_SNP S_35941549	953426	G	T
000056F_1430433_SNP S_35986424	1430433	C	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1001912_SNP S_35945936	1001912	G	A
000056F_2284498_SNP S_36069988	2284498	T	G
000056F_2284497_SNP S_36069987	2284497	C	A
000056F_3046682_SNP S_36147178	3046682	T	C
000056F_363416_SNP S_35886678	363416	C	T
000056F_1361699_SNP S_35980378	1361699	T	G
000056F_1892558_SNP S_36031277	1892558	C	A
000056F_1689603_SNP S_36013647	1689603	A	G
000056F_1067284_SNP S_35951195	1067284	T	C
000056F_1002044_SNP S_35945954	1002044	A	T
000056F_1154432_SNP S_35959097	1154432	T	G
000056F_198349_SNP S_35871699	198349	A	C
000056F_600203_SNP S_35909172	600203	T	A
000056F_3065127_SNP S_36148720	3065127	T	C
000056F_1877044_SNP S_36029901	1877044	A	C
000056F_1425485_SNP S_35985915	1425485	C	T
000056F_1720807_SNP S_36016466	1720807	T	G
000056F_1873888_SNP S_36029531	1873888	C	T
000056F_2664260_SNP S_36106853	2664260	G	A
000056F_2019674_SNP S_36045027	2019674	C	G
000056F_2033142_SNP S_36046343	2033142	T	C
000056F_2632587_SNP S_36103666	2632587	A	G
000056F_1720880_SNP S_36016471	1720880	C	T
000056F_3404306_SNP S_36184238	3404306	G	C
000056F_3566332_SNP	3566332	G	A
000056F_1565615_SNP	1565615	G	A
000056F_1777073_SNP S_36021090	1777073	C	T
000056F_1041618_SNP S_35948838	1041618	A	G
000056F_2685843_SNP S_36108809	2685843	T	A
000056F_4086893_SNP S_36271405	4086893	G	A
000056F_2667474_SNP S_36107132	2667474	C	T
000056F_1709750_SNP S_36015641	1709750	T	C
000056F_1577080_SNP S_36003469	1577080	G	T
000056F_5416543_SNP S_36406915	5416543	A	G
000056F_1784929_SNP S_36021765	1784929	C	G
000056F_1710374_SNP S_36015678	1710374	T	A
000056F_3098515_SNP S_36152519	3098515	C	A
000056F_1745240_SNP S_36018366	1745240	C	G
000056F_1921173_SNP S_36033782	1921173	G	A
000056F_1942460_SNP S_36035776	1942460	T	C
000056F_930129_SNP S_35939673	930129	T	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1480171_SNP S_35993893	1480171	A	T
000056F_1594090_SNP S_36004828	1594090	G	A
000056F_313067_SNP S_35882160	313067	A	C
000056F_1034428_SNP S_35948261	1034428	A	C
000056F_2637942_SNP S_36104121	2637942	A	G
000056F_1400502_SNP S_35983703	1400502	A	G
000056F_1828912_SNP S_36025849	1828912	T	C
000056F_1538200_SNP S_36000374	1538200	T	C
000056F_2119961_SNP S_36054608	2119961	G	A
000056F_2117621_SNP S_36054417	2117621	C	T
000056F_2837133_SNP S_36122516	2837133	A	G
000056F_1452885_SNP S_35988579	1452885	T	C
000056F_2534413_SNP S_36094867	2534413	T	A
000056F_1158101_SNP S_35959513	1158101	C	G
000056F_1151202_SNP S_35958734	1151202	G	A
000056F_948013_SNP S_35941122	948013	T	C
000056F_920521_SNP S_35938747	920521	A	C
000056F_352527_SNP S_35885551	352527	C	T
000056F_2441826_SNP S_36086012	2441826	A	G
000056F_393578_SNP S_35889556	393578	T	C
000056F_1185877_SNP S_35962673	1185877	A	G
000056F_933994_SNP S_35940085	933994	T	C
000056F_1650893_SNP S_36010286	1650893	G	A
000056F_3390809_SNP S_36183155	3390809	T	A
000056F_4065721_SNP S_36270006	4065721	G	A
000056F_3121993_SNP S_36154498	3121993	G	A
000056F_4468008_SNP S_36310950	4468008	T	C
000056F_2166260_SNP S_36059012	2166260	C	T
000056F_279055_SNP S_35878919	279055	T	A
000056F_2998629_SNP S_36139513	2998629	T	C
000056F_1231256_SNP S_35967033	1231256	G	C
000056F_1014618_SNP S_35946838	1014618	A	G
000056F_1001175_SNP S_35945879	1001175	C	G
000056F_2500150_SNP S_36091439	2500150	C	T
000056F_4262889_SNP S_36289953	4262889	A	C
000056F_3991815_SNP S_36246169	3991815	A	T
000056F_3267050_SNP S_36169657	3267050	T	C
000056F_1934054_SNP S_36034879	1934054	T	C
000056F_2117868_SNP S_36054453	2117868	T	G
000056F_1259413_SNP S_35969745	1259413	T	C
000056F_1854803_SNP S_36027942	1854803	T	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1452854_SNP S_35988577	1452854	A	G
000056F_2515552_SNP S_36092916	2515552	T	C
000056F_1077501_SNP S_35952054	1077501	T	C
000056F_106601_SNP S_35861285	106601	A	G
000056F_1257231_SNP S_35969585	1257231	T	A
000056F_136671_SNP S_35864897	136671	C	T
000056F_1856380_SNP S_36028103	1856380	A	G
000056F_1055758_SNP S_35950041	1055758	A	C
000056F_4413222_SNP S_36304151	4413222	G	A
000056F_1044987_SNP S_35949137	1044987	A	C
000056F_1168929_SNP S_35960580	1168929	C	A
000056F_4184152_SNP S_36281035	4184152	T	C
000056F_862340_SNP S_35933622	862340	C	T
000056F_1199803_SNP S_35963846	1199803	C	G
000056F_5023722_SNP S_36368291	5023722	A	G
000056F_2578153_SNP S_36098944	2578153	G	T
000056F_2582566_SNP S_36099328	2582566	C	T
000056F_1324448_SNP S_35976318	1324448	C	T
000056F_1342869_SNP S_35978588	1342869	T	C
000056F_1687636_SNP S_36013549	1687636	A	G
000056F_3615964_SNP S_36204612	3615964	C	T
000056F_2084124_SNP S_36050996	2084124	C	T
000056F_1167941_SNP S_35960494	1167941	T	C
000056F_176602_SNP S_35869751	176602	G	T
000056F_1257660_SNP S_35969630	1257660	C	A
000056F_2302671_SNP S_36071632	2302671	G	A
000056F_2334913_SNP S_36076026	2334913	A	T
000056F_1184801_SNP S_35962596	1184801	A	T
000056F_3209844_SNP S_36163222	3209844	T	A
000056F_1787868_SNP S_36022129	1787868	G	C
000056F_1885106_SNP S_36030618	1885106	T	C
000056F_1825895_SNP S_36025621	1825895	T	C
000056F_1825897_SNP S_36025622	1825897	C	T
000056F_648391_SNP S_35913450	648391	A	T
000056F_3485003_SNP S_36192815	3485003	T	C
000056F_4675861_SNP S_36330415	4675861	C	T
000056F_3758187_SNP S_36221072	3758187	T	C
000056F_988709_SNP S_35944669	988709	G	A
000056F_1816060_SNP S_36024863	1816060	G	T
000056F_721035_SNP S_35920328	721035	G	C
000056F_434289_SNP S_35893567	434289	A	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_923064_SNP S_35939043	923064	A	C
000056F_2549260_SNP S_36096214	2549260	T	A
000056F_2549261_SNP S_36096215	2549261	A	T
000056F_1101704_SNP S_35954495	1101704	T	A
000056F_1588547_SNP S_36004246	1588547	C	G
000056F_2611855_SNP S_36101797	2611855	T	A
000056F_4380940_SNP S_36301409	4380940	G	T
000056F_3575554_SNP S_36201336	3575554	A	C
000056F_1694190_SNP S_36014012	1694190	T	C
000056F_2393990_SNP S_36081727	2393990	C	T
000056F_1292307_SNP S_35973306	1292307	A	G
000056F_286909_SNP S_35879719	286909	T	C
000056F_4945020_SNP S_36359374	4945020	T	C
000056F_3491270_SNP S_36193420	3491270	G	C
000056F_4702443_SNP S_36332634	4702443	G	A
000056F_3131651_SNP S_36155331	3131651	T	C
000056F_2795985_SNP S_36118678	2795985	T	G
000056F_4805338_SNP S_36345370	4805338	A	G
000056F_2487671_SNP S_36090406	2487671	A	C
000056F_636117_SNP S_35912489	636117	G	C
000056F_2286575_SNP S_36070181	2286575	C	T
000056F_1988756_SNP S_36042115	1988756	G	T
000056F_1658455_SNP S_36010913	1658455	G	A
000056F_1097952_SNP S_35954227	1097952	C	T
000056F_1350283_SNP S_35979181	1350283	A	T
000056F_363428_SNP S_35886679	363428	T	G
000056F_2349285_SNP S_36077313	2349285	G	T
000056F_161146_SNP S_35868143	161146	G	A
000056F_2904960_SNP S_36128759	2904960	A	T
000056F_756504_SNP S_35923976	756504	A	T
000056F_2424201_SNP S_36084506	2424201	T	A
000056F_3122563_SNP S_36154587	3122563	C	T
000056F_1309862_SNP S_35975065	1309862	A	C
000056F_994535_SNP S_35945408	994535	G	C
000056F_1199860_SNP S_35963850	1199860	A	T
000056F_1401547_SNP S_35983780	1401547	T	C
000056F_2212683_SNP S_36064138	2212683	A	C
000056F_2763751_SNP S_36115921	2763751	C	T
000056F_1075841_SNP S_35951872	1075841	A	T
000056F_1775073_SNP S_36020935	1775073	A	C
000056F_1267370_SNP S_35970592	1267370	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2861044_SNP S_36124638	2861044	A	C
000056F_2259461_SNP S_36068305	2259461	T	A
000056F_2222246_SNP S_36065264	2222246	A	T
000056F_2718459_SNP S_36111499	2718459	A	G
000056F_22814_SNP S_35853213	22814	G	A
000056F_5289820_SNP S_36394181	5289820	T	A
000056F_2826827_SNP S_36121610	2826827	T	C
000056F_2183967_SNP S_36060549	2183967	A	G
000056F_1143955_SNP S_35958145	1143955	T	G
000056F_392224_SNP S_35889439	392224	C	G
000056F_2189248_SNP S_36061047	2189248	G	T
000056F_3029340_SNP	3029340	A	C
000056F_3520202_SNP S_36196307	3520202	T	C
000056F_2880448_SNP S_36126284	2880448	T	A
000056F_2198654_SNP S_36061950	2198654	A	T
000056F_3410070_SNP S_36184794	3410070	C	T
000056F_2634930_SNP S_36103872	2634930	T	C
000056F_2704854_SNP S_36110418	2704854	C	G
000056F_897776_SNP S_35936827	897776	A	C
000056F_1297875_SNP S_35973895	1297875	G	A
000056F_1982202_SNP S_36041707	1982202	G	A
000056F_4804346_SNP S_36345291	4804346	A	C
000056F_973501_SNP S_35943032	973501	T	C
000056F_3280654_SNP S_36170935	3280654	T	A
000056F_45278_SNP S_35855256	45278	G	A
000056F_225577_SNP S_35874278	225577	A	G
000056F_831112_SNP S_35930844	831112	G	C
000056F_2207894_SNP S_36063705	2207894	A	T
000056F_2078138_SNP S_36050471	2078138	G	T
000056F_2696165_SNP S_36109722	2696165	G	T
000056F_2593422_SNP S_36100247	2593422	A	T
000056F_1815750_SNP S_36024830	1815750	C	T
000056F_2018353_SNP S_36044866	2018353	C	T
000056F_5092114_SNP S_36375308	5092114	A	C
000056F_3622700_SNP S_36205179	3622700	A	T
000056F_1708858_SNP S_36015556	1708858	G	T
000056F_1296625_SNP S_35973806	1296625	G	T
000056F_1259584_SNP S_35969762	1259584	T	A
000056F_1437346_SNP S_35987188	1437346	G	T
000056F_1822227_SNP S_36025357	1822227	G	A
000056F_2016178_SNP S_36044682	2016178	T	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_976125_SNP S_35943411	976125	G	T
000056F_2815959_SNP S_36120597	2815959	A	C
000056F_2057356_SNP S_36048544	2057356	G	C
000056F_3632382_SNP S_36206018	3632382	T	G
000056F_183510_SNP S_35870330	183510	G	C
000056F_1506180_SNP S_35996105	1506180	A	G
000056F_2873270_SNP S_36125655	2873270	A	G
000056F_742586_SNP S_35922736	742586	G	A
000056F_1537615_SNP S_36000336	1537615	G	A
000056F_1374287_SNP S_35981471	1374287	T	C
000056F_4657377_SNP S_36328752	4657377	A	G
000056F_3841916_SNP S_36230576	3841916	C	A
000056F_1137568_SNP S_35957445	1137568	G	T
000056F_3279249_SNP	3279249	T	A
000056F_2142308_SNP S_36056765	2142308	A	G
000056F_3482699_SNP S_36192633	3482699	G	C
000056F_2352141_SNP S_36077575	2352141	C	A
000056F_1244553_SNP S_35968213	1244553	A	G
000056F_1697376_SNP S_36014385	1697376	C	A
000056F_2299573_SNP S_36071344	2299573	G	C
000056F_2299575_SNP S_36071346	2299575	T	C
000056F_206377_SNP S_35872588	206377	G	A
000056F_1496109_SNP S_35995188	1496109	C	T
000056F_1993811_SNP	1993811	T	G
000056F_1916388_SNP S_36033289	1916388	C	T
000056F_1491523_SNP S_35994812	1491523	T	G
000056F_394027_SNP	394027	G	T
000056F_1151013_SNP S_35958725	1151013	G	T
000056F_394025_SNP	394025	T	G
000056F_880667_SNP S_35935325	880667	G	T
000056F_680006_SNP S_35916532	680006	T	A
000056F_1062795_SNP S_35950775	1062795	G	C
000056F_1842129_SNP S_36026691	1842129	G	T
000056F_2879816_SNP S_36126209	2879816	G	A
000056F_3937947_SNP S_36240842	3937947	A	G
000056F_3682541_SNP S_36210509	3682541	C	A
000056F_3176762_SNP	3176762	A	T
000056F_1705150_SNP S_36015307	1705150	T	G
000056F_2823743_SNP S_36121372	2823743	T	C
000056F_3163574_SNP S_36158347	3163574	C	A
000056F_2763697_SNP S_36115918	2763697	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2000606_SNP S_36043319	2000606	A	T
000056F_2749135_SNP S_36114503	2749135	C	T
000056F_1189163_SNP S_35962942	1189163	T	C
000056F_1091199_SNP S_35953653	1091199	C	G
000056F_2905444_SNP S_36128795	2905444	T	C
000056F_3110791_SNP S_36153530	3110791	T	G
000056F_2871281_SNP S_36125511	2871281	C	A
000056F_1259749_SNP S_35969772	1259749	A	T
000056F_172830_SNP S_35869407	172830	C	T
000056F_3292670_SNP S_36171845	3292670	T	G
000056F_2916256_SNP S_36129849	2916256	A	G
000056F_2411552_SNP S_36083282	2411552	G	T
000056F_39608_SNP S_35854759	39608	G	C
000056F_1134796_SNP S_35957237	1134796	G	A
000056F_3128518_SNP S_36154976	3128518	G	A
000056F_1912285_SNP S_36033014	1912285	T	G
000056F_927436_SNP S_35939452	927436	C	T
000056F_894476_SNP	894476	A	C
000056F_3773492_SNP S_36222585	3773492	C	T
000056F_2574110_SNP S_36098563	2574110	T	C
000056F_1095155_SNP S_35953937	1095155	C	A
000056F_2750447_SNP S_36114619	2750447	G	A
000056F_705288_SNP S_35918890	705288	A	G
000056F_1417628_SNP S_35985101	1417628	G	T
000056F_1906756_SNP S_36032531	1906756	A	T
000056F_1999390_SNP S_36043189	1999390	T	G
000056F_1680801_SNP S_36012963	1680801	T	G
000056F_2086901_SNP S_36051272	2086901	G	A
000056F_1048338_SNP S_35949424	1048338	G	A
000056F_1740286_SNP S_36018027	1740286	C	T
000056F_1853199_SNP S_36027811	1853199	G	A
000056F_2070980_SNP S_36049935	2070980	C	G
000056F_2089126_SNP S_36051443	2089126	A	G
000056F_2849041_SNP S_36123560	2849041	G	A
000056F_1111671_SNP S_35955397	1111671	T	C
000056F_1101043_SNP S_35954423	1101043	C	T
000056F_1215916_SNP S_35965332	1215916	G	A
000056F_917654_SNP S_35938483	917654	A	T
000056F_2100568_SNP S_36052552	2100568	G	A
000056F_3131652_SNP	3131652	C	T
000056F_388116_SNP S_35888842	388116	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4033868_SNP S_36267332	4033868	T	G
000056F_1507277_SNP S_35996254	1507277	G	T
000056F_4059166_SNP S_36269473	4059166	A	T
000056F_2191208_SNP	2191208	A	C
000056F_4730941_SNP S_36335397	4730941	G	A
000056F_3480270_SNP S_36192355	3480270	C	T
000056F_3968027_SNP	3968027	T	C
000056F_2082261_SNP S_36050802	2082261	A	G
000056F_460696_SNP	460696	C	T
000056F_1667805_SNP S_36011590	1667805	T	C
000056F_1700106_SNP S_36014629	1700106	G	A
000056F_4358370_SNP S_36299681	4358370	T	A
000056F_1985418_SNP S_36041919	1985418	A	T
000056F_4682224_SNP S_36330924	4682224	A	G
000056F_1860080_SNP S_36028486	1860080	T	C
000056F_454563_SNP S_35895312	454563	A	G
000056F_1673695_SNP S_36012257	1673695	A	G
000056F_3116462_SNP S_36154038	3116462	T	G
000056F_2121105_SNP S_36054733	2121105	T	C
000056F_1420749_SNP S_35985371	1420749	T	C
000056F_820293_SNP S_35929839	820293	A	G
000056F_1882828_SNP S_36030431	1882828	G	A
000056F_1299176_SNP S_35974090	1299176	T	G
000056F_1044716_SNP S_35949121	1044716	A	G
000056F_3094015_SNP S_36152142	3094015	A	G
000056F_714600_SNP S_35919760	714600	A	G
000056F_2272541_SNP S_36069325	2272541	C	A
000056F_1440500_SNP S_35987477	1440500	T	A
000056F_1215422_SNP S_35965245	1215422	T	C
000056F_4535580_SNP S_36316693	4535580	G	A
000056F_2233988_SNP S_36066274	2233988	G	A
000056F_2383180_SNP S_36080573	2383180	T	G
000056F_276401_SNP S_35878745	276401	C	A
000056F_362752_SNP S_35886654	362752	G	A
000056F_1764490_SNP S_36020020	1764490	A	C
000056F_1536184_SNP S_36000188	1536184	C	T
000056F_2727679_SNP	2727679	G	A
000056F_390537_SNP	390537	C	G
000056F_224543_SNP S_35874185	224543	A	T
000056F_4630041_SNP S_36325400	4630041	T	C
000056F_2382987_SNP S_36080569	2382987	C	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2360835_SNP S_36078442	2360835	T	A
000056F_5439760_SNP S_36410287	5439760	C	T
000056F_838754_SNP S_35931429	838754	C	G
000056F_3565755_SNP S_36200041	3565755	T	C
000056F_570478_SNP S_35906701	570478	T	C
000056F_1217457_SNP S_35965540	1217457	C	G
000056F_2429561_SNP S_36085065	2429561	C	T
000056F_3366986_SNP S_36181053	3366986	T	A
000056F_4175989_SNP S_36280247	4175989	G	A
000056F_4599574_SNP S_36322875	4599574	T	C
000056F_4956579_SNP S_36361203	4956579	A	G
000056F_635637_SNP S_35912400	635637	A	G
000056F_1691589_SNP S_36013796	1691589	G	C
000056F_1209761_SNP S_35964741	1209761	T	A
000056F_1423124_SNP S_35985569	1423124	A	T
000056F_1897040_SNP S_36031721	1897040	C	T
000056F_1043192_SNP S_35948994	1043192	T	A
000056F_4588610_SNP S_36321849	4588610	A	T
000056F_2020688_SNP S_36045096	2020688	T	C
000056F_5148347_SNP S_36380688	5148347	C	T
000056F_1843047_SNP S_36026811	1843047	A	G
000056F_1254868_SNP S_35969354	1254868	T	C
000056F_1314563_SNP S_35975469	1314563	T	C
000056F_1448542_SNP S_35988219	1448542	T	C
000056F_1753762_SNP S_36019130	1753762	C	T
000056F_3921474_SNP S_36239389	3921474	A	T
000056F_1759684_SNP S_36019532	1759684	C	T
000056F_1919084_SNP S_36033581	1919084	T	C
000056F_1763735_SNP S_36019954	1763735	A	G
000056F_1278779_SNP S_35972159	1278779	A	G
000056F_1850803_SNP S_36027604	1850803	C	G
000056F_1078064_SNP S_35952147	1078064	A	G
000056F_1319235_SNP S_35975899	1319235	C	G
000056F_2622671_SNP S_36102720	2622671	T	A
000056F_2013558_SNP S_36044455	2013558	A	G
000056F_3167711_SNP S_36158720	3167711	G	A
000056F_2645391_SNP S_36104861	2645391	C	T
000056F_4304651_SNP S_36294294	4304651	T	C
000056F_3994555_SNP S_36246362	3994555	A	T
000056F_3994548_SNP S_36246361	3994548	T	A
000056F_1590511_SNP S_36004494	1590511	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1411758_SNP S_35984671	1411758	A	G
000056F_1580687_SNP S_36003740	1580687	C	G
000056F_818238_SNP S_35929653	818238	C	A
000056F_2836181_SNP S_36122420	2836181	T	C
000056F_1741429_SNP S_36018121	1741429	A	C
000056F_961974_SNP S_35942410	961974	A	T
000056F_3383844_SNP S_36182609	3383844	C	A
000056F_532358_SNP S_35902947	532358	A	C
000056F_2539711_SNP	2539711	G	C
000056F_3397357_SNP S_36183674	3397357	C	G
000056F_2052702_SNP S_36048049	2052702	C	T
000056F_3239763_SNP S_36166879	3239763	T	A
000056F_1021535_SNP S_35947351	1021535	C	A
000056F_825873_SNP S_35930305	825873	T	G
000056F_1570191_SNP S_36002828	1570191	T	G
000056F_3182111_SNP S_36160145	3182111	T	A
000056F_2445084_SNP S_36086292	2445084	A	T
000056F_283393_SNP S_35879410	283393	A	T
000056F_1278750_SNP S_35972157	1278750	G	A
000056F_1432119_SNP S_35986602	1432119	C	A
000056F_2359892_SNP S_36078356	2359892	G	T
000056F_4104735_SNP S_36273138	4104735	C	G
000056F_183919_SNP S_35870365	183919	T	C
000056F_2722381_SNP S_36111807	2722381	T	G
000056F_2901848_SNP S_36128469	2901848	T	C
000056F_2621998_SNP S_36102665	2621998	C	T
000056F_1228789_SNP S_35966816	1228789	T	C
000056F_2063463_SNP S_36049351	2063463	A	G
000056F_2910912_SNP	2910912	T	G
000056F_2910913_SNP	2910913	T	C
000056F_2430795_SNP S_36085180	2430795	A	C
000056F_2194729_SNP S_36061528	2194729	A	C
000056F_764145_SNP S_35924683	764145	T	A
000056F_5587804_SNP	5587804	T	A
000056F_2281322_SNP S_36069723	2281322	C	T
000056F_2908007_SNP S_36129093	2908007	T	C
000056F_1740669_SNP S_36018069	1740669	C	T
000056F_4053205_SNP S_36268865	4053205	A	C
000056F_1285474_SNP S_35972645	1285474	A	T
000056F_2043079_SNP S_36047176	2043079	A	G
000056F_981420_SNP S_35943985	981420	C	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2807612_SNP S_36119803	2807612	T	C
000056F_380179_SNP S_35888129	380179	G	T
000056F_1916544_SNP S_36033310	1916544	A	C
000056F_1916545_SNP S_36033311	1916545	T	C
000056F_2099199_SNP S_36052442	2099199	C	T
000056F_1777249_SNP S_36021099	1777249	A	G
000056F_1279954_SNP S_35972249	1279954	C	T
000056F_198401_SNP S_35871703	198401	G	A
000056F_1890713_SNP S_36031088	1890713	T	G
000056F_2138149_SNP S_36056352	2138149	A	G
000056F_792537_SNP S_35927333	792537	A	T
000056F_1096021_SNP S_35954013	1096021	G	C
000056F_3531394_SNP S_36197215	3531394	G	C
000056F_476406_SNP S_35897235	476406	A	G
000056F_1209586_SNP S_35964721	1209586	C	A
000056F_2497273_SNP S_36091260	2497273	C	T
000056F_1767806_SNP S_36020267	1767806	C	G
000056F_3371655_SNP S_36181486	3371655	G	A
000056F_1640318_SNP S_36009358	1640318	C	T
000056F_1115484_SNP S_35955717	1115484	C	T
000056F_1440474_SNP S_35987476	1440474	C	A
000056F_179094_SNP S_35870021	179094	A	T
000056F_2341403_SNP S_36076497	2341403	G	A
000056F_361428_SNP S_35886511	361428	C	T
000056F_1696311_SNP S_36014284	1696311	G	T
000056F_722214_SNP S_35920395	722214	G	C
000056F_5005161_SNP S_36366627	5005161	T	C
000056F_4860646_SNP S_36350477	4860646	C	T
000056F_2711015_SNP S_36110817	2711015	G	C
000056F_1488794_SNP S_35994533	1488794	A	T
000056F_2081811_SNP S_36050758	2081811	C	T
000056F_565863_SNP S_35906179	565863	C	T
000056F_1427205_SNP S_35986098	1427205	G	T
000056F_2336653_SNP S_36076131	2336653	A	T
000056F_2286480_SNP S_36070172	2286480	A	T
000056F_2723262_SNP S_36111850	2723262	T	A
000056F_1366524_SNP S_35980861	1366524	C	T
000056F_779811_SNP S_35926328	779811	G	A
000056F_1367274_SNP S_35980911	1367274	G	T
000056F_746522_SNP S_35923090	746522	T	C
000056F_2386723_SNP S_36080987	2386723	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2005661_SNP S_36043771	2005661	T	C
000056F_1575559_SNP S_36003359	1575559	T	G
000056F_1886282_SNP S_36030702	1886282	T	C
000056F_2418595_SNP S_36083907	2418595	G	T
000056F_978879_SNP S_35943741	978879	T	C
000056F_2685427_SNP S_36108768	2685427	C	T
000056F_1725040_SNP S_36016714	1725040	T	C
000056F_2012825_SNP S_36044411	2012825	G	A
000056F_1285452_SNP S_35972644	1285452	T	G
000056F_1508297_SNP S_35996396	1508297	C	A
000056F_587397_SNP S_35908029	587397	G	A
000056F_1925396_SNP S_36034158	1925396	T	A
000056F_1199794_SNP S_35963844	1199794	G	C
000056F_1570409_SNP S_36002841	1570409	A	C
000056F_1687958_SNP S_36013564	1687958	A	T
000056F_173685_SNP S_35869486	173685	C	T
000056F_2158642_SNP S_36058280	2158642	A	G
000056F_2495363_SNP S_36090972	2495363	G	A
000056F_3320755_SNP S_36176274	3320755	A	C
000056F_1098467_SNP S_35954253	1098467	C	G
000056F_49923_SNP S_35855710	49923	T	C
000056F_4201781_SNP S_36283108	4201781	G	C
000056F_1975680_SNP S_36040949	1975680	T	G
000056F_473281_SNP S_35896931	473281	T	C
000056F_3985652_SNP S_36245525	3985652	G	A
000056F_1099894_SNP S_35954358	1099894	C	T
000056F_2193641_SNP S_36061443	2193641	C	G
000056F_3404841_SNP S_36184306	3404841	T	G
000056F_1812738_SNP S_36024006	1812738	G	A
000056F_1974237_SNP S_36040856	1974237	C	T
000056F_2224946_SNP S_36065517	2224946	G	A
000056F_1849492_SNP S_36027486	1849492	T	C
000056F_635396_SNP S_35912366	635396	T	G
000056F_2792690_SNP S_36118362	2792690	A	T
000056F_2405878_SNP S_36082866	2405878	G	A
000056F_4174056_SNP S_36280095	4174056	A	G
000056F_1172099_SNP S_35960955	1172099	T	A
000056F_1636224_SNP S_36008965	1636224	A	G
000056F_1636225_SNP S_36008967	1636225	A	G
000056F_125877_SNP S_35863610	125877	A	G
000056F_2649411_SNP S_36105347	2649411	A	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2612811_SNP S_36101841	2612811	A	G
000056F_2612825_SNP S_36101844	2612825	C	A
000056F_1731342_SNP S_36017240	1731342	A	G
000056F_3159094_SNP S_36158007	3159094	T	C
000056F_2066712_SNP S_36049606	2066712	C	G
000056F_2350466_SNP S_36077419	2350466	T	G
000056F_2084050_SNP S_36050992	2084050	T	A
000056F_2406172_SNP S_36082888	2406172	A	T
000056F_1089527_SNP	1089527	G	C
000056F_2084153_SNP S_36050999	2084153	C	T
000056F_1753804_SNP S_36019133	1753804	A	C
000056F_5040356_SNP S_36369989	5040356	G	C
000056F_2622353_SNP S_36102694	2622353	A	T
000056F_1078369_SNP S_35952165	1078369	T	G
000056F_979636_SNP S_35943802	979636	T	C
000056F_1721278_SNP S_36016491	1721278	C	A
000056F_1136761_SNP S_35957333	1136761	A	G
000056F_1974754_SNP S_36040891	1974754	A	T
000056F_2842570_SNP S_36123020	2842570	A	C
000056F_1624506_SNP S_36007716	1624506	C	A
000056F_2015832_SNP S_36044648	2015832	C	A
000056F_3054373_SNP S_36147956	3054373	C	T
000056F_908147_SNP S_35937616	908147	C	A
000056F_1979060_SNP S_36041257	1979060	T	G
000056F_5765624_SNP S_36443019	5765624	T	C
000056F_3264675_SNP S_36169347	3264675	T	A
000056F_2118860_SNP S_36054519	2118860	T	A
000056F_2118861_SNP S_36054520	2118861	T	C
000056F_2245740_SNP S_36067339	2245740	A	T
000056F_2072503_SNP S_36050047	2072503	T	C
000056F_349675_SNP S_35885365	349675	C	G
000056F_715074_SNP S_35919803	715074	T	G
000056F_2859752_SNP S_36124542	2859752	T	C
000056F_955705_SNP S_35941848	955705	C	G
000056F_1185534_SNP S_35962649	1185534	T	C
000056F_881570_SNP S_35935392	881570	T	C
000056F_1656152_SNP S_36010766	1656152	C	T
000056F_3007100_SNP S_36140988	3007100	A	T
000056F_2600681_SNP S_36100859	2600681	G	T
000056F_4647817_SNP S_36327991	4647817	C	A
000056F_2158667_SNP S_36058281	2158667	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_3047588_SNP S_36147242	3047588	G	C
000056F_1777238_SNP S_36021098	1777238	C	T
000056F_195636_SNP	195636	T	C
000056F_4840896_SNP S_36348761	4840896	C	G
000056F_241401_SNP S_35875667	241401	T	G
000056F_2011578_SNP S_36044306	2011578	A	T
000056F_3570501_SNP S_36200863	3570501	A	C
000056F_2926016_SNP S_36130745	2926016	A	T
000056F_2490843_SNP S_36090633	2490843	G	A
000056F_1239235_SNP S_35967837	1239235	A	G
000056F_4863158_SNP S_36350683	4863158	A	G
000056F_3058240_SNP S_36148206	3058240	C	A
000056F_176713_SNP S_35869796	176713	G	A
000056F_860030_SNP S_35933423	860030	G	A
000056F_860028_SNP S_35933422	860028	A	T
000056F_860031_SNP S_35933424	860031	T	G
000056F_2668998_SNP S_36107290	2668998	A	C
000056F_932491_SNP S_35939939	932491	A	C
000056F_2404828_SNP S_36082769	2404828	A	G
000056F_4607042_SNP S_36323526	4607042	C	G
000056F_2718438_SNP S_36111496	2718438	C	T
000056F_1724627_SNP S_36016684	1724627	A	G
000056F_3052092_SNP S_36147688	3052092	G	A
000056F_1681157_SNP S_36012986	1681157	T	G
000056F_2193728_SNP S_36061450	2193728	T	C
000056F_1589732_SNP S_36004406	1589732	C	A
000056F_1239865_SNP S_35967896	1239865	T	A
000056F_2691698_SNP S_36109330	2691698	A	G
000056F_2032681_SNP S_36046304	2032681	G	A
000056F_1796378_SNP S_36022791	1796378	C	A
000056F_1823227_SNP S_36025419	1823227	A	C
000056F_1140127_SNP S_35957653	1140127	G	T
000056F_1796943_SNP S_36022835	1796943	A	T
000056F_1847425_SNP S_36027283	1847425	C	T
000056F_2911076_SNP S_36129396	2911076	A	T
000056F_3130603_SNP	3130603	A	G
000056F_433593_SNP S_35893511	433593	G	C
000056F_2945041_SNP S_36132481	2945041	A	T
000056F_5298259_SNP S_36395193	5298259	A	T
000056F_2015173_SNP S_36044571	2015173	T	A
000056F_192096_SNP S_35870777	192096	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2081833_SNP S_36050760	2081833	G	T
000056F_1111414_SNP S_35955357	1111414	T	C
000056F_1972483_SNP S_36040672	1972483	G	A
000056F_2505431_SNP S_36092106	2505431	C	T
000056F_3925171_SNP S_36239829	3925171	C	A
000056F_1114629_SNP S_35955636	1114629	T	C
000056F_1209771_SNP S_35964742	1209771	A	G
000056F_983585_SNP S_35944139	983585	A	G
000056F_179972_SNP S_35870133	179972	T	G
000056F_737572_SNP S_35922354	737572	G	T
000056F_2901074_SNP S_36128350	2901074	A	G
000056F_2846600_SNP S_36123378	2846600	A	G
000056F_1033798_SNP S_35948214	1033798	A	T
000056F_1502738_SNP S_35995819	1502738	A	T
000056F_194050_SNP S_35870966	194050	A	T
000056F_2664598_SNP S_36106867	2664598	A	C
000056F_259603_SNP S_35877205	259603	G	A
000056F_394446_SNP S_35889626	394446	T	G
000056F_2183445_SNP S_36060490	2183445	A	G
000056F_1699484_SNP S_36014575	1699484	G	C
000056F_1034429_SNP S_35948262	1034429	C	A
000056F_2052962_SNP S_36048068	2052962	C	G
000056F_1770476_SNP S_36020504	1770476	A	C
000056F_1964483_SNP S_36039948	1964483	T	C
000056F_2022389_SNP S_36045261	2022389	T	C
000056F_2078999_SNP S_36050534	2078999	C	A
000056F_5295087_SNP S_36394855	5295087	A	T
000056F_3287144_SNP S_36171463	3287144	G	A
000056F_2910911_SNP	2910911	C	G
000056F_3345354_SNP S_36178587	3345354	G	T
000056F_3447371_SNP S_36189218	3447371	G	A
000056F_2938979_SNP S_36132175	2938979	A	T
000056F_2938981_SNP S_36132176	2938981	T	G
000056F_2610556_SNP S_36101671	2610556	T	G
000056F_444149_SNP S_35894664	444149	T	C
000056F_950476_SNP S_35941317	950476	G	A
000056F_809692_SNP S_35928982	809692	T	A
000056F_1960678_SNP S_36039543	1960678	A	C
000056F_1430200_SNP S_35986395	1430200	T	A
000056F_1623106_SNP S_36007583	1623106	T	C
000056F_839828_SNP S_35931489	839828	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4610688_SNP S_36323841	4610688	A	T
000056F_3248624_SNP S_36167788	3248624	A	G
000056F_1812899_SNP S_36024017	1812899	C	T
000056F_1463034_SNP S_35989488	1463034	T	G
000056F_1350140_SNP S_35979172	1350140	G	T
000056F_392952_SNP S_35889517	392952	T	C
000056F_2157931_SNP S_36058233	2157931	A	C
000056F_2579498_SNP S_36099079	2579498	G	A
000056F_97131_SNP S_35860254	97131	C	T
000056F_2765129_SNP S_36116011	2765129	A	C
000056F_3491320_SNP S_36193428	3491320	G	A
000056F_1481847_SNP S_35994028	1481847	C	T
000056F_1940655_SNP S_36035593	1940655	C	A
000056F_2564108_SNP S_36097614	2564108	T	C
000056F_2222358_SNP S_36065269	2222358	C	G
000056F_3522467_SNP S_36196500	3522467	G	A
000056F_1656017_SNP S_36010761	1656017	G	T
000056F_1019578_SNP S_35947142	1019578	G	T
000056F_1845639_SNP S_36027074	1845639	G	A
000056F_181081_SNP S_35870222	181081	G	A
000056F_382748_SNP S_35888341	382748	T	A
000056F_3172132_SNP S_36159178	3172132	T	C
000056F_1824600_SNP S_36025537	1824600	C	G
000056F_3359658_SNP S_36179935	3359658	C	A
000056F_3359714_SNP S_36179979	3359714	C	T
000056F_2563015_SNP S_36097503	2563015	G	A
000056F_2374739_SNP S_36079846	2374739	G	A
000056F_2059773_SNP S_36048751	2059773	A	G
000056F_2059772_SNP S_36048750	2059772	C	A
000056F_2792650_SNP S_36118360	2792650	C	A
000056F_1974241_SNP S_36040857	1974241	G	T
000056F_1195262_SNP S_35963518	1195262	C	T
000056F_3270233_SNP S_36169990	3270233	C	T
000056F_3491308_SNP S_36193426	3491308	T	G
000056F_955595_SNP S_35941841	955595	T	G
000056F_3310230_SNP S_36174048	3310230	C	T
000056F_1067215_SNP S_35951188	1067215	T	C
000056F_1613436_SNP S_36006715	1613436	A	T
000056F_1902320_SNP S_36032185	1902320	G	A
000056F_913380_SNP S_35938105	913380	G	A
000056F_2337671_SNP S_36076201	2337671	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1990042_SNP S_36042194	1990042	T	C
000056F_1171488_SNP S_35960861	1171488	C	G
000056F_1288166_SNP S_35972894	1288166	C	T
000056F_4184107_SNP S_36281034	4184107	G	C
000056F_2135939_SNP S_36056197	2135939	C	A
000056F_3937622_SNP S_36240827	3937622	T	G
000056F_2861814_SNP S_36124703	2861814	A	T
000056F_925648_SNP S_35939301	925648	T	A
000056F_2780038_SNP S_36117361	2780038	T	C
000056F_1338106_SNP S_35978116	1338106	G	A
000056F_1258012_SNP S_35969663	1258012	C	T
000056F_2176354_SNP S_36059831	2176354	G	A
000056F_2693603_SNP S_36109460	2693603	G	A
000056F_5796517_SNP S_36446186	5796517	C	T
000056F_1230750_SNP S_35967001	1230750	A	T
000056F_1797420_SNP S_36022874	1797420	G	A
000056F_2379806_SNP S_36080330	2379806	C	T
000056F_2402195_SNP S_36082515	2402195	C	T
000056F_476630_SNP S_35897250	476630	A	T
000056F_438568_SNP S_35894073	438568	T	C
000056F_3176853_SNP S_36159683	3176853	G	A
000056F_1580114_SNP S_36003692	1580114	G	A
000056F_2502889_SNP S_36091759	2502889	C	T
000056F_1119802_SNP S_35956149	1119802	G	A
000056F_317228_SNP S_35882604	317228	T	A
000056F_2252657_SNP S_36067795	2252657	T	C
000056F_1622773_SNP S_36007531	1622773	G	A
000056F_3052869_SNP S_36147771	3052869	T	A
000056F_2487401_SNP S_36090382	2487401	C	A
000056F_3575342_SNP S_36201313	3575342	C	A
000056F_1985407_SNP S_36041916	1985407	A	T
000056F_2327339_SNP S_36075363	2327339	T	C
000056F_1111912_SNP S_35955421	1111912	C	G
000056F_536453_SNP S_35903412	536453	C	T
000056F_1847948_SNP S_36027347	1847948	G	C
000056F_3163763_SNP S_36158358	3163763	C	T
000056F_1480167_SNP S_35993892	1480167	T	C
000056F_3320688_SNP S_36176268	3320688	C	T
000056F_2622979_SNP S_36102750	2622979	A	G
000056F_1582738_SNP S_36003850	1582738	G	A
000056F_907813_SNP S_35937588	907813	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2478819_SNP S_36089648	2478819	A	G
000056F_3480229_SNP S_36192345	3480229	C	T
000056F_2930640_SNP S_36131309	2930640	A	G
000056F_1876518_SNP S_36029819	1876518	C	T
000056F_1452613_SNP S_35988566	1452613	T	C
000056F_501645_SNP S_35899728	501645	G	A
000056F_607989_SNP S_35909828	607989	G	T
000056F_1578971_SNP S_36003620	1578971	G	A
000056F_352522_SNP S_35885550	352522	A	G
000056F_27056_SNP S_35853584	27056	T	C
000056F_1594272_SNP S_36004838	1594272	T	C
000056F_2627155_SNP S_36103123	2627155	G	T
000056F_2252663_SNP S_36067796	2252663	A	T
000056F_2605142_SNP S_36101261	2605142	A	T
000056F_2605143_SNP S_36101262	2605143	T	A
000056F_391282_SNP S_35889345	391282	T	A
000056F_1140889_SNP S_35957732	1140889	A	C
000056F_1123381_SNP S_35956417	1123381	C	G
000056F_2924333_SNP S_36130649	2924333	T	G
000056F_1310081_SNP S_35975083	1310081	T	C
000056F_1480839_SNP S_35993936	1480839	T	G
000056F_2896229_SNP S_36127823	2896229	G	T
000056F_1327191_SNP S_35976489	1327191	T	A
000056F_1149475_SNP S_35958602	1149475	A	T
000056F_2540806_SNP S_36095378	2540806	G	A
000056F_1021567_SNP S_35947354	1021567	T	C
000056F_1572539_SNP S_36003081	1572539	C	T
000056F_2248297_SNP S_36067524	2248297	C	A
000056F_3117887_SNP S_36154160	3117887	G	T
000056F_1156844_SNP S_35959270	1156844	T	A
000056F_2856910_SNP S_36124349	2856910	C	T
000056F_2231468_SNP S_36066011	2231468	A	T
000056F_2661411_SNP S_36106575	2661411	G	A
000056F_574074_SNP S_35906905	574074	C	A
000056F_1049438_SNP S_35949494	1049438	T	C
000056F_1098405_SNP S_35954250	1098405	A	G
000056F_1694731_SNP S_36014082	1694731	T	C
000056F_2626861_SNP S_36103103	2626861	T	C
000056F_2101561_SNP S_36052617	2101561	G	A
000056F_1246633_SNP S_35968447	1246633	C	A
000056F_1246634_SNP S_35968448	1246634	C	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1837565_SNP S_36026388	1837565	G	A
000056F_1589800_SNP S_36004408	1589800	G	T
000056F_5292012_SNP S_36394534	5292012	A	C
000056F_1807745_SNP S_36023705	1807745	G	C
000056F_2675364_SNP S_36107860	2675364	G	A
000056F_1421032_SNP S_35985397	1421032	T	A
000056F_1421033_SNP S_35985398	1421033	A	T
000056F_2593844_SNP S_36100269	2593844	T	C
000056F_1335989_SNP S_35977623	1335989	C	A
000056F_2644980_SNP	2644980	T	C
000056F_3929871_SNP S_36240254	3929871	T	A
000056F_1438319_SNP S_35987257	1438319	T	A
000056F_1777418_SNP S_36021114	1777418	A	C
000056F_2189237_SNP S_36061045	2189237	T	G
000056F_1764486_SNP S_36020019	1764486	C	T
000056F_1965059_SNP S_36040007	1965059	C	T
000056F_1692696_SNP S_36013889	1692696	A	T
000056F_2727875_SNP S_36112232	2727875	T	C
000056F_1077226_SNP S_35952036	1077226	T	C
000056F_1999617_SNP S_36043203	1999617	C	A
000056F_27037_SNP S_35853583	27037	C	T
000056F_2286502_SNP S_36070174	2286502	T	G
000056F_2500084_SNP S_36091434	2500084	A	T
000056F_505112_SNP S_35900000	505112	A	G
000056F_1353442_SNP S_35979468	1353442	C	T
000056F_1073063_SNP S_35951687	1073063	A	C
000056F_2556399_SNP S_36096920	2556399	T	G
000056F_427552_SNP S_35892944	427552	T	G
000056F_1186364_SNP S_35962716	1186364	C	G
000056F_1329521_SNP S_35976809	1329521	A	G
000056F_577156_SNP S_35907201	577156	C	A
000056F_286893_SNP S_35879716	286893	C	T
000056F_2045786_SNP S_36047398	2045786	A	G
000056F_792501_SNP S_35927329	792501	T	C
000056F_1631110_SNP S_36008243	1631110	T	A
000056F_577245_SNP S_35907211	577245	C	T
000056F_2904971_SNP S_36128760	2904971	A	G
000056F_2194907_SNP	2194907	T	C
000056F_546754_SNP S_35904409	546754	G	A
000056F_2183972_SNP S_36060551	2183972	A	C
000056F_1209578_SNP S_35964720	1209578	A	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1019576_SNP S_35947141	1019576	C	A
000056F_917870_SNP S_35938524	917870	C	A
000056F_1223067_SNP S_35966074	1223067	A	G
000056F_2547127_SNP S_36096008	2547127	T	A
000056F_1902070_SNP S_36032157	1902070	G	T
000056F_1973451_SNP S_36040750	1973451	T	C
000056F_2379849_SNP S_36080334	2379849	C	G
000056F_398565_SNP S_35889938	398565	A	T
000056F_4312699_SNP S_36295069	4312699	T	C
000056F_1264738_SNP S_35970324	1264738	G	A
000056F_923921_SNP S_35939117	923921	G	A
000056F_3195428_SNP S_36161404	3195428	C	T
000056F_1631214_SNP S_36008249	1631214	A	G
000056F_3938026_SNP S_36240851	3938026	A	G
000056F_5202083_SNP S_36385597	5202083	G	A
000056F_392653_SNP S_35889485	392653	C	T
000056F_1431173_SNP S_35986488	1431173	A	C
000056F_1359531_SNP S_35980216	1359531	T	C
000056F_2382952_SNP S_36080565	2382952	T	C
000056F_924723_SNP S_35939198	924723	G	A
000056F_341451_SNP S_35884685	341451	A	T
000056F_1580553_SNP S_36003734	1580553	A	T
000056F_2008709_SNP S_36044045	2008709	A	G
000056F_2875997_SNP S_36125932	2875997	C	T
000056F_3244526_SNP S_36167319	3244526	G	C
000056F_3532452_SNP S_36197323	3532452	A	G
000056F_2556726_SNP S_36096954	2556726	T	C
000056F_1228046_SNP S_35966760	1228046	G	A
000056F_1166483_SNP S_35960322	1166483	A	G
000056F_4753257_SNP S_36338212	4753257	A	G
000056F_2363358_SNP S_36078729	2363358	G	T
000056F_2957576_SNP	2957576	T	G
000056F_2957577_SNP	2957577	A	G
000056F_1694113_SNP S_36014006	1694113	G	A
000056F_3575350_SNP S_36201314	3575350	A	C
000056F_1698628_SNP S_36014500	1698628	G	A
000056F_3288548_SNP S_36171575	3288548	T	C
000056F_572837_SNP S_35906826	572837	C	T
000056F_572836_SNP S_35906824	572836	T	A
000056F_1042821_SNP S_35948956	1042821	T	C
000056F_1309919_SNP S_35975069	1309919	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2204473_SNP S_36063259	2204473	T	G
000056F_1542289_SNP S_36000682	1542289	C	A
000056F_1849462_SNP S_36027483	1849462	A	T
000056F_1258703_SNP S_35969708	1258703	T	A
000056F_4280293_SNP S_36291940	4280293	T	C
000056F_2341858_SNP S_36076530	2341858	A	C
000056F_2959074_SNP S_36134358	2959074	G	C
000056F_3057504_SNP S_36148179	3057504	A	T
000056F_2548194_SNP S_36096111	2548194	G	A
000056F_1967511_SNP S_36040248	1967511	T	G
000056F_2240776_SNP S_36066911	2240776	T	C
000056F_4546020_SNP S_36317553	4546020	T	G
000056F_4042676_SNP S_36268033	4042676	A	G
000056F_2065370_SNP S_36049534	2065370	A	C
000056F_2805631_SNP S_36119660	2805631	C	A
000056F_2038397_SNP S_36046771	2038397	C	A
000056F_2768826_SNP S_36116308	2768826	G	T
000056F_1006880_SNP S_35946308	1006880	G	A
000056F_207193_SNP S_35872654	207193	C	A
000056F_1368667_SNP S_35981029	1368667	G	T
000056F_1429204_SNP S_35986290	1429204	G	T
000056F_1793483_SNP S_36022567	1793483	C	T
000056F_5134942_SNP S_36379517	5134942	T	C
000056F_2717901_SNP S_36111401	2717901	C	T
000056F_334272_SNP S_35884072	334272	G	A
000056F_1481105_SNP S_35993968	1481105	T	A
000056F_3979566_SNP S_36244961	3979566	T	A
000056F_2936222_SNP S_36131965	2936222	G	A
000056F_1259794_SNP S_35969775	1259794	C	T
000056F_917840_SNP S_35938517	917840	T	A
000056F_2099271_SNP S_36052448	2099271	G	T
000056F_1336022_SNP S_35977627	1336022	A	G
000056F_3338728_SNP S_36177761	3338728	T	G
000056F_457455_SNP S_35895527	457455	C	A
000056F_379020_SNP S_35887970	379020	G	C
000056F_340977_SNP S_35884608	340977	T	C
000056F_1448577_SNP S_35988222	1448577	C	T
000056F_174826_SNP S_35869605	174826	G	A
000056F_1846222_SNP S_36027157	1846222	C	T
000056F_3827579_SNP S_36228508	3827579	T	C
000056F_1916180_SNP S_36033274	1916180	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2172175_SNP S_36059488	2172175	A	G
000056F_1136804_SNP S_35957337	1136804	T	C
000056F_2438224_SNP S_36085743	2438224	A	G
000056F_1411549_SNP S_35984650	1411549	A	G
000056F_2709410_SNP S_36110746	2709410	A	C
000056F_3337082_SNP S_36177575	3337082	C	G
000056F_1933730_SNP S_36034855	1933730	T	C
000056F_5645508_SNP S_36430270	5645508	A	T
000056F_2602373_SNP S_36101031	2602373	A	G
000056F_2128043_SNP S_36055461	2128043	G	A
000056F_1452920_SNP S_35988581	1452920	T	A
000056F_737568_SNP S_35922353	737568	G	T
000056F_2033935_SNP S_36046408	2033935	G	A
000056F_2385176_SNP S_36080770	2385176	A	C
000056F_3342620_SNP S_36178202	3342620	T	C
000056F_1193983_SNP S_35963415	1193983	A	G
000056F_2650305_SNP S_36105461	2650305	A	G
000056F_2569130_SNP S_36098063	2569130	A	T
000056F_1572254_SNP S_36003045	1572254	T	G
000056F_415003_SNP S_35891616	415003	G	A
000056F_1969456_SNP S_36040402	1969456	C	A
000056F_2612813_SNP S_36101842	2612813	C	A
000056F_2716384_SNP S_36111269	2716384	G	A
000056F_2612814_SNP S_36101843	2612814	G	C
000056F_1212003_SNP S_35964908	1212003	C	T
000056F_1303693_SNP S_35974537	1303693	G	C
000056F_1246702_SNP S_35968450	1246702	T	C
000056F_2685290_SNP S_36108763	2685290	C	T
000056F_2005270_SNP S_36043737	2005270	T	C
000056F_2161641_SNP S_36058569	2161641	C	T
000056F_2007341_SNP	2007341	T	G
000056F_2511482_SNP S_36092610	2511482	A	G
000056F_4504233_SNP S_36314209	4504233	A	T
000056F_1121112_SNP S_35956256	1121112	A	C
000056F_1570912_SNP S_36002877	1570912	C	G
000056F_1437326_SNP S_35987185	1437326	A	C
000056F_2504385_SNP S_36091967	2504385	C	A
000056F_4535729_SNP S_36316701	4535729	A	C
000056F_2510862_SNP S_36092563	2510862	G	A
000056F_1185179_SNP S_35962617	1185179	T	C
000056F_1193055_SNP S_35963276	1193055	T	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1346980_SNP S_35978923	1346980	C	T
000056F_774008_SNP S_35925669	774008	T	G
000056F_2014660_SNP S_36044531	2014660	C	G
000056F_5168680_SNP S_36382686	5168680	T	C
000056F_2688224_SNP S_36109039	2688224	C	T
000056F_2810351_SNP S_36119999	2810351	T	A
000056F_2337596_SNP S_36076197	2337596	T	G
000056F_708188_SNP S_35919172	708188	T	C
000056F_4809654_SNP	4809654	C	A
000056F_1980003_SNP	1980003	T	C
000056F_1760918_SNP S_36019647	1760918	G	A
000056F_2078937_SNP S_36050531	2078937	T	C
000056F_895020_SNP S_35936616	895020	G	A
000056F_577157_SNP S_35907202	577157	G	A
000056F_2413053_SNP S_36083393	2413053	A	C
000056F_2189230_SNP S_36061043	2189230	A	G
000056F_1715485_SNP S_36016072	1715485	C	T
000056F_2373259_SNP S_36079707	2373259	T	A
000056F_1606934_SNP S_36006175	1606934	A	C
000056F_3644548_SNP S_36207073	3644548	A	T
000056F_2531664_SNP S_36094648	2531664	C	T
000056F_2831391_SNP S_36121946	2831391	G	C
000056F_1812710_SNP S_36024005	1812710	C	T
000056F_3104881_SNP S_36153029	3104881	C	G
000056F_2177433_SNP S_36059942	2177433	C	A
000056F_2120450_SNP	2120450	T	C
000056F_3989512_SNP S_36245964	3989512	C	G
000056F_1083930_SNP S_35952707	1083930	C	T
000056F_3637072_SNP S_36206452	3637072	A	G
000056F_5005154_SNP S_36366625	5005154	C	G
000056F_2538611_SNP S_36095199	2538611	T	C
000056F_2684355_SNP S_36108656	2684355	T	G
000056F_1741854_SNP S_36018148	1741854	G	A
000056F_2557885_SNP S_36097073	2557885	A	T
000056F_2723054_SNP S_36111833	2723054	T	A
000056F_1734071_SNP S_36017467	1734071	C	T
000056F_1519633_SNP S_35998022	1519633	A	G
000056F_1504604_SNP S_35995964	1504604	C	A
000056F_380752_SNP S_35888178	380752	T	G
000056F_5739346_SNP S_36440410	5739346	A	C
000056F_1206293_SNP S_35964391	1206293	C	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1215922_SNP S_35965334	1215922	C	A
000056F_4404512_SNP S_36303286	4404512	G	A
000056F_1804220_SNP S_36023493	1804220	G	A
000056F_1296718_SNP S_35973816	1296718	G	T
000056F_1436645_SNP S_35987098	1436645	A	C
000056F_3307903_SNP S_36173362	3307903	C	G
000056F_433576_SNP S_35893509	433576	T	C
000056F_1231958_SNP S_35967086	1231958	T	A
000056F_2765150_SNP S_36116013	2765150	T	G
000056F_1617721_SNP S_36007119	1617721	T	C
000056F_1191960_SNP S_35963183	1191960	T	A
000056F_2220135_SNP S_36065048	2220135	C	T
000056F_3051847_SNP S_36147668	3051847	G	A
000056F_1964353_SNP S_36039933	1964353	T	G
000056F_2203096_SNP S_36063142	2203096	G	C
000056F_3338530_SNP S_36177726	3338530	C	T
000056F_2794880_SNP S_36118613	2794880	C	A
000056F_1916827_SNP S_36033329	1916827	C	A
000056F_4449185_SNP S_36307511	4449185	A	T
000056F_4470729_SNP S_36311244	4470729	T	C
000056F_2144039_SNP S_36056948	2144039	C	T
000056F_3050861_SNP S_36147606	3050861	A	G
000056F_4262876_SNP S_36289952	4262876	G	A
000056F_1449750_SNP S_35988337	1449750	T	C
000056F_1688074_SNP S_36013573	1688074	G	A
000056F_1074448_SNP S_35951777	1074448	A	C
000056F_714605_SNP S_35919761	714605	T	G
000056F_3293357_SNP S_36171888	3293357	T	C
000056F_1152190_SNP S_35958815	1152190	A	G
000056F_1773166_SNP S_36020783	1773166	A	T
000056F_948052_SNP S_35941124	948052	T	C
000056F_1304047_SNP S_35974563	1304047	A	T
000056F_1916796_SNP S_36033327	1916796	A	G
000056F_2093899_SNP S_36051860	2093899	T	C
000056F_2430032_SNP	2430032	A	G
000056F_1041790_SNP	1041790	A	T
000056F_1041789_SNP	1041789	A	T
000056F_2287041_SNP S_36070220	2287041	G	A
000056F_3282636_SNP S_36171081	3282636	G	A
000056F_3125545_SNP S_36154784	3125545	T	C
000056F_3134214_SNP S_36155543	3134214	C	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_909485_SNP S_35937708	909485	T	C
000056F_1919136_SNP S_36033588	1919136	A	G
000056F_2341378_SNP S_36076495	2341378	A	T
000056F_2249121_SNP S_36067566	2249121	C	G
000056F_2194926_SNP S_36061545	2194926	G	A
000056F_2811247_SNP S_36120082	2811247	C	A
000056F_2249122_SNP S_36067567	2249122	A	G
000056F_1010183_SNP S_35946540	1010183	A	G
000056F_1927642_SNP S_36034329	1927642	G	T
000056F_3398472_SNP S_36183762	3398472	T	A
000056F_434301_SNP S_35893568	434301	T	A
000056F_1812658_SNP S_36024000	1812658	C	A
000056F_1013123_SNP S_35946755	1013123	G	C
000056F_2863107_SNP S_36124867	2863107	T	C
000056F_1257654_SNP S_35969629	1257654	T	C
000056F_898024_SNP S_35936842	898024	A	C
000056F_1985417_SNP S_36041918	1985417	C	A
000056F_4375283_SNP S_36300987	4375283	A	G
000056F_2007179_SNP S_36043907	2007179	A	G
000056F_3149978_SNP S_36157152	3149978	G	T
000056F_2235226_SNP S_36066333	2235226	T	C
000056F_1395514_SNP S_35982910	1395514	A	G
000056F_2086881_SNP S_36051270	2086881	A	G
000056F_4129142_SNP S_36275542	4129142	A	T
000056F_4441219_SNP S_36306807	4441219	C	T
000056F_969898_SNP S_35942778	969898	A	G
000056F_389355_SNP S_35889071	389355	C	A
000056F_3292694_SNP S_36171848	3292694	G	A
000056F_1843313_SNP S_36026826	1843313	T	C
000056F_1007214_SNP S_35946325	1007214	T	C
000056F_2043850_SNP S_36047219	2043850	G	A
000056F_1384360_SNP S_35982052	1384360	A	C
000056F_3163767_SNP S_36158359	3163767	G	T
000056F_1423367_SNP S_35985596	1423367	G	A
000056F_1278352_SNP S_35972125	1278352	T	A
000056F_1110925_SNP S_35955300	1110925	G	A
000056F_2880892_SNP S_36126333	2880892	G	T
000056F_505144_SNP S_35900002	505144	A	G
000056F_2693630_SNP S_36109462	2693630	C	G
000056F_3121250_SNP S_36154438	3121250	A	T
000056F_2505475_SNP S_36092107	2505475	T	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1606876_SNP S_36006170	1606876	G	A
000056F_1073062_SNP S_35951686	1073062	T	C
000056F_2487677_SNP S_36090407	2487677	G	A
000056F_917891_SNP S_35938525	917891	C	T
000056F_1992992_SNP S_36042450	1992992	A	G
000056F_50986_SNP S_35855803	50986	A	G
000056F_2657217_SNP S_36106208	2657217	C	T
000056F_2377394_SNP S_36080157	2377394	T	C
000056F_5115086_SNP S_36377755	5115086	C	T
000056F_4280292_SNP S_36291939	4280292	T	C
000056F_3954318_SNP S_36242119	3954318	C	T
000056F_1713917_SNP S_36015958	1713917	C	T
000056F_3546401_SNP S_36198563	3546401	A	G
000056F_1185038_SNP S_35962609	1185038	G	T
000056F_947877_SNP S_35941116	947877	A	G
000056F_3507718_SNP S_36194997	3507718	A	G
000056F_5208416_SNP S_36386135	5208416	G	A
000056F_4769628_SNP S_36340228	4769628	T	C
000056F_1374277_SNP S_35981470	1374277	T	A
000056F_1960525_SNP S_36039529	1960525	C	A
000056F_2478835_SNP S_36089650	2478835	A	T
000056F_2163713_SNP S_36058755	2163713	G	A
000056F_988713_SNP S_35944670	988713	G	A
000056F_677805_SNP S_35916157	677805	T	C
000056F_3621735_SNP S_36205093	3621735	A	G
000056F_258418_SNP S_35877101	258418	C	T
000056F_311516_SNP S_35882008	311516	A	G
000056F_2163692_SNP S_36058754	2163692	T	A
000056F_2282769_SNP S_36069860	2282769	G	A
000056F_2282768_SNP S_36069859	2282768	T	A
000056F_1939084_SNP S_36035480	1939084	C	T
000056F_2360685_SNP S_36078430	2360685	A	G
000056F_3116470_SNP S_36154039	3116470	T	C
000056F_1297196_SNP S_35973852	1297196	T	A
000056F_1312004_SNP S_35975275	1312004	G	A
000056F_1579245_SNP S_36003640	1579245	G	A
000056F_2490425_SNP S_36090588	2490425	T	A
000056F_1195524_SNP S_35963551	1195524	T	C
000056F_2930584_SNP	2930584	G	A
000056F_4942374_SNP S_36359100	4942374	C	T
000056F_915003_SNP S_35938243	915003	C	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_915004_SNP S_35938244	915004	C	A
000056F_444401_SNP S_35894672	444401	G	C
000056F_2296365_SNP S_36071048	2296365	A	C
000056F_275225_SNP S_35878643	275225	C	T
000056F_928305_SNP S_35939554	928305	T	C
000056F_2490856_SNP S_36090643	2490856	T	C
000056F_372201_SNP S_35887390	372201	T	A
000056F_1304323_SNP S_35974580	1304323	T	A
000056F_2257146_SNP S_36068079	2257146	G	A
000056F_586777_SNP S_35907986	586777	G	A
000056F_1697807_SNP S_36014434	1697807	G	C
000056F_2208100_SNP S_36063736	2208100	T	C
000056F_1919087_SNP S_36033582	1919087	A	C
000056F_2178680_SNP S_36060079	2178680	C	T
000056F_2016193_SNP S_36044684	2016193	T	A
000056F_1113099_SNP S_35955529	1113099	G	T
000056F_1309920_SNP S_35975070	1309920	A	T
000056F_845698_SNP S_35932244	845698	A	C
000056F_1960325_SNP S_36039517	1960325	T	C
000056F_1770471_SNP S_36020503	1770471	G	T
000056F_4977247_SNP S_36363219	4977247	T	A
000056F_1572257_SNP S_36003047	1572257	C	G
000056F_2008713_SNP S_36044047	2008713	T	C
000056F_2008712_SNP S_36044046	2008712	T	G
000056F_1231480_SNP S_35967049	1231480	A	G
000056F_1993290_SNP S_36042506	1993290	T	A
000056F_3822737_SNP S_36228019	3822737	C	G
000056F_3822738_SNP S_36228020	3822738	T	A
000056F_2716415_SNP S_36111272	2716415	T	C
000056F_206381_SNP S_35872590	206381	G	T
000056F_1152650_SNP S_35958902	1152650	A	T
000056F_1867163_SNP S_36029054	1867163	T	C
000056F_94364_SNP S_35860012	94364	G	C
000056F_3166278_SNP S_36158548	3166278	T	C
000056F_2165807_SNP S_36058976	2165807	G	T
000056F_1275883_SNP S_35971796	1275883	C	T
000056F_3388908_SNP S_36182994	3388908	C	T
000056F_2764341_SNP S_36115956	2764341	T	C
000056F_96934_SNP S_35860248	96934	T	A
000056F_2556400_SNP S_36096921	2556400	G	A
000056F_2240441_SNP S_36066854	2240441	C	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2364899_SNP S_36079023	2364899	C	T
000056F_1738570_SNP S_36017830	1738570	T	C
000056F_195664_SNP	195664	A	G
000056F_1084459_SNP S_35952823	1084459	A	C
000056F_2563998_SNP S_36097599	2563998	C	G
000056F_415861_SNP S_35891679	415861	T	C
000056F_1379464_SNP S_35981779	1379464	C	T
000056F_414799_SNP S_35891599	414799	G	A
000056F_3009901_SNP S_36141461	3009901	A	T
000056F_3573900_SNP S_36201166	3573900	A	C
000056F_2731174_SNP S_36112680	2731174	A	T
000056F_2624272_SNP S_36102837	2624272	A	C
000056F_1592744_SNP S_36004701	1592744	C	A
000056F_1877508_SNP S_36029937	1877508	G	A
000056F_1872032_SNP S_36029397	1872032	C	T
000056F_1877876_SNP	1877876	T	A
000056F_1603727_SNP S_36005751	1603727	C	T
000056F_1536177_SNP S_36000187	1536177	C	T
000056F_1023690_SNP S_35947515	1023690	T	A
000056F_1824263_SNP S_36025526	1824263	G	C
000056F_394290_SNP S_35889612	394290	T	G
000056F_2856898_SNP S_36124348	2856898	G	T
000056F_3925205_SNP S_36239832	3925205	T	A
000056F_2985870_SNP S_36138483	2985870	C	T
000056F_1873927_SNP S_36029535	1873927	G	A
000056F_830507_SNP S_35930793	830507	T	A
000056F_2056261_SNP S_36048455	2056261	A	G
000056F_1911304_SNP S_36032933	1911304	C	T
000056F_1041785_SNP	1041785	A	C
000056F_2718235_SNP S_36111480	2718235	T	G
000056F_1937582_SNP S_36035381	1937582	A	T
000056F_1272529_SNP S_35971390	1272529	A	C
000056F_1210095_SNP S_35964774	1210095	C	T
000056F_2494697_SNP S_36090922	2494697	G	T
000056F_874941_SNP S_35934690	874941	A	G
000056F_1062669_SNP S_35950764	1062669	A	G
000056F_5032372_SNP S_36369078	5032372	T	A
000056F_452953_SNP S_35895139	452953	A	C
000056F_2573366_SNP S_36098515	2573366	T	A
000056F_4945017_SNP S_36359373	4945017	A	T
000056F_1841048_SNP S_36026608	1841048	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2092507_SNP S_36051714	2092507	G	A
000056F_2237422_SNP S_36066526	2237422	T	A
000056F_2879531_SNP S_36126165	2879531	G	A
000056F_1764465_SNP S_36020016	1764465	A	T
000056F_1764466_SNP S_36020017	1764466	T	C
000056F_2386486_SNP S_36080977	2386486	T	C
000056F_1815972_SNP S_36024860	1815972	T	C
000056F_2052958_SNP S_36048067	2052958	T	C
000056F_3131962_SNP S_36155365	3131962	C	G
000056F_2436739_SNP S_36085626	2436739	G	A
000056F_878519_SNP S_35935089	878519	G	A
000056F_311503_SNP S_35882007	311503	A	G
000056F_222801_SNP S_35874012	222801	G	T
000056F_1827159_SNP S_36025722	1827159	T	A
000056F_535240_SNP S_35903289	535240	G	A
000056F_2924368_SNP S_36130654	2924368	G	T
000056F_643944_SNP S_35913111	643944	T	C
000056F_1049430_SNP S_35949492	1049430	T	A
000056F_2193696_SNP S_36061447	2193696	A	T
000056F_2283841_SNP S_36069947	2283841	T	C
000056F_1068139_SNP S_35951278	1068139	G	T
000056F_4030011_SNP S_36267039	4030011	T	C
000056F_1637922_SNP S_36009169	1637922	C	A
000056F_3954322_SNP S_36242120	3954322	G	A
000056F_1304188_SNP S_35974571	1304188	A	G
000056F_1759035_SNP S_36019488	1759035	C	T
000056F_1759034_SNP S_36019487	1759034	T	A
000056F_2622009_SNP S_36102667	2622009	G	T
000056F_2025534_SNP S_36045587	2025534	A	G
000056F_4839024_SNP S_36348623	4839024	A	C
000056F_201056_SNP S_35872007	201056	T	A
000056F_1412661_SNP S_35984726	1412661	C	T
000056F_2543501_SNP S_36095634	2543501	T	A
000056F_4722279_SNP S_36334574	4722279	C	T
000056F_4320805_SNP S_36295940	4320805	T	C
000056F_1753527_SNP S_36019106	1753527	A	C
000056F_1641658_SNP S_36009484	1641658	T	A
000056F_3586180_SNP S_36202138	3586180	G	C
000056F_2179988_SNP S_36060211	2179988	G	T
000056F_401012_SNP S_35890138	401012	T	A
000056F_829964_SNP S_35930751	829964	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1566754_SNP S_36002524	1566754	A	G
000056F_1186922_SNP S_35962762	1186922	A	T
000056F_1185031_SNP S_35962608	1185031	T	C
000056F_3954307_SNP	3954307	A	C
000056F_4332961_SNP S_36297001	4332961	G	A
000056F_2264526_SNP S_36068729	2264526	A	T
000056F_1266602_SNP S_35970537	1266602	T	C
000056F_565835_SNP S_35906176	565835	C	T
000056F_1077229_SNP S_35952037	1077229	T	C
000056F_1111408_SNP S_35955355	1111408	G	T
000056F_4329934_SNP S_36296765	4329934	A	G
000056F_24136_SNP S_35853359	24136	G	C
000056F_1067067_SNP S_35951160	1067067	T	C
000056F_2502483_SNP S_36091739	2502483	G	A
000056F_3516248_SNP S_36195778	3516248	C	A
000056F_1162666_SNP S_35959911	1162666	T	G
000056F_2444775_SNP S_36086270	2444775	C	A
000056F_1373018_SNP S_35981401	1373018	G	T
000056F_2009703_SNP S_36044113	2009703	T	C
000056F_1320694_SNP S_35975994	1320694	C	A
000056F_2009702_SNP S_36044112	2009702	T	A
000056F_2018759_SNP S_36044895	2018759	T	A
000056F_258736_SNP S_35877140	258736	A	G
000056F_1143967_SNP S_35958146	1143967	A	C
000056F_2598445_SNP S_36100692	2598445	C	T
000056F_1320112_SNP S_35975953	1320112	C	T
000056F_486607_SNP S_35898301	486607	G	A
000056F_935549_SNP S_35940197	935549	A	T
000056F_1819764_SNP S_36025144	1819764	A	G
000056F_1413517_SNP S_35984772	1413517	T	C
000056F_3447184_SNP S_36189206	3447184	C	T
000056F_3283030_SNP S_36171109	3283030	T	C
000056F_1693396_SNP S_36013944	1693396	T	G
000056F_1693409_SNP S_36013946	1693409	G	C
000056F_1491191_SNP S_35994781	1491191	T	C
000056F_1190250_SNP S_35963078	1190250	G	A
000056F_2406184_SNP S_36082889	2406184	A	T
000056F_1266848_SNP S_35970552	1266848	A	G
000056F_3404712_SNP S_36184300	3404712	T	C
000056F_2615777_SNP S_36102116	2615777	C	T
000056F_2121119_SNP S_36054736	2121119	A	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2045668_SNP S_36047392	2045668	C	T
000056F_4345312_SNP S_36298306	4345312	T	C
000056F_29715_SNP S_35853952	29715	G	A
000056F_2141583_SNP S_36056729	2141583	G	A
000056F_1258305_SNP	1258305	A	G
000056F_2071861_SNP S_36050001	2071861	C	T
000056F_1319629_SNP S_35975929	1319629	G	A
000056F_1751347_SNP S_36018839	1751347	T	A
000056F_1822216_SNP S_36025356	1822216	G	A
000056F_1309346_SNP S_35975032	1309346	T	C
000056F_1641788_SNP S_36009493	1641788	C	T
000056F_2334807_SNP	2334807	T	A
000056F_2334809_SNP S_36076019	2334809	T	A
000056F_2334806_SNP	2334806	T	A
000056F_2334808_SNP	2334808	T	A
000056F_2924320_SNP	2924320	C	A
000056F_2768255_SNP S_36116258	2768255	T	A
000056F_2679063_SNP S_36108179	2679063	T	A
000056F_2430805_SNP S_36085181	2430805	C	T
000056F_1345240_SNP S_35978787	1345240	T	G
000056F_2617592_SNP S_36102267	2617592	A	G
000056F_1584286_SNP S_36003945	1584286	G	A
000056F_823447_SNP S_35930138	823447	A	G
000056F_2726493_SNP S_36112088	2726493	C	A
000056F_515938_SNP S_35901096	515938	A	G
000056F_2038731_SNP S_36046800	2038731	G	T
000056F_2823526_SNP S_36121362	2823526	T	G
000056F_1299172_SNP S_35974089	1299172	T	C
000056F_1760241_SNP S_36019593	1760241	A	C
000056F_1723200_SNP S_36016609	1723200	C	T
000056F_2685901_SNP S_36108814	2685901	A	C
000056F_2901652_SNP S_36128446	2901652	C	A
000056F_2901651_SNP S_36128445	2901651	G	T
000056F_1059773_SNP S_35950423	1059773	C	T
000056F_391704_SNP S_35889385	391704	A	G
000056F_1973436_SNP S_36040747	1973436	A	C
000056F_2296380_SNP S_36071049	2296380	C	T
000056F_1771918_SNP S_36020690	1771918	A	T
000056F_979985_SNP S_35943833	979985	G	A
000056F_2325663_SNP S_36075241	2325663	T	G
000056F_1784946_SNP S_36021770	1784946	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_932134_SNP S_35939914	932134	T	C
000056F_3233794_SNP S_36166274	3233794	T	G
000056F_3104886_SNP S_36153031	3104886	T	A
000056F_1716772_SNP S_36016144	1716772	T	G
000056F_904012_SNP S_35937264	904012	C	G
000056F_1109904_SNP S_35955206	1109904	G	A
000056F_2708554_SNP S_36110683	2708554	C	T
000056F_2863752_SNP S_36124912	2863752	G	T
000056F_1353970_SNP S_35979515	1353970	G	A
000056F_395470_SNP S_35889686	395470	A	G
000056F_2709674_SNP S_36110768	2709674	A	G
000056F_4722277_SNP S_36334572	4722277	C	T
000056F_863696_SNP S_35933721	863696	A	G
000056F_750673_SNP S_35923412	750673	A	G
000056F_1823836_SNP	1823836	G	A
000056F_3390747_SNP S_36183149	3390747	T	G
000056F_1113495_SNP S_35955565	1113495	G	T
000056F_1167946_SNP S_35960496	1167946	A	T
000056F_2056269_SNP	2056269	A	G
000056F_1084887_SNP S_35952852	1084887	G	A
000056F_998324_SNP S_35945670	998324	C	T
000056F_2879271_SNP S_36126155	2879271	T	C
000056F_1271773_SNP S_35971335	1271773	C	T
000056F_1721781_SNP S_36016526	1721781	A	T
000056F_3480263_SNP S_36192352	3480263	T	C
000056F_236620_SNP S_35875324	236620	C	A
000056F_3052029_SNP S_36147680	3052029	A	T
000056F_846038_SNP S_35932266	846038	A	T
000056F_1486578_SNP S_35994321	1486578	A	T
000056F_875231_SNP S_35934780	875231	C	T
000056F_2073169_SNP S_36050094	2073169	T	A
000056F_1283160_SNP S_35972400	1283160	T	C
000056F_1893236_SNP S_36031368	1893236	G	A
000056F_2526464_SNP S_36094232	2526464	T	C
000056F_2526465_SNP S_36094233	2526465	A	G
000056F_1216349_SNP S_35965411	1216349	T	G
000056F_1001461_SNP S_35945898	1001461	T	C
000056F_394447_SNP S_35889627	394447	C	A
000056F_1973667_SNP S_36040772	1973667	C	A
000056F_1650905_SNP S_36010287	1650905	T	C
000056F_874867_SNP S_35934688	874867	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2231612_SNP S_36066016	2231612	A	G
000056F_3941170_SNP S_36241109	3941170	A	G
000056F_28000_SNP S_35853751	28000	T	G
000056F_1606659_SNP S_36006154	1606659	T	C
000056F_947743_SNP S_35941110	947743	G	A
000056F_23634_SNP S_35853323	23634	C	A
000056F_3442527_SNP S_36188673	3442527	G	A
000056F_2906807_SNP S_36128902	2906807	C	T
000056F_1819754_SNP S_36025141	1819754	T	C
000056F_2190315_SNP	2190315	A	G
000056F_1827906_SNP S_36025775	1827906	A	T
000056F_4949879_SNP S_36359935	4949879	A	T
000056F_2113409_SNP S_36053947	2113409	G	A
000056F_3178026_SNP S_36159755	3178026	C	T
000056F_3226809_SNP S_36165779	3226809	A	C
000056F_809723_SNP S_35928986	809723	C	A
000056F_1978738_SNP S_36041232	1978738	C	T
000056F_1978740_SNP S_36041233	1978740	A	G
000056F_1013699_SNP S_35946790	1013699	T	G
000056F_1538272_SNP S_36000377	1538272	C	A
000056F_1196642_SNP S_35963629	1196642	T	G
000056F_1812383_SNP S_36023970	1812383	G	A
000056F_4534212_SNP S_36316582	4534212	G	A
000056F_1968915_SNP S_36040368	1968915	G	T
000056F_2478644_SNP S_36089635	2478644	C	T
000056F_5188272_SNP S_36384409	5188272	A	G
000056F_1854973_SNP S_36027949	1854973	C	T
000056F_1759031_SNP S_36019486	1759031	G	T
000056F_4414654_SNP S_36304256	4414654	C	T
000056F_1807736_SNP S_36023703	1807736	C	T
000056F_4598941_SNP S_36322832	4598941	C	G
000056F_1247821_SNP S_35968626	1247821	C	A
000056F_2258986_SNP S_36068267	2258986	T	A
000056F_4230671_SNP S_36285711	4230671	G	C
000056F_2689982_SNP S_36109168	2689982	C	A
000056F_1391223_SNP S_35982468	1391223	G	A
000056F_2711445_SNP S_36110861	2711445	G	C
000056F_3036367_SNP S_36146013	3036367	A	C
000056F_1361225_SNP S_35980347	1361225	A	T
000056F_3092584_SNP S_36152037	3092584	T	A
000056F_3416862_SNP S_36185330	3416862	A	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1118585_SNP S_35955975	1118585	C	T
000056F_478142_SNP S_35897411	478142	A	C
000056F_1438996_SNP S_35987338	1438996	T	G
000056F_2062616_SNP S_36049305	2062616	T	G
000056F_2142491_SNP S_36056778	2142491	A	T
000056F_1144337_SNP S_35958173	1144337	C	A
000056F_466039_SNP S_35896217	466039	C	T
000056F_1889517_SNP S_36030986	1889517	A	T
000056F_2195720_SNP S_36061614	2195720	T	G
000056F_1304048_SNP S_35974564	1304048	C	T
000056F_5204585_SNP S_36385835	5204585	A	T
000056F_1818265_SNP S_36025034	1818265	T	C
000056F_1425196_SNP S_35985843	1425196	A	G
000056F_933381_SNP S_35940017	933381	C	A
000056F_2752332_SNP S_36114766	2752332	G	A
000056F_324689_SNP	324689	C	T
000056F_1349863_SNP S_35979150	1349863	C	T
000056F_1648762_SNP S_36010109	1648762	G	A
000056F_1975727_SNP S_36040954	1975727	C	A
000056F_1267540_SNP S_35970600	1267540	A	G
000056F_2032555_SNP S_36046295	2032555	A	T
000056F_2944617_SNP S_36132418	2944617	A	C
000056F_1632318_SNP S_36008334	1632318	T	C
000056F_1403089_SNP S_35983888	1403089	C	T
000056F_3574120_SNP S_36201190	3574120	T	C
000056F_3011890_SNP S_36141720	3011890	A	G
000056F_1877495_SNP S_36029935	1877495	A	G
000056F_2476975_SNP S_36089524	2476975	T	A
000056F_1069416_SNP S_35951364	1069416	T	C
000056F_1922526_SNP S_36033869	1922526	A	G
000056F_1848892_SNP S_36027442	1848892	G	A
000056F_1820056_SNP S_36025159	1820056	C	G
000056F_2194742_SNP S_36061531	2194742	A	C
000056F_761304_SNP S_35924376	761304	G	A
000056F_5423234_SNP S_36407717	5423234	A	T
000056F_4020253_SNP S_36266296	4020253	T	C
000056F_1688731_SNP S_36013612	1688731	A	G
000056F_1344995_SNP S_35978768	1344995	C	A
000056F_4575892_SNP S_36320514	4575892	G	A
000056F_5720520_SNP S_36438499	5720520	C	A
000056F_1915927_SNP S_36033258	1915927	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_3307878_SNP S_36173357	3307878	T	C
000056F_1003719_SNP S_35946090	1003719	A	G
000056F_3382062_SNP S_36182425	3382062	C	T
000056F_2441679_SNP S_36086001	2441679	G	T
000056F_1257572_SNP S_35969617	1257572	T	G
000056F_486606_SNP S_35898300	486606	A	T
000056F_1210112_SNP S_35964776	1210112	A	G
000056F_285126_SNP S_35879591	285126	G	T
000056F_1304239_SNP S_35974573	1304239	A	G
000056F_2007438_SNP S_36043946	2007438	T	G
000056F_1192508_SNP S_35963237	1192508	T	G
000056F_1085053_SNP S_35952872	1085053	A	G
000056F_896219_SNP S_35936730	896219	G	A
000056F_5697110_SNP S_36436473	5697110	C	A
000056F_2868269_SNP S_36125259	2868269	C	T
000056F_1077795_SNP S_35952129	1077795	T	C
000056F_2560515_SNP S_36097298	2560515	G	C
000056F_953496_SNP S_35941554	953496	T	C
000056F_2863100_SNP S_36124866	2863100	G	C
000056F_702484_SNP S_35918554	702484	C	G
000056F_1091134_SNP S_35953649	1091134	T	C
000056F_2598404_SNP S_36100689	2598404	T	C
000056F_1447524_SNP S_35988111	1447524	A	T
000056F_1447525_SNP S_35988112	1447525	A	T
000056F_2617266_SNP S_36102246	2617266	T	G
000056F_1391520_SNP S_35982485	1391520	A	C
000056F_1347485_SNP S_35978961	1347485	T	G
000056F_2230547_SNP S_36065957	2230547	C	G
000056F_2960720_SNP S_36134947	2960720	A	G
000056F_4951924_SNP S_36360289	4951924	T	C
000056F_1911931_SNP S_36032985	1911931	T	C
000056F_4531956_SNP S_36316404	4531956	A	T
000056F_1014186_SNP	1014186	T	A
000056F_3713344_SNP S_36213596	3713344	A	G
000056F_3307902_SNP S_36173360	3307902	C	G
000056F_2588322_SNP S_36099809	2588322	C	G
000056F_2809205_SNP S_36119935	2809205	C	G
000056F_2438089_SNP S_36085731	2438089	C	G
000056F_1623324_SNP S_36007609	1623324	A	T
000056F_1127894_SNP S_35956755	1127894	A	G
000056F_2592712_SNP S_36100183	2592712	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_925953_SNP S_35939326	925953	T	G
000056F_3142708_SNP S_36156475	3142708	T	C
000056F_2043031_SNP S_36047169	2043031	A	G
000056F_1513505_SNP S_35996904	1513505	C	A
000056F_4097997_SNP S_36272302	4097997	A	G
000056F_982625_SNP S_35944057	982625	T	C
000056F_1319256_SNP S_35975904	1319256	C	T
000056F_1132183_SNP S_35957088	1132183	G	A
000056F_2272515_SNP S_36069323	2272515	A	T
000056F_1851925_SNP S_36027717	1851925	T	G
000056F_1766515_SNP S_36020164	1766515	G	A
000056F_5074278_SNP S_36373397	5074278	C	A
000056F_5074279_SNP S_36373398	5074279	A	T
000056F_5202394_SNP S_36385661	5202394	C	T
000056F_567290_SNP S_35906351	567290	C	A
000056F_567291_SNP S_35906352	567291	G	A
000056F_2212730_SNP S_36064141	2212730	T	G
000056F_2176112_SNP S_36059815	2176112	G	C
000056F_2730396_SNP S_36112528	2730396	A	G
000056F_652603_SNP S_35913821	652603	T	C
000056F_960073_SNP S_35942223	960073	C	T
000056F_360387_SNP S_35886399	360387	G	A
000056F_593912_SNP S_35908648	593912	A	T
000056F_1400459_SNP S_35983700	1400459	T	G
000056F_2287471_SNP S_36070243	2287471	A	T
000056F_2649512_SNP S_36105352	2649512	T	G
000056F_1066058_SNP S_35951101	1066058	C	A
000056F_1578417_SNP S_36003587	1578417	G	T
000056F_1933739_SNP S_36034856	1933739	T	C
000056F_1933740_SNP S_36034857	1933740	A	G
000056F_2640843_SNP S_36104366	2640843	T	C
000056F_1992999_SNP	1992999	G	A
000056F_1327209_SNP S_35976491	1327209	T	C
000056F_1693626_SNP S_36013958	1693626	T	A
000056F_3397298_SNP S_36183667	3397298	G	C
000056F_1361236_SNP S_35980348	1361236	G	A
000056F_722010_SNP S_35920385	722010	C	T
000056F_866172_SNP S_35933943	866172	C	T
000056F_2495022_SNP S_36090948	2495022	A	G
000056F_179075_SNP S_35870019	179075	A	T
000056F_2548174_SNP S_36096109	2548174	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2157925_SNP S_36058232	2157925	T	C
000056F_2391335_SNP S_36081453	2391335	G	C
000056F_1290082_SNP S_35973069	1290082	T	A
000056F_1853882_SNP S_36027866	1853882	T	C
000056F_2712988_SNP S_36110997	2712988	C	T
000056F_1659009_SNP S_36010976	1659009	T	C
000056F_1659007_SNP S_36010975	1659007	A	C
000056F_2735166_SNP S_36113075	2735166	A	C
000056F_1187969_SNP S_35962851	1187969	G	T
000056F_2605489_SNP S_36101289	2605489	A	C
000056F_2768818_SNP S_36116306	2768818	G	A
000056F_1130724_SNP S_35956973	1130724	T	C
000056F_1854983_SNP S_36027950	1854983	G	T
000056F_3692526_SNP S_36211453	3692526	G	A
000056F_3681208_SNP S_36210281	3681208	A	G
000056F_1244970_SNP S_35968267	1244970	T	A
000056F_225827_SNP S_35874317	225827	C	G
000056F_2958804_SNP S_36134272	2958804	T	A
000056F_1374334_SNP S_35981473	1374334	T	C
000056F_3249636_SNP S_36167880	3249636	G	A
000056F_2102646_SNP S_36052653	2102646	C	T
000056F_2067797_SNP	2067797	T	G
000056F_3226516_SNP S_36165763	3226516	T	G
000056F_2041149_SNP S_36047027	2041149	A	T
000056F_5692035_SNP S_36435823	5692035	T	C
000056F_2709567_SNP S_36110762	2709567	T	C
000056F_2709565_SNP S_36110761	2709565	G	A
000056F_272756_SNP S_35878372	272756	T	C
000056F_2141641_SNP S_36056732	2141641	G	A
000056F_2257699_SNP S_36068125	2257699	A	G
000056F_2257697_SNP S_36068123	2257697	T	A
000056F_2257700_SNP S_36068126	2257700	A	C
000056F_2393588_SNP S_36081678	2393588	T	A
000056F_2723070_SNP S_36111835	2723070	G	A
000056F_2377358_SNP S_36080155	2377358	C	G
000056F_2444659_SNP S_36086259	2444659	A	G
000056F_1859170_SNP S_36028408	1859170	G	A
000056F_3056865_SNP S_36148145	3056865	T	A
000056F_2229456_SNP S_36065890	2229456	A	C
000056F_2229455_SNP S_36065889	2229455	A	C
000056F_2146947_SNP S_36057273	2146947	A	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4534215_SNP S_36316584	4534215	C	A
000056F_2397704_SNP S_36082062	2397704	A	C
000056F_714594_SNP S_35919759	714594	A	T
000056F_2356303_SNP S_36078018	2356303	C	T
000056F_3585820_SNP S_36202117	3585820	C	T
000056F_2436767_SNP S_36085629	2436767	C	T
000056F_2056036_SNP S_36048437	2056036	T	C
000056F_1101309_SNP S_35954471	1101309	T	A
000056F_3359253_SNP S_36179862	3359253	G	T
000056F_921178_SNP S_35938870	921178	A	G
000056F_1421301_SNP S_35985414	1421301	T	C
000056F_2335474_SNP S_36076052	2335474	A	G
000056F_3052026_SNP S_36147677	3052026	T	A
000056F_3052027_SNP S_36147678	3052027	T	A
000056F_2746274_SNP S_36114342	2746274	T	G
000056F_1992461_SNP S_36042364	1992461	G	A
000056F_1302685_SNP S_35974390	1302685	T	C
000056F_1197286_SNP S_35963667	1197286	G	A
000056F_2905386_SNP S_36128787	2905386	T	C
000056F_978523_SNP S_35943704	978523	T	A
000056F_978524_SNP S_35943705	978524	T	C
000056F_969645_SNP S_35942760	969645	G	A
000056F_1854965_SNP S_36027948	1854965	C	T
000056F_2157371_SNP S_36058129	2157371	A	T
000056F_2238353_SNP S_36066628	2238353	C	T
000056F_2019433_SNP S_36045008	2019433	A	T
000056F_2355125_SNP S_36077906	2355125	T	C
000056F_772852_SNP S_35925555	772852	C	T
000056F_1154130_SNP S_35959085	1154130	A	G
000056F_1009987_SNP S_35946524	1009987	C	T
000056F_1859074_SNP S_36028404	1859074	C	T
000056F_1252389_SNP S_35969147	1252389	T	A
000056F_1091421_SNP S_35953674	1091421	A	T
000056F_2689687_SNP S_36109154	2689687	G	C
000056F_2362274_SNP S_36078566	2362274	G	A
000056F_3995879_SNP S_36246484	3995879	T	G
000056F_1642061_SNP S_36009522	1642061	T	C
000056F_1026683_SNP S_35947733	1026683	C	T
000056F_1760953_SNP S_36019651	1760953	A	C
000056F_3391570_SNP S_36183203	3391570	G	T
000056F_3391569_SNP S_36183202	3391569	C	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1796372_SNP S_36022790	1796372	A	G
000056F_2725743_SNP S_36112030	2725743	G	C
000056F_2201344_SNP S_36062878	2201344	C	G
000056F_2765158_SNP S_36116014	2765158	G	A
000056F_5451357_SNP S_36411737	5451357	G	A
000056F_2017593_SNP S_36044784	2017593	A	G
000056F_1528018_SNP S_35999218	1528018	C	A
000056F_1584236_SNP S_36003942	1584236	A	T
000056F_2073124_SNP S_36050091	2073124	T	G
000056F_712057_SNP S_35919519	712057	A	G
000056F_2078164_SNP S_36050473	2078164	T	C
000056F_380146_SNP S_35888127	380146	A	T
000056F_2032536_SNP S_36046294	2032536	A	G
000056F_1853866_SNP S_36027864	1853866	T	A
000056F_1717011_SNP S_36016165	1717011	C	T
000056F_2382835_SNP S_36080559	2382835	C	T
000056F_460714_SNP	460714	T	C
000056F_818542_SNP S_35929673	818542	T	A
000056F_5118209_SNP S_36378042	5118209	C	G
000056F_1537585_SNP S_36000334	1537585	T	A
000056F_1805183_SNP S_36023562	1805183	G	A
000056F_1851846_SNP S_36027707	1851846	T	A
000056F_1900533_SNP S_36032012	1900533	T	C
000056F_1238571_SNP S_35967801	1238571	T	C
000056F_553704_SNP	553704	C	T
000056F_1327198_SNP S_35976490	1327198	A	T
000056F_1694527_SNP S_36014036	1694527	G	T
000056F_1414754_SNP S_35984861	1414754	C	T
000056F_1192509_SNP S_35963238	1192509	T	A
000056F_2502511_SNP S_36091740	2502511	T	C
000056F_2237410_SNP S_36066525	2237410	C	T
000056F_2871329_SNP S_36125513	2871329	G	A
000056F_786226_SNP S_35926893	786226	G	A
000056F_1229620_SNP S_35966898	1229620	C	T
000056F_108644_SNP S_35861662	108644	C	T
000056F_1698163_SNP S_36014461	1698163	G	T
000056F_1400454_SNP S_35983699	1400454	C	G
000056F_2068088_SNP S_36049703	2068088	C	T
000056F_3097034_SNP S_36152346	3097034	T	A
000056F_2660347_SNP S_36106494	2660347	T	C
000056F_1114082_SNP S_35955589	1114082	C	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1695334_SNP S_36014144	1695334	C	T
000056F_2689728_SNP S_36109156	2689728	T	C
000056F_3442544_SNP S_36188684	3442544	A	G
000056F_4221075_SNP S_36284933	4221075	T	C
000056F_2138060_SNP S_36056346	2138060	G	A
000056F_1326951_SNP S_35976473	1326951	G	A
000056F_1873551_SNP S_36029512	1873551	T	A
000056F_2095486_SNP S_36052084	2095486	A	T
000056F_1431751_SNP S_35986520	1431751	G	T
000056F_2115770_SNP S_36054152	2115770	G	A
000056F_1841916_SNP S_36026678	1841916	A	C
000056F_2272517_SNP S_36069324	2272517	C	A
000056F_3288653_SNP S_36171591	3288653	T	C
000056F_3937285_SNP S_36240810	3937285	C	T
000056F_2621451_SNP	2621451	A	G
000056F_2214056_SNP S_36064303	2214056	G	A
000056F_1816493_SNP S_36024893	1816493	T	C
000056F_3388901_SNP S_36182992	3388901	G	A
000056F_1008348_SNP S_35946413	1008348	G	T
000056F_520715_SNP S_35901560	520715	C	G
000056F_1977381_SNP S_36041100	1977381	A	C
000056F_1068097_SNP S_35951268	1068097	G	A
000056F_1698150_SNP S_36014460	1698150	A	G
000056F_2662454_SNP S_36106704	2662454	C	T
000056F_1192634_SNP S_35963246	1192634	A	T
000056F_986083_SNP S_35944406	986083	A	C
000056F_2527114_SNP S_36094295	2527114	G	A
000056F_2135590_SNP S_36056133	2135590	A	G
000056F_955648_SNP S_35941845	955648	T	C
000056F_2685635_SNP S_36108789	2685635	A	G
000056F_1158753_SNP S_35959561	1158753	A	C
000056F_478144_SNP S_35897412	478144	C	A
000056F_1259463_SNP S_35969749	1259463	T	A
000056F_1139945_SNP S_35957639	1139945	T	C
000056F_1344003_SNP S_35978688	1344003	A	T
000056F_1974456_SNP S_36040871	1974456	T	A
000056F_1808461_SNP S_36023742	1808461	C	G
000056F_3288657_SNP S_36171592	3288657	C	G
000056F_2687395_SNP S_36108972	2687395	G	C
000056F_1646117_SNP S_36009903	1646117	T	A
000056F_2442818_SNP S_36086119	2442818	T	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1783149_SNP S_36021575	1783149	T	G
000056F_1839078_SNP S_36026470	1839078	A	T
000056F_3582909_SNP S_36201944	3582909	A	T
000056F_1221697_SNP S_35965878	1221697	G	A
000056F_1447361_SNP S_35988104	1447361	C	T
000056F_4722273_SNP S_36334571	4722273	C	A
000056F_4845154_SNP S_36349123	4845154	T	A
000056F_2791215_SNP S_36118259	2791215	C	T
000056F_1071763_SNP S_35951563	1071763	C	A
000056F_2840231_SNP S_36122791	2840231	C	G
000056F_2624637_SNP S_36102896	2624637	C	A
000056F_3396691_SNP S_36183616	3396691	G	C
000056F_1610663_SNP S_36006492	1610663	G	A
000056F_2157608_SNP S_36058146	2157608	T	G
000056F_1786459_SNP S_36021950	1786459	G	A
000056F_751492_SNP S_35923464	751492	C	G
000056F_1089187_SNP S_35953361	1089187	T	C
000056F_4686656_SNP S_36331289	4686656	G	A
000056F_3538954_SNP S_36197826	3538954	T	C
000056F_2613019_SNP S_36101855	2613019	G	A
000056F_1425450_SNP S_35985912	1425450	T	C
000056F_2097078_SNP S_36052209	2097078	G	T
000056F_2067026_SNP S_36049622	2067026	A	G
000056F_1992955_SNP	1992955	T	C
000056F_2410450_SNP S_36083189	2410450	A	T
000056F_2797168_SNP S_36118774	2797168	G	A
000056F_1666862_SNP S_36011502	1666862	A	G
000056F_1118906_SNP S_35956001	1118906	T	C
000056F_2016616_SNP S_36044707	2016616	G	C
000056F_2588333_SNP S_36099810	2588333	A	G
000056F_1218158_SNP S_35965589	1218158	G	T
000056F_2652141_SNP S_36105691	2652141	G	A
000056F_2056519_SNP S_36048480	2056519	G	A
000056F_76613_SNP S_35858200	76613	A	G
000056F_76614_SNP S_35858201	76614	A	C
000056F_2315056_SNP S_36073793	2315056	G	A
000056F_1303718_SNP S_35974539	1303718	C	T
000056F_2280470_SNP S_36069632	2280470	G	A
000056F_2280473_SNP S_36069633	2280473	G	T
000056F_218894_SNP S_35873686	218894	G	C
000056F_2909398_SNP S_36129287	2909398	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1813060_SNP S_36024035	1813060	G	T
000056F_1481477_SNP S_35993993	1481477	A	C
000056F_765768_SNP S_35924837	765768	A	G
000056F_1277948_SNP S_35972086	1277948	T	G
000056F_3056867_SNP S_36148146	3056867	A	C
000056F_921872_SNP S_35938961	921872	T	A
000056F_363141_SNP S_35886665	363141	C	T
000056F_2653282_SNP S_36105784	2653282	A	C
000056F_1508245_SNP S_35996393	1508245	T	G
000056F_2062577_SNP S_36049299	2062577	C	A
000056F_613482_SNP S_35910343	613482	G	A
000056F_5193436_SNP S_36384811	5193436	T	A
000056F_2863761_SNP S_36124913	2863761	C	A
000056F_2040242_SNP S_36046942	2040242	C	G
000056F_1048623_SNP S_35949452	1048623	A	T
000056F_3958355_SNP S_36242445	3958355	G	A
000056F_1949424_SNP	1949424	T	C
000056F_1746736_SNP S_36018494	1746736	A	C
000056F_1189614_SNP S_35962972	1189614	G	T
000056F_1593861_SNP S_36004815	1593861	T	C
000056F_3150437_SNP S_36157195	3150437	C	A
000056F_1111051_SNP S_35955312	1111051	T	A
000056F_1539541_SNP	1539541	T	G
000056F_1992644_SNP S_36042390	1992644	T	A
000056F_1697955_SNP S_36014448	1697955	T	G
000056F_3937282_SNP S_36240809	3937282	A	G
000056F_1588085_SNP S_36004208	1588085	T	C
000056F_4839016_SNP S_36348622	4839016	C	A
000056F_3954312_SNP S_36242118	3954312	G	A
000056F_908129_SNP S_35937615	908129	G	C
000056F_353741_SNP S_35885708	353741	T	C
000056F_1688715_SNP S_36013610	1688715	G	C
000056F_2179984_SNP S_36060209	2179984	G	A
000056F_5357816_SNP S_36400934	5357816	T	A
000056F_5357815_SNP S_36400933	5357815	T	C
000056F_1847747_SNP S_36027319	1847747	A	T
000056F_1423418_SNP S_35985606	1423418	G	A
000056F_1919112_SNP S_36033587	1919112	G	A
000056F_1989888_SNP S_36042181	1989888	C	G
000056F_3397321_SNP S_36183669	3397321	C	T
000056F_3117909_SNP S_36154161	3117909	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1236547_SNP S_35967600	1236547	C	A
000056F_2284496_SNP S_36069986	2284496	T	G
000056F_1536153_SNP S_36000186	1536153	G	C
000056F_648152_SNP S_35913439	648152	G	A
000056F_1022458_SNP S_35947423	1022458	T	C
000056F_1017253_SNP S_35946978	1017253	T	A
000056F_1017252_SNP S_35946977	1017252	A	C
000056F_2338746_SNP S_36076266	2338746	A	T
000056F_1400475_SNP S_35983701	1400475	T	C
000056F_3619061_SNP S_36204894	3619061	A	T
000056F_1694662_SNP S_36014077	1694662	A	G
000056F_2656775_SNP S_36106164	2656775	A	G
000056F_2870509_SNP S_36125425	2870509	C	G
000056F_3534747_SNP S_36197485	3534747	C	T
000056F_1782115_SNP S_36021513	1782115	T	A
000056F_2650087_SNP S_36105394	2650087	C	T
000056F_2684797_SNP S_36108694	2684797	T	G
000056F_4919428_SNP S_36357109	4919428	T	G
000056F_3106771_SNP S_36153165	3106771	A	C
000056F_1086148_SNP S_35952988	1086148	G	C
000056F_2626871_SNP S_36103106	2626871	G	T
000056F_466033_SNP S_35896216	466033	T	C
000056F_1414205_SNP S_35984822	1414205	T	G
000056F_1291511_SNP S_35973231	1291511	G	A
000056F_3586643_SNP S_36202217	3586643	C	T
000056F_4844878_SNP S_36349097	4844878	C	T
000056F_2590039_SNP S_36099975	2590039	T	C
000056F_2104907_SNP S_36052795	2104907	A	C
000056F_1893242_SNP S_36031371	1893242	T	C
000056F_3267460_SNP S_36169700	3267460	T	C
000056F_62083_SNP S_35856703	62083	A	C
000056F_2911052_SNP S_36129394	2911052	A	G
000056F_1818789_SNP S_36025064	1818789	T	A
000056F_2945231_SNP S_36132512	2945231	G	A
000056F_1059297_SNP S_35950377	1059297	T	C
000056F_1480241_SNP S_35993901	1480241	A	G
000056F_2016116_SNP S_36044677	2016116	T	C
000056F_1160480_SNP S_35959767	1160480	C	A
000056F_3268829_SNP S_36169839	3268829	C	T
000056F_1519836_SNP S_35998032	1519836	G	A
000056F_2253125_SNP S_36067829	2253125	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2172174_SNP S_36059487	2172174	G	C
000056F_476643_SNP S_35897251	476643	T	A
000056F_2966274_SNP S_36135594	2966274	C	A
000056F_1721566_SNP S_36016509	1721566	A	G
000056F_1721285_SNP S_36016493	1721285	T	G
000056F_706058_SNP S_35918942	706058	A	T
000056F_1960595_SNP S_36039539	1960595	G	A
000056F_3322710_SNP S_36176609	3322710	A	T
000056F_3322709_SNP S_36176608	3322709	A	C
000056F_1199839_SNP S_35963848	1199839	C	A
000056F_1021518_SNP S_35947350	1021518	A	C
000056F_1859053_SNP S_36028403	1859053	T	A
000056F_2089139_SNP S_36051445	2089139	C	A
000056F_1882975_SNP S_36030446	1882975	C	T
000056F_2685513_SNP S_36108777	2685513	G	A
000056F_2000605_SNP S_36043318	2000605	C	T
000056F_1643643_SNP S_36009624	1643643	G	T
000056F_352730_SNP S_35885575	352730	G	C
000056F_743311_SNP S_35922796	743311	C	A
000056F_2157646_SNP S_36058147	2157646	G	A
000056F_1193599_SNP S_35963374	1193599	A	G
000056F_2402164_SNP S_36082513	2402164	T	C
000056F_1021228_SNP S_35947331	1021228	T	A
000056F_1807807_SNP S_36023708	1807807	T	C
000056F_4367637_SNP S_36300387	4367637	T	A
000056F_2102941_SNP S_36052668	2102941	C	A
000056F_4233889_SNP S_36285987	4233889	A	G
000056F_3707918_SNP S_36213196	3707918	A	C
000056F_4177676_SNP S_36280441	4177676	C	A
000056F_1423388_SNP S_35985603	1423388	G	T
000056F_2944984_SNP S_36132471	2944984	G	A
000056F_1917796_SNP S_36033470	1917796	G	A
000056F_1205825_SNP S_35964354	1205825	A	C
000056F_2737106_SNP S_36113267	2737106	C	A
000056F_2640903_SNP S_36104371	2640903	T	C
000056F_1233415_SNP S_35967274	1233415	T	C
000056F_1123014_SNP S_35956393	1123014	C	T
000056F_4086769_SNP S_36271389	4086769	G	A
000056F_2660355_SNP S_36106496	2660355	G	A
000056F_1091108_SNP S_35953647	1091108	C	T
000056F_2821866_SNP	2821866	A	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_3128609_SNP S_36154978	3128609	G	T
000056F_1425433_SNP S_35985911	1425433	G	A
000056F_1005588_SNP S_35946216	1005588	T	C
000056F_1764478_SNP S_36020018	1764478	C	A
000056F_2789883_SNP S_36118151	2789883	A	G
000056F_225837_SNP S_35874319	225837	T	A
000056F_1840931_SNP S_36026597	1840931	A	G
000056F_2616701_SNP S_36102207	2616701	A	G
000056F_998137_SNP S_35945654	998137	C	A
000056F_1048748_SNP S_35949460	1048748	T	C
000056F_1503086_SNP S_35995847	1503086	C	T
000056F_2219736_SNP S_36065014	2219736	T	C
000056F_3893866_SNP S_36235686	3893866	G	T
000056F_1193439_SNP S_35963328	1193439	A	T
000056F_4557673_SNP S_36318553	4557673	G	A
000056F_3886356_SNP S_36235118	3886356	G	T
000056F_2931875_SNP S_36131482	2931875	A	C
000056F_1072703_SNP S_35951654	1072703	G	A
000056F_1270948_SNP S_35971237	1270948	C	T
000056F_1851890_SNP S_36027712	1851890	T	C
000056F_1282153_SNP S_35972320	1282153	A	T
000056F_1917772_SNP S_36033465	1917772	G	A
000056F_1277134_SNP S_35972003	1277134	C	T
000056F_29722_SNP S_35853954	29722	T	G
000056F_1572832_SNP S_36003105	1572832	C	A
000056F_1445919_SNP S_35987947	1445919	C	T
000056F_1804215_SNP S_36023492	1804215	T	C
000056F_4349539_SNP S_36298728	4349539	T	G
000056F_4877689_SNP S_36353408	4877689	G	A
000056F_2696689_SNP S_36109770	2696689	A	G
000056F_2709548_SNP S_36110759	2709548	T	A
000056F_2086863_SNP S_36051268	2086863	C	T
000056F_3239510_SNP S_36166853	3239510	T	C
000056F_988757_SNP S_35944674	988757	A	G
000056F_1897921_SNP S_36031817	1897921	C	T
000056F_2512504_SNP S_36092687	2512504	T	C
000056F_3320709_SNP S_36176270	3320709	C	T
000056F_1179825_SNP S_35962393	1179825	C	A
000056F_1713926_SNP S_36015960	1713926	A	G
000056F_5146365_SNP S_36380476	5146365	A	G
000056F_1228726_SNP S_35966810	1228726	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2623618_SNP S_36102783	2623618	A	T
000056F_2623620_SNP S_36102785	2623620	A	T
000056F_3705239_SNP S_36212990	3705239	G	T
000056F_2623619_SNP S_36102784	2623619	A	T
000056F_1991690_SNP S_36042310	1991690	C	T
000056F_1816775_SNP S_36024912	1816775	G	T
000056F_1965110_SNP S_36040014	1965110	A	G
000056F_564974_SNP S_35906131	564974	A	G
000056F_1426065_SNP S_35986007	1426065	G	T
000056F_1594099_SNP S_36004829	1594099	T	G
000056F_1911836_SNP S_36032976	1911836	A	G
000056F_2212711_SNP S_36064140	2212711	T	A
000056F_902241_SNP S_35937134	902241	G	T
000056F_2582477_SNP S_36099321	2582477	A	G
000056F_1648753_SNP S_36010107	1648753	T	C
000056F_1572530_SNP S_36003080	1572530	G	T
000056F_1145250_SNP S_35958235	1145250	T	G
000056F_1688677_SNP S_36013609	1688677	G	A
000056F_2585809_SNP S_36099598	2585809	T	C
000056F_1217995_SNP S_35965574	1217995	A	T
000056F_1015698_SNP S_35946908	1015698	G	A
000056F_3390014_SNP S_36183099	3390014	G	A
000056F_3390017_SNP S_36183100	3390017	T	A
000056F_2013601_SNP S_36044459	2013601	T	C
000056F_2668822_SNP S_36107280	2668822	A	G
000056F_1193116_SNP S_35963279	1193116	A	G
000056F_532353_SNP S_35902946	532353	T	A
000056F_1851912_SNP S_36027715	1851912	T	A
000056F_4718098_SNP S_36334136	4718098	G	A
000056F_1048622_SNP S_35949451	1048622	T	C
000056F_1803224_SNP S_36023407	1803224	A	G
000056F_2252948_SNP S_36067812	2252948	A	G
000056F_795721_SNP S_35927727	795721	G	C
000056F_1818787_SNP S_36025063	1818787	T	C
000056F_181068_SNP S_35870217	181068	A	T
000056F_3138265_SNP S_36155967	3138265	C	G
000056F_1393817_SNP S_35982647	1393817	C	A
000056F_397808_SNP S_35889870	397808	T	A
000056F_1997224_SNP	1997224	T	A
000056F_1021422_SNP S_35947340	1021422	C	G
000056F_3677446_SNP S_36209835	3677446	G	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2068063_SNP S_36049702	2068063	T	G
000056F_1760960_SNP S_36019652	1760960	A	C
000056F_1277110_SNP S_35972002	1277110	G	A
000056F_1737605_SNP S_36017765	1737605	G	C
000056F_3007060_SNP S_36140980	3007060	A	G
000056F_2117940_SNP S_36054456	2117940	T	A
000056F_1789953_SNP S_36022301	1789953	A	T
000056F_1607642_SNP S_36006211	1607642	G	A
000056F_3205248_SNP S_36162457	3205248	A	G
000056F_870545_SNP S_35934314	870545	C	G
000056F_2032327_SNP S_36046283	2032327	C	T
000056F_1359512_SNP S_35980215	1359512	A	T
000056F_1413159_SNP S_35984746	1413159	A	C
000056F_1819250_SNP S_36025101	1819250	G	T
000056F_1779534_SNP S_36021282	1779534	A	G
000056F_1838725_SNP S_36026448	1838725	C	T
000056F_2857730_SNP S_36124415	2857730	G	A
000056F_2588343_SNP S_36099811	2588343	A	G
000056F_51055_SNP S_35855809	51055	A	G
000056F_265238_SNP S_35877765	265238	T	A
000056F_2033348_SNP S_36046369	2033348	T	A
000056F_2033350_SNP S_36046370	2033350	T	C
000056F_2598427_SNP S_36100691	2598427	T	A
000056F_1803756_SNP S_36023459	1803756	G	A
000056F_1855230_SNP	1855230	T	C
000056F_1304211_SNP S_35974572	1304211	T	A
000056F_27397_SNP	27397	C	T
000056F_1437175_SNP S_35987166	1437175	G	T
000056F_1704501_SNP S_36015273	1704501	A	G
000056F_5463772_SNP S_36412806	5463772	G	C
000056F_1486163_SNP S_35994297	1486163	G	A
000056F_3709485_SNP S_36213292	3709485	C	T
000056F_1756694_SNP S_36019347	1756694	A	G
000056F_3436711_SNP	3436711	C	G
000056F_2129510_SNP S_36055594	2129510	A	G
000056F_2706326_SNP S_36110502	2706326	T	A
000056F_494804_SNP S_35898988	494804	G	A
000056F_494805_SNP S_35898989	494805	T	C
000056F_1010454_SNP S_35946551	1010454	T	G
000056F_1010463_SNP S_35946553	1010463	T	C
000056F_2935950_SNP S_36131936	2935950	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2896775_SNP S_36127842	2896775	T	G
000056F_1756666_SNP S_36019346	1756666	G	A
000056F_3110654_SNP S_36153519	3110654	T	C
000056F_1085204_SNP S_35952897	1085204	A	T
000056F_2329361_SNP S_36075625	2329361	G	A
000056F_1171844_SNP S_35960895	1171844	A	G
000056F_2543788_SNP S_36095654	2543788	T	G
000056F_1603853_SNP S_36005804	1603853	C	T
000056F_377005_SNP S_35887797	377005	A	C
000056F_2105095_SNP S_36052803	2105095	T	A
000056F_1698247_SNP S_36014472	1698247	T	G
000056F_1915897_SNP S_36033256	1915897	A	G
000056F_2016476_SNP S_36044700	2016476	T	C
000056F_1160855_SNP S_35959786	1160855	T	C
000056F_4039319_SNP S_36267729	4039319	C	T
000056F_1666438_SNP S_36011449	1666438	C	G
000056F_468266_SNP S_35896415	468266	A	C
000056F_39584_SNP S_35854755	39584	A	G
000056F_1106735_SNP S_35954899	1106735	T	C
000056F_3613249_SNP S_36204402	3613249	A	G
000056F_659817_SNP S_35914493	659817	G	C
000056F_1026680_SNP S_35947732	1026680	A	C
000056F_1806283_SNP S_36023621	1806283	A	T
000056F_3305293_SNP S_36172973	3305293	T	C
000056F_4684484_SNP S_36331131	4684484	T	A
000056F_2864761_SNP S_36124974	2864761	C	T
000056F_1593877_SNP S_36004817	1593877	C	T
000056F_3150406_SNP S_36157191	3150406	G	T
000056F_446439_SNP S_35894811	446439	T	C
000056F_2407365_SNP S_36082975	2407365	C	T
000056F_2382965_SNP S_36080568	2382965	T	C
000056F_1908999_SNP S_36032735	1908999	C	A
000056F_2879334_SNP S_36126159	2879334	C	T
000056F_312946_SNP S_35882147	312946	C	T
000056F_1658750_SNP	1658750	C	A
000056F_2178886_SNP S_36060093	2178886	A	C
000056F_1583416_SNP S_36003889	1583416	T	C
000056F_1592324_SNP S_36004676	1592324	T	G
000056F_1709697_SNP S_36015638	1709697	C	T
000056F_308500_SNP S_35881779	308500	T	C
000056F_1226089_SNP S_35966495	1226089	A	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4522363_SNP S_36315592	4522363	A	T
000056F_2066115_SNP S_36049585	2066115	T	C
000056F_177803_SNP S_35869880	177803	A	T
000056F_2933772_SNP S_36131704	2933772	T	A
000056F_1721568_SNP S_36016510	1721568	G	A
000056F_818547_SNP S_35929674	818547	T	C
000056F_1889207_SNP S_36030943	1889207	C	G
000056F_1900153_SNP S_36031983	1900153	G	C
000056F_4130364_SNP S_36275669	4130364	A	T
000056F_1347517_SNP S_35978963	1347517	G	A
000056F_1148960_SNP S_35958511	1148960	T	A
000056F_1148956_SNP S_35958506	1148956	T	A
000056F_1148955_SNP S_35958505	1148955	T	A
000056F_1148954_SNP S_35958504	1148954	T	A
000056F_1450146_SNP S_35988394	1450146	A	G
000056F_2815002_SNP S_36120515	2815002	T	G
000056F_182789_SNP S_35870295	182789	T	C
000056F_3799869_SNP S_36226119	3799869	A	G
000056F_4695194_SNP S_36331984	4695194	A	G
000056F_2031117_SNP S_36046189	2031117	A	G
000056F_1152201_SNP S_35958816	1152201	A	T
000056F_1656523_SNP S_36010790	1656523	T	C
000056F_1463205_SNP S_35989545	1463205	A	T
000056F_1954541_SNP S_36038433	1954541	C	A
000056F_1270928_SNP S_35971234	1270928	A	G
000056F_2693583_SNP S_36109458	2693583	G	A
000056F_2012924_SNP S_36044414	2012924	G	T
000056F_1435153_SNP S_35986959	1435153	A	G
000056F_2538600_SNP S_36095197	2538600	G	A
000056F_1323026_SNP S_35976206	1323026	A	G
000056F_916045_SNP S_35938324	916045	A	T
000056F_1850044_SNP S_36027540	1850044	C	T
000056F_4546024_SNP S_36317554	4546024	A	T
000056F_1189441_SNP S_35962959	1189441	G	A
000056F_1871993_SNP S_36029394	1871993	G	A
000056F_1033169_SNP S_35948167	1033169	A	G
000056F_1111240_SNP S_35955328	1111240	A	C
000056F_26696_SNP S_35853556	26696	A	G
000056F_1101454_SNP S_35954479	1101454	A	T
000056F_1164208_SNP S_35960072	1164208	A	C
000056F_1112870_SNP S_35955509	1112870	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_120140_SNP S_35863145	120140	A	G
000056F_120137_SNP S_35863144	120137	C	G
000056F_1415479_SNP S_35984915	1415479	A	G
000056F_3822924_SNP S_36228031	3822924	C	T
000056F_4107978_SNP S_36273538	4107978	A	G
000056F_2037317_SNP S_36046641	2037317	A	T
000056F_1822259_SNP S_36025359	1822259	A	T
000056F_2067887_SNP S_36049691	2067887	C	G
000056F_2902152_SNP S_36128497	2902152	C	T
000056F_3942284_SNP S_36241216	3942284	T	C
000056F_2878455_SNP S_36126107	2878455	G	C
000056F_2871318_SNP S_36125512	2871318	G	T
000056F_1682847_SNP S_36013195	1682847	A	C
000056F_2999911_SNP S_36139652	2999911	T	C
000056F_1805062_SNP S_36023552	1805062	C	T
000056F_2258941_SNP S_36068265	2258941	A	T
000056F_3052181_SNP S_36147697	3052181	C	T
000056F_3052183_SNP	3052183	T	C
000056F_639875_SNP S_35912819	639875	T	C
000056F_834400_SNP S_35931084	834400	G	C
000056F_1559597_SNP S_36002182	1559597	A	G
000056F_3138269_SNP S_36155969	3138269	C	T
000056F_2704969_SNP S_36110428	2704969	T	G
000056F_2036410_SNP S_36046592	2036410	G	A
000056F_980516_SNP S_35943893	980516	G	C
000056F_147333_SNP S_35866425	147333	T	C
000056F_3109755_SNP S_36153438	3109755	T	C
000056F_389313_SNP S_35889068	389313	C	A
000056F_3293883_SNP S_36171930	3293883	C	G
000056F_157446_SNP S_35867866	157446	A	T
000056F_2652176_SNP S_36105693	2652176	A	G
000056F_941490_SNP S_35940508	941490	T	C
000056F_1730940_SNP S_36017207	1730940	A	C
000056F_5108252_SNP S_36377067	5108252	T	A
000056F_2258979_SNP S_36068266	2258979	T	A
000056F_2014497_SNP S_36044501	2014497	G	A
000056F_3293309_SNP S_36171883	3293309	G	A
000056F_1789981_SNP S_36022303	1789981	T	A
000056F_2562023_SNP S_36097437	2562023	A	T
000056F_2667787_SNP S_36107149	2667787	C	A
000056F_2667784_SNP S_36107148	2667784	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4647460_SNP S_36327950	4647460	C	T
000056F_125839_SNP S_35863609	125839	T	C
000056F_125834_SNP S_35863608	125834	A	C
000056F_1636197_SNP S_36008963	1636197	G	T
000056F_4990809_SNP S_36365523	4990809	G	C
000056F_5720550_SNP S_36438501	5720550	A	G
000056F_1210246_SNP S_35964784	1210246	T	C
000056F_1223643_SNP S_35966140	1223643	C	G
000056F_2505107_SNP S_36092079	2505107	T	A
000056F_2043039_SNP S_36047172	2043039	G	T
000056F_2043036_SNP S_36047171	2043036	C	T
000056F_862469_SNP S_35933632	862469	T	G
000056F_1055943_SNP S_35950070	1055943	C	G
000056F_437586_SNP S_35893897	437586	C	A
000056F_1851436_SNP S_36027674	1851436	T	G
000056F_1222260_SNP S_35966013	1222260	C	A
000056F_2015034_SNP S_36044560	2015034	T	C
000056F_1150306_SNP S_35958681	1150306	G	A
000056F_1777146_SNP S_36021095	1777146	C	T
000056F_27399_SNP S_35853629	27399	C	T
000056F_994490_SNP S_35945406	994490	T	G
000056F_2202322_SNP	2202322	C	T
000056F_2475372_SNP S_36089436	2475372	T	C
000056F_320812_SNP S_35882969	320812	G	T
000056F_1846468_SNP S_36027193	1846468	A	T
000056F_961764_SNP S_35942402	961764	G	A
000056F_2709732_SNP S_36110773	2709732	A	G
000056F_2052743_SNP S_36048051	2052743	C	G
000056F_408728_SNP S_35890850	408728	T	C
000056F_3239519_SNP S_36166854	3239519	G	T
000056F_1595612_SNP S_36004947	1595612	T	C
000056F_415281_SNP S_35891648	415281	G	T
000056F_1305360_SNP S_35974643	1305360	C	T
000056F_1232644_SNP S_35967224	1232644	G	A
000056F_3396702_SNP S_36183618	3396702	T	C
000056F_2868571_SNP S_36125271	2868571	T	C
000056F_1650926_SNP S_36010288	1650926	C	G
000056F_2600653_SNP S_36100849	2600653	G	T
000056F_1503278_SNP S_35995861	1503278	T	G
000056F_1739292_SNP S_36017860	1739292	A	G
000056F_1218016_SNP	1218016	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1085193_SNP S_35952895	1085193	C	T
000056F_2944624_SNP S_36132420	2944624	A	C
000056F_2478417_SNP S_36089619	2478417	T	A
000056F_4582515_SNP S_36321216	4582515	T	C
000056F_1349912_SNP S_35979155	1349912	A	G
000056F_1603776_SNP S_36005796	1603776	A	C
000056F_1694679_SNP S_36014079	1694679	C	G
000056F_372230_SNP S_35887395	372230	G	T
000056F_2079253_SNP S_36050566	2079253	A	G
000056F_1804179_SNP S_36023490	1804179	T	C
000056F_1755707_SNP S_36019232	1755707	T	C
000056F_1623564_SNP S_36007631	1623564	C	T
000056F_863648_SNP S_35933717	863648	T	C
000056F_2560520_SNP S_36097299	2560520	G	A
000056F_1570459_SNP S_36002845	1570459	T	A
000056F_2013371_SNP S_36044445	2013371	G	T
000056F_2056284_SNP S_36048459	2056284	A	T
000056F_1649597_SNP S_36010179	1649597	G	A
000056F_1503074_SNP S_35995845	1503074	T	G
000056F_2056272_SNP	2056272	A	G
000056F_1821111_SNP S_36025244	1821111	A	G
000056F_804317_SNP S_35928557	804317	A	C
000056F_2113656_SNP S_36054004	2113656	G	T
000056F_4021709_SNP S_36266357	4021709	T	A
000056F_2643963_SNP S_36104657	2643963	A	T
000056F_1148959_SNP S_35958510	1148959	T	C
000056F_1523606_SNP S_35998420	1523606	T	C
000056F_980759_SNP S_35943926	980759	C	T
000056F_1756603_SNP S_36019343	1756603	C	A
000056F_1191256_SNP S_35963151	1191256	A	T
000056F_1756656_SNP S_36019345	1756656	A	G
000056F_2142475_SNP S_36056776	2142475	A	G
000056F_1239704_SNP S_35967873	1239704	G	A
000056F_1244029_SNP S_35968177	1244029	C	T
000056F_3036385_SNP	3036385	T	C
000056F_1481488_SNP S_35993996	1481488	C	G
000056F_1017079_SNP S_35946970	1017079	A	T
000056F_433647_SNP S_35893516	433647	A	T
000056F_1247671_SNP S_35968610	1247671	G	A
000056F_607062_SNP S_35909775	607062	C	T
000056F_1911796_SNP S_36032973	1911796	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2541844_SNP S_36095468	2541844	C	T
000056F_34686_SNP S_35854328	34686	T	A
000056F_2640860_SNP S_36104367	2640860	T	C
000056F_3293886_SNP S_36171931	3293886	C	T
000056F_1658742_SNP S_36010960	1658742	G	A
000056F_181069_SNP S_35870218	181069	A	T
000056F_181070_SNP S_35870219	181070	A	T
000056F_1746579_SNP S_36018471	1746579	G	T
000056F_1819478_SNP S_36025121	1819478	A	G
000056F_3051459_SNP S_36147641	3051459	T	A
000056F_1437180_SNP S_35987167	1437180	C	A
000056F_1715900_SNP	1715900	T	C
000056F_1210289_SNP S_35964787	1210289	G	T
000056F_2899312_SNP S_36128101	2899312	C	T
000056F_532240_SNP S_35902936	532240	C	A
000056F_1771911_SNP S_36020689	1771911	A	T
000056F_176550_SNP S_35869750	176550	A	C
000056F_2089165_SNP S_36051447	2089165	C	G
000056F_2143974_SNP S_36056937	2143974	A	G
000056F_1287685_SNP S_35972840	1287685	A	C
000056F_1282158_SNP S_35972322	1282158	A	T
000056F_3291262_SNP S_36171788	3291262	C	A
000056F_947737_SNP S_35941109	947737	G	C
000056F_1816759_SNP S_36024910	1816759	G	A
000056F_1113492_SNP S_35955564	1113492	A	G
000056F_2871261_SNP S_36125509	2871261	G	A
000056F_3613236_SNP S_36204399	3613236	A	C
000056F_1395191_SNP	1395191	C	T
000056F_4273530_SNP S_36291068	4273530	C	A
000056F_2119037_SNP	2119037	T	G
000056F_1193444_SNP S_35963333	1193444	A	C
000056F_2433996_SNP	2433996	T	C
000056F_2433991_SNP S_36085300	2433991	C	T
000056F_437701_SNP S_35893908	437701	A	T
000056F_1133522_SNP S_35957157	1133522	G	A
000056F_1451155_SNP S_35988455	1451155	T	G
000056F_1412656_SNP S_35984725	1412656	C	A
000056F_3295036_SNP S_36172092	3295036	G	A
000056F_2196066_SNP S_36061726	2196066	A	G
000056F_1588383_SNP	1588383	C	T
000056F_1413163_SNP S_35984747	1413163	A	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2678037_SNP S_36108086	2678037	T	A
000056F_1724932_SNP S_36016705	1724932	G	A
000056F_1580652_SNP S_36003738	1580652	C	T
000056F_1543963_SNP S_36000805	1543963	G	C
000056F_1016005_SNP S_35946932	1016005	G	A
000056F_3248635_SNP S_36167790	3248635	G	A
000056F_3248630_SNP S_36167789	3248630	T	A
000056F_1415526_SNP S_35984920	1415526	C	T
000056F_1988940_SNP S_36042131	1988940	G	A
000056F_1855248_SNP S_36028003	1855248	A	C
000056F_1149511_SNP S_35958604	1149511	T	A
000056F_941476_SNP S_35940505	941476	C	T
000056F_1144963_SNP S_35958218	1144963	T	C
000056F_1987545_SNP S_36042028	1987545	G	C
000056F_1425937_SNP S_35985960	1425937	C	T
000056F_1043146_SNP S_35948991	1043146	C	T
000056F_2997158_SNP S_36139375	2997158	G	A
000056F_1876329_SNP S_36029802	1876329	C	T
000056F_1968243_SNP S_36040319	1968243	T	G
000056F_1859538_SNP S_36028435	1859538	G	A
000056F_1171033_SNP S_35960819	1171033	C	G
000056F_791339_SNP S_35927256	791339	G	C
000056F_2045646_SNP S_36047391	2045646	G	A
000056F_901015_SNP S_35937047	901015	C	T
000056F_1205813_SNP S_35964353	1205813	G	A
000056F_1244001_SNP S_35968173	1244001	G	A
000056F_947775_SNP S_35941111	947775	T	A
000056F_1101315_SNP S_35954472	1101315	G	T
000056F_988751_SNP S_35944673	988751	A	G
000056F_2547858_SNP	2547858	G	C
000056F_2901693_SNP S_36128449	2901693	A	G
000056F_2901694_SNP S_36128450	2901694	T	G
000056F_1391490_SNP S_35982482	1391490	G	C
000056F_2086805_SNP S_36051255	2086805	T	C
000056F_1751328_SNP S_36018837	1751328	T	C
000056F_1606913_SNP S_36006174	1606913	G	A
000056F_2557689_SNP S_36097034	2557689	C	T
000056F_1481538_SNP S_35994004	1481538	C	A
000056F_375853_SNP S_35887702	375853	G	T
000056F_1698180_SNP S_36014463	1698180	C	T
000056F_5440073_SNP S_36410308	5440073	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2189246_SNP S_36061046	2189246	A	T
000056F_943319_SNP S_35940677	943319	C	A
000056F_2617317_SNP S_36102249	2617317	T	A
000056F_259685_SNP	259685	A	T
000056F_2202136_SNP	2202136	T	G
000056F_2165415_SNP S_36058944	2165415	A	G
000056F_1259512_SNP S_35969757	1259512	C	G
000056F_1642806_SNP S_36009569	1642806	G	A
000056F_1142278_SNP S_35957941	1142278	C	T
000056F_1353457_SNP S_35979469	1353457	G	C
000056F_1132971_SNP S_35957131	1132971	A	G
000056F_4122015_SNP S_36274912	4122015	G	A
000056F_4119156_SNP S_36274631	4119156	T	A
000056F_1720704_SNP S_36016463	1720704	T	C
000056F_980781_SNP S_35943929	980781	C	A
000056F_921995_SNP S_35938968	921995	A	G
000056F_1490098_SNP S_35994684	1490098	C	T
000056F_2350169_SNP S_36077390	2350169	C	A
000056F_1819523_SNP S_36025126	1819523	A	G
000056F_998311_SNP S_35945669	998311	T	G
000056F_4044469_SNP S_36268164	4044469	T	A
000056F_2000340_SNP S_36043284	2000340	T	C
000056F_2118712_SNP S_36054514	2118712	A	T
000056F_1960665_SNP S_36039541	1960665	A	G
000056F_3992663_SNP S_36246216	3992663	T	C
000056F_1227897_SNP S_35966738	1227897	T	A
000056F_1462917_SNP S_35989478	1462917	A	G
000056F_2258261_SNP S_36068181	2258261	C	T
000056F_1585393_SNP S_36004060	1585393	G	C
000056F_1891701_SNP S_36031199	1891701	T	G
000056F_2327230_SNP S_36075353	2327230	T	C
000056F_547050_SNP S_35904438	547050	A	G
000056F_1649014_SNP S_36010129	1649014	C	T
000056F_2058478_SNP S_36048684	2058478	C	T
000056F_2797619_SNP S_36118836	2797619	C	T
000056F_2024990_SNP S_36045547	2024990	T	C
000056F_2637703_SNP S_36104104	2637703	A	G
000056F_5439830_SNP S_36410291	5439830	G	A
000056F_1059606_SNP S_35950394	1059606	A	C
000056F_1305391_SNP S_35974645	1305391	A	G
000056F_1480217_SNP	1480217	G	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2099561_SNP S_36052464	2099561	A	G
000056F_1144046_SNP S_35958151	1144046	C	A
000056F_1487743_SNP S_35994438	1487743	G	A
000056F_1510395_SNP S_35996583	1510395	C	A
000056F_1006773_SNP S_35946301	1006773	G	A
000056F_2368118_SNP S_36079236	2368118	A	C
000056F_5077901_SNP S_36373881	5077901	T	G
000056F_1339380_SNP S_35978279	1339380	C	T
000056F_1638845_SNP S_36009257	1638845	T	A
000056F_1059799_SNP S_35950424	1059799	T	C
000056F_1669486_SNP S_36011842	1669486	A	G
000056F_2960675_SNP	2960675	A	T
000056F_1226121_SNP S_35966496	1226121	C	T
000056F_1226144_SNP S_35966510	1226144	T	C
000056F_3233803_SNP S_36166275	3233803	T	C
000056F_1352963_SNP S_35979432	1352963	A	G
000056F_1818805_SNP S_36025065	1818805	C	A
000056F_1216082_SNP S_35965343	1216082	A	G
000056F_1205899_SNP S_35964357	1205899	G	A
000056F_1631159_SNP S_36008246	1631159	A	T
000056F_1761131_SNP S_36019665	1761131	T	C
000056F_2363330_SNP S_36078727	2363330	A	T
000056F_2709555_SNP S_36110760	2709555	C	G
000056F_1279142_SNP S_35972191	1279142	A	G
000056F_2095502_SNP S_36052087	2095502	C	G
000056F_2831119_SNP S_36121920	2831119	G	A
000056F_1373012_SNP S_35981400	1373012	A	T
000056F_1071039_SNP S_35951486	1071039	T	G
000056F_1355842_SNP S_35979614	1355842	T	C
000056F_998270_SNP S_35945667	998270	A	T
000056F_1838893_SNP S_36026462	1838893	T	C
000056F_2114511_SNP S_36054058	2114511	A	G
000056F_2475263_SNP S_36089426	2475263	A	G
000056F_835125_SNP S_35931146	835125	G	A
000056F_2663986_SNP S_36106829	2663986	C	G
000056F_1855247_SNP S_36028002	1855247	T	C
000056F_2783008_SNP S_36117572	2783008	C	T
000056F_804165_SNP S_35928549	804165	T	C
000056F_1499891_SNP S_35995563	1499891	T	A
000056F_762226_SNP S_35924448	762226	G	A
000056F_2305755_SNP S_36071989	2305755	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_3333524_SNP	3333524	G	C
000056F_2387191_SNP S_36081021	2387191	G	T
000056F_2858049_SNP S_36124434	2858049	A	G
000056F_392581_SNP S_35889481	392581	C	T
000056F_2899300_SNP S_36128099	2899300	C	T
000056F_2899302_SNP S_36128100	2899302	A	G
000056F_2096892_SNP S_36052197	2096892	C	G
000056F_1609726_SNP S_36006442	1609726	T	A
000056F_1206241_SNP S_35964388	1206241	G	A
000056F_1917986_SNP S_36033495	1917986	T	C
000056F_4990808_SNP	4990808	G	C
000056F_2033358_SNP S_36046371	2033358	C	T
000056F_1152841_SNP S_35958925	1152841	T	G
000056F_237066_SNP S_35875342	237066	T	A
000056F_3217875_SNP S_36164687	3217875	G	T
000056F_2179861_SNP S_36060202	2179861	A	T
000056F_1013678_SNP S_35946787	1013678	C	A
000056F_2543394_SNP S_36095629	2543394	C	T
000056F_1696294_SNP S_36014282	1696294	C	T
000056F_1604028_SNP S_36005822	1604028	T	C
000056F_1420561_SNP S_35985364	1420561	C	T
000056F_2713979_SNP S_36111162	2713979	T	G
000056F_2660443_SNP S_36106503	2660443	C	T
000056F_2039518_SNP S_36046902	2039518	A	T
000056F_2496567_SNP S_36091191	2496567	T	A
000056F_2280609_SNP S_36069640	2280609	T	C
000056F_3283037_SNP S_36171110	3283037	A	C
000056F_2183994_SNP S_36060553	2183994	G	C
000056F_452677_SNP S_35895113	452677	A	T
000056F_1132974_SNP S_35957132	1132974	A	C
000056F_3099441_SNP S_36152594	3099441	G	T
000056F_612179_SNP S_35910256	612179	T	A
000056F_3036192_SNP	3036192	T	C
000056F_2019351_SNP S_36045002	2019351	G	T
000056F_2016108_SNP S_36044675	2016108	C	A
000056F_2672569_SNP S_36107633	2672569	A	C
000056F_2387195_SNP S_36081023	2387195	T	C
000056F_607668_SNP S_35909811	607668	G	A
000056F_870596_SNP S_35934321	870596	C	G
000056F_856889_SNP S_35933136	856889	T	C
000056F_185695_SNP S_35870511	185695	C	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1149525_SNP S_35958605	1149525	G	A
000056F_2155186_SNP S_36057990	2155186	C	T
000056F_2236011_SNP S_36066399	2236011	G	A
000056F_2582474_SNP S_36099320	2582474	G	T
000056F_1112789_SNP S_35955496	1112789	T	C
000056F_468301_SNP S_35896443	468301	C	T
000056F_1077859_SNP S_35952133	1077859	C	G
000056F_109229_SNP S_35861745	109229	G	A
000056F_4551919_SNP S_36318081	4551919	T	C
000056F_1211428_SNP S_35964857	1211428	A	G
000056F_29716_SNP S_35853953	29716	A	T
000056F_29713_SNP S_35853951	29713	C	T
000056F_2015090_SNP S_36044565	2015090	A	T
000056F_1930955_SNP S_36034652	1930955	G	T
000056F_1659021_SNP S_36010978	1659021	A	T
000056F_1160461_SNP S_35959764	1160461	A	G
000056F_1854031_SNP S_36027878	1854031	C	T
000056F_1368772_SNP S_35981036	1368772	T	A
000056F_1975383_SNP S_36040932	1975383	T	C
000056F_1278394_SNP S_35972126	1278394	C	G
000056F_825658_SNP S_35930283	825658	C	T
000056F_825661_SNP S_35930284	825661	T	G
000056F_2035660_SNP S_36046499	2035660	T	C
000056F_2191262_SNP S_36061258	2191262	G	A
000056F_2685534_SNP S_36108779	2685534	C	T
000056F_1490106_SNP S_35994685	1490106	G	T
000056F_1354109_SNP S_35979519	1354109	T	G
000056F_476347_SNP S_35897229	476347	T	A
000056F_1825239_SNP S_36025583	1825239	A	G
000056F_1430218_SNP	1430218	T	G
000056F_1121061_SNP S_35956253	1121061	G	C
000056F_1925352_SNP S_36034151	1925352	A	G
000056F_5739406_SNP	5739406	C	A
000056F_1643647_SNP S_36009625	1643647	A	G
000056F_1420584_SNP S_35985365	1420584	G	C
000056F_3008678_SNP S_36141311	3008678	T	A
000056F_5115151_SNP S_36377759	5115151	A	T
000056F_1787242_SNP S_36022081	1787242	G	A
000056F_1198404_SNP S_35963736	1198404	G	T
000056F_1191253_SNP S_35963150	1191253	T	C
000056F_2014524_SNP S_36044502	2014524	C	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4680686_SNP S_36330758	4680686	T	C
000056F_1222242_SNP S_35966007	1222242	T	G
000056F_1434934_SNP S_35986934	1434934	G	C
000056F_1266091_SNP S_35970462	1266091	G	T
000056F_4584292_SNP S_36321387	4584292	G	A
000056F_3503506_SNP S_36194466	3503506	A	G
000056F_1805130_SNP S_36023557	1805130	A	C
000056F_1823122_SNP S_36025411	1823122	G	C
000056F_2067907_SNP S_36049692	2067907	G	T
000056F_1481553_SNP S_35994005	1481553	G	A
000056F_895282_SNP S_35936671	895282	T	A
000056F_2920500_SNP S_36130219	2920500	G	A
000056F_1354110_SNP S_35979520	1354110	G	C
000056F_3421701_SNP S_36185654	3421701	G	A
000056F_2418318_SNP S_36083889	2418318	G	T
000056F_1900181_SNP S_36031986	1900181	A	G
000056F_1006664_SNP S_35946296	1006664	T	G
000056F_1617119_SNP S_36007075	1617119	A	T
000056F_1859492_SNP S_36028433	1859492	A	C
000056F_2771941_SNP S_36116601	2771941	G	A
000056F_883133_SNP S_35935531	883133	G	A
000056F_2101538_SNP S_36052616	2101538	A	C
000056F_1231810_SNP S_35967067	1231810	A	G
000056F_1279103_SNP S_35972188	1279103	C	T
000056F_1566121_SNP S_36002468	1566121	G	A
000056F_880683_SNP S_35935327	880683	A	T
000056F_221827_SNP S_35873915	221827	A	G
000056F_1272837_SNP S_35971419	1272837	T	C
000056F_2878371_SNP S_36126100	2878371	A	T
000056F_2617314_SNP S_36102248	2617314	T	G
000056F_2588417_SNP S_36099815	2588417	A	T
000056F_2879276_SNP S_36126156	2879276	T	C
000056F_4844586_SNP S_36349077	4844586	C	T
000056F_4938399_SNP S_36358767	4938399	C	G
000056F_2924561_SNP S_36130662	2924561	C	G
000056F_1639668_SNP S_36009313	1639668	G	A
000056F_1205905_SNP S_35964358	1205905	A	T
000056F_791344_SNP S_35927257	791344	A	G
000056F_1607639_SNP S_36006210	1607639	A	C
000056F_2780846_SNP S_36117417	2780846	G	A
000056F_4021713_SNP S_36266359	4021713	G	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_3326032_SNP	3326032	C	T
000056F_1404931_SNP S_35984023	1404931	T	C
000056F_1992695_SNP S_36042395	1992695	G	C
000056F_1398335_SNP S_35983456	1398335	T	C
000056F_24116_SNP S_35853355	24116	A	C
000056F_2067847_SNP S_36049688	2067847	T	C
000056F_2608865_SNP S_36101545	2608865	A	G
000056F_201728_SNP S_35872079	201728	C	T
000056F_201725_SNP S_35872078	201725	A	C
000056F_2024943_SNP S_36045542	2024943	A	G
000056F_1010198_SNP S_35946541	1010198	A	C
000056F_1048157_SNP S_35949418	1048157	G	T
000056F_2257153_SNP S_36068080	2257153	C	A
000056F_950477_SNP S_35941318	950477	T	A
000056F_1823131_SNP S_36025412	1823131	G	A
000056F_2009162_SNP S_36044069	2009162	G	A
000056F_1481933_SNP S_35994036	1481933	T	G
000056F_311947_SNP S_35882062	311947	C	T
000056F_577236_SNP S_35907209	577236	G	A
000056F_1033545_SNP S_35948198	1033545	A	G
000056F_1435132_SNP S_35986957	1435132	T	G
000056F_1507284_SNP S_35996257	1507284	C	T
000056F_27443_SNP S_35853636	27443	T	C
000056F_2656984_SNP S_36106188	2656984	A	C
000056F_1823456_SNP S_36025436	1823456	A	T
000056F_3150414_SNP S_36157193	3150414	T	C
000056F_2255406_SNP S_36067991	2255406	A	G
000056F_1195660_SNP S_35963561	1195660	G	A
000056F_880680_SNP S_35935326	880680	T	A
000056F_1966513_SNP S_36040163	1966513	T	A
000056F_2696150_SNP S_36109719	2696150	G	A
000056F_4313797_SNP S_36295205	4313797	A	G
000056F_1136798_SNP S_35957336	1136798	A	G
000056F_2179985_SNP S_36060210	2179985	T	A
000056F_1975397_SNP S_36040933	1975397	T	C
000056F_2282089_SNP S_36069775	2282089	G	C
000056F_1101443_SNP S_35954476	1101443	T	C
000056F_2248336_SNP S_36067529	2248336	C	A
000056F_1211426_SNP S_35964856	1211426	G	A
000056F_2072959_SNP S_36050078	2072959	A	G
000056F_1910577_SNP S_36032878	1910577	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_32560_SNP S_35854164	32560	T	C
000056F_1840868_SNP S_36026588	1840868	T	C
000056F_1355812_SNP S_35979611	1355812	T	C
000056F_3512030_SNP S_36195367	3512030	G	T
000056F_2280507_SNP S_36069635	2280507	A	G
000056F_1987234_SNP S_36042009	1987234	G	T
000056F_2164852_SNP S_36058904	2164852	C	T
000056F_1709703_SNP S_36015639	1709703	T	C
000056F_942354_SNP S_35940608	942354	C	A
000056F_1197794_SNP S_35963695	1197794	T	A
000056F_2114578_SNP S_36054062	2114578	A	G
000056F_2832161_SNP S_36122024	2832161	A	T
000056F_2832163_SNP S_36122025	2832163	C	T
000056F_1787238_SNP S_36022076	1787238	C	A
000056F_1289612_SNP S_35973008	1289612	A	T
000056F_1089194_SNP S_35953362	1089194	T	G
000056F_1060042_SNP S_35950446	1060042	T	C
000056F_648532_SNP S_35913461	648532	C	A
000056F_1637088_SNP S_36009097	1637088	T	A
000056F_420808_SNP S_35892329	420808	C	T
000056F_2660404_SNP S_36106499	2660404	C	T
000056F_5208422_SNP S_36386136	5208422	A	G
000056F_3364223_SNP S_36180661	3364223	C	A
000056F_1930996_SNP S_36034654	1930996	C	T
000056F_1930990_SNP S_36034653	1930990	A	T
000056F_2860245_SNP S_36124570	2860245	C	T
000056F_2020586_SNP S_36045088	2020586	T	G
000056F_1197169_SNP S_35963663	1197169	A	C
000056F_1049705_SNP S_35949521	1049705	C	T
000056F_2025291_SNP S_36045577	2025291	T	C
000056F_3094361_SNP S_36152165	3094361	T	A
000056F_1152848_SNP S_35958926	1152848	T	C
000056F_2490029_SNP S_36090571	2490029	A	G
000056F_2713963_SNP S_36111161	2713963	T	G
000056F_2434000_SNP S_36085302	2434000	A	G
000056F_3197211_SNP S_36161571	3197211	T	C
000056F_2690167_SNP S_36109179	2690167	T	A
000056F_737137_SNP S_35922315	737137	C	T
000056F_1398344_SNP S_35983457	1398344	A	G
000056F_972523_SNP S_35942968	972523	C	T
000056F_2233196_SNP S_36066202	2233196	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_481920_SNP S_35897903	481920	A	C
000056F_581646_SNP	581646	T	C
000056F_4577944_SNP S_36320715	4577944	C	T
000056F_3115603_SNP S_36153995	3115603	G	C
000056F_946076_SNP S_35940972	946076	A	G
000056F_1140910_SNP S_35957735	1140910	G	T
000056F_1827509_SNP S_36025746	1827509	G	T
000056F_897344_SNP S_35936804	897344	C	G
000056F_1975362_SNP S_36040931	1975362	G	A
000056F_1851881_SNP S_36027711	1851881	T	G
000056F_1463071_SNP S_35989491	1463071	T	C
000056F_1566130_SNP S_36002469	1566130	T	C
000056F_979568_SNP S_35943801	979568	G	C
000056F_3099213_SNP S_36152579	3099213	G	A
000056F_1694516_SNP S_36014030	1694516	T	A
000056F_1818845_SNP S_36025067	1818845	A	G
000056F_929250_SNP S_35939612	929250	G	A
000056F_1595616_SNP S_36004948	1595616	T	C
000056F_1839134_SNP S_36026472	1839134	C	T
000056F_2056328_SNP S_36048469	2056328	T	C
000056F_1718746_SNP S_36016304	1718746	C	T
000056F_1049235_SNP S_35949472	1049235	G	T
000056F_1758626_SNP S_36019475	1758626	T	C
000056F_2384128_SNP S_36080689	2384128	A	G
000056F_3197219_SNP S_36161572	3197219	A	C
000056F_4652580_SNP S_36328298	4652580	T	C
000056F_2879316_SNP S_36126158	2879316	G	A
000056F_801743_SNP S_35928353	801743	G	A
000056F_1802382_SNP S_36023334	1802382	G	A
000056F_3672849_SNP S_36209567	3672849	C	A
000056F_950177_SNP S_35941304	950177	G	C
000056F_27100_SNP S_35853588	27100	G	T
000056F_2029726_SNP S_36046097	2029726	T	C
000056F_1133542_SNP S_35957161	1133542	C	G
000056F_2537877_SNP S_36095108	2537877	A	G
000056F_3636716_SNP S_36206409	3636716	A	T
000056F_36988_SNP S_35854505	36988	G	T
000056F_2792402_SNP S_36118345	2792402	A	T
000056F_1772746_SNP S_36020753	1772746	A	C
000056F_1846480_SNP S_36027195	1846480	C	G
000056F_1404003_SNP S_35983943	1404003	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2131082_SNP S_36055758	2131082	G	T
000056F_825186_SNP S_35930260	825186	C	A
000056F_2795937_SNP S_36118677	2795937	C	T
000056F_1141314_SNP S_35957769	1141314	G	C
000056F_1942966_SNP	1942966	T	A
000056F_3669762_SNP S_36209316	3669762	C	G
000056F_1013194_SNP S_35946764	1013194	A	G
000056F_4712063_SNP S_36333444	4712063	C	G
000056F_1694210_SNP S_36014013	1694210	T	C
000056F_804377_SNP	804377	G	A
000056F_2020585_SNP S_36045087	2020585	G	A
000056F_4329916_SNP S_36296762	4329916	G	A
000056F_481929_SNP S_35897904	481929	C	G
000056F_3239102_SNP S_36166820	3239102	G	A
000056F_2024894_SNP S_36045537	2024894	A	C
000056F_1197792_SNP S_35963694	1197792	T	A
000056F_835131_SNP S_35931147	835131	G	T
000056F_1910797_SNP S_36032894	1910797	T	C
000056F_2141646_SNP S_36056735	2141646	A	C
000056F_1425872_SNP S_35985952	1425872	T	C
000056F_1049696_SNP S_35949519	1049696	T	A
000056F_2068104_SNP S_36049706	2068104	A	G
000056F_979115_SNP S_35943764	979115	C	T
000056F_2976784_SNP S_36137037	2976784	T	A
000056F_3822937_SNP S_36228033	3822937	G	A
000056F_4557217_SNP S_36318532	4557217	C	G
000056F_1195501_SNP S_35963548	1195501	C	A
000056F_1673534_SNP S_36012238	1673534	T	C
000056F_312934_SNP S_35882146	312934	T	C
000056F_4503925_SNP S_36314192	4503925	A	G
000056F_2191254_SNP S_36061257	2191254	A	G
000056F_2537860_SNP S_36095106	2537860	T	C
000056F_2716393_SNP S_36111270	2716393	A	G
000056F_4111743_SNP S_36273842	4111743	G	T
000056F_3877610_SNP S_36234190	3877610	T	C
000056F_1399870_SNP S_35983649	1399870	T	G
000056F_3674303_SNP S_36209637	3674303	C	A
000056F_1049233_SNP S_35949471	1049233	A	G
000056F_2087183_SNP S_36051299	2087183	C	T
000056F_2067843_SNP S_36049687	2067843	A	G
000056F_2901154_SNP S_36128356	2901154	C	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1641697_SNP S_36009485	1641697	A	T
000056F_1954547_SNP S_36038435	1954547	C	T
000056F_1772226_SNP S_36020709	1772226	G	A
000056F_3679791_SNP S_36210113	3679791	A	G
000056F_1249746_SNP S_35968843	1249746	C	T
000056F_1459363_SNP S_35989165	1459363	C	G
000056F_2387008_SNP S_36081011	2387008	A	T
000056F_1907055_SNP S_36032560	1907055	T	A
000056F_1221219_SNP S_35965823	1221219	A	C
000056F_2096881_SNP S_36052196	2096881	G	A
000056F_2814636_SNP S_36120430	2814636	C	A
000056F_2018595_SNP S_36044880	2018595	A	C
000056F_3678362_SNP S_36209906	3678362	C	T
000056F_1140909_SNP S_35957734	1140909	T	G
000056F_2194751_SNP S_36061532	2194751	A	T
000056F_1711658_SNP S_36015778	1711658	G	C
000056F_2513395_SNP S_36092750	2513395	A	G
000056F_1330158_SNP S_35976886	1330158	C	G
000056F_1704512_SNP S_36015274	1704512	T	G
000056F_3068126_SNP	3068126	T	C
000056F_4242627_SNP S_36286764	4242627	T	A
000056F_2136982_SNP S_36056266	2136982	C	A
000056F_1724927_SNP S_36016704	1724927	C	T
000056F_989379_SNP S_35944753	989379	T	G
000056F_3937292_SNP S_36240811	3937292	A	G
000056F_1424282_SNP S_35985703	1424282	G	A
000056F_4380751_SNP S_36301398	4380751	T	C
000056F_1398328_SNP S_35983454	1398328	A	G
000056F_2007333_SNP S_36043923	2007333	A	T
000056F_2863044_SNP S_36124865	2863044	T	C
000056F_1009133_SNP S_35946473	1009133	C	A
000056F_1288129_SNP S_35972892	1288129	T	C
000056F_4713777_SNP S_36333661	4713777	G	A
000056F_3128866_SNP S_36155061	3128866	A	C
000056F_2600666_SNP S_36100850	2600666	A	G
000056F_1613239_SNP S_36006700	1613239	T	C
000056F_1690340_SNP S_36013696	1690340	A	T
000056F_2706917_SNP S_36110538	2706917	C	A
000056F_4976889_SNP S_36363180	4976889	T	C
000056F_2538520_SNP S_36095192	2538520	T	C
000056F_2792989_SNP S_36118382	2792989	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2976786_SNP S_36137039	2976786	A	T
000056F_1906940_SNP S_36032545	1906940	C	T
000056F_2327215_SNP S_36075350	2327215	A	T
000056F_547046_SNP S_35904437	547046	T	C
000056F_1856068_SNP S_36028065	1856068	A	G
000056F_1427279_SNP S_35986103	1427279	A	C
000056F_1358393_SNP S_35980092	1358393	A	C
000056F_1049693_SNP S_35949518	1049693	C	A
000056F_2011607_SNP S_36044307	2011607	C	T
000056F_1720647_SNP S_36016458	1720647	C	T
000056F_2114481_SNP S_36054056	2114481	A	G
000056F_1698001_SNP S_36014450	1698001	T	G
000056F_1806273_SNP S_36023620	1806273	C	T
000056F_1786455_SNP S_36021949	1786455	C	T
000056F_1795852_SNP	1795852	A	G
000056F_1354204_SNP S_35979528	1354204	A	T
000056F_2864743_SNP S_36124972	2864743	T	G
000056F_4928963_SNP S_36357858	4928963	G	A
000056F_1311572_SNP S_35975240	1311572	G	T
000056F_4532012_SNP S_36316409	4532012	A	T
000056F_1134855_SNP S_35957245	1134855	T	C
000056F_1134856_SNP S_35957246	1134856	C	T
000056F_2685672_SNP S_36108791	2685672	T	C
000056F_2018592_SNP S_36044879	2018592	G	C
000056F_1013181_SNP S_35946762	1013181	A	G
000056F_3691755_SNP S_36211370	3691755	G	A
000056F_1267293_SNP S_35970585	1267293	C	A
000056F_1195310_SNP S_35963523	1195310	T	C
000056F_2487865_SNP S_36090423	2487865	T	A
000056F_894912_SNP S_35936609	894912	C	T
000056F_1427364_SNP S_35986115	1427364	G	C
000056F_2513626_SNP S_36092759	2513626	T	C
000056F_1413463_SNP S_35984768	1413463	A	T
000056F_1091153_SNP S_35953651	1091153	C	T
000056F_1795828_SNP S_36022750	1795828	T	C
000056F_2538567_SNP S_36095196	2538567	T	C
000056F_1303977_SNP S_35974555	1303977	A	T
000056F_3038297_SNP S_36146294	3038297	A	G
000056F_1733683_SNP S_36017439	1733683	T	G
000056F_3411619_SNP S_36184903	3411619	C	G
000056F_1134311_SNP S_35957202	1134311	A	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1134313_SNP S_35957203	1134313	C	T
000056F_2143940_SNP S_36056931	2143940	G	A
000056F_988797_SNP S_35944675	988797	A	G
000056F_1026611_SNP S_35947726	1026611	G	T
000056F_2811342_SNP S_36120092	2811342	A	C
000056F_2327207_SNP S_36075349	2327207	T	G
000056F_1277984_SNP S_35972089	1277984	T	C
000056F_2135850_SNP S_36056191	2135850	T	C
000056F_2036753_SNP S_36046613	2036753	A	T
000056F_2018599_SNP S_36044882	2018599	C	T
000056F_862408_SNP S_35933624	862408	T	G
000056F_4313845_SNP S_36295207	4313845	C	T
000056F_2278163_SNP S_36069453	2278163	C	T
000056F_1487771_SNP S_35994439	1487771	T	C
000056F_3421690_SNP S_36185652	3421690	A	G
000056F_3121596_SNP S_36154472	3121596	T	A
000056F_327085_SNP S_35883508	327085	G	T
000056F_2714150_SNP S_36111169	2714150	G	C
000056F_2268098_SNP S_36069044	2268098	C	T
000056F_1819486_SNP S_36025122	1819486	T	C
000056F_2709176_SNP S_36110727	2709176	C	T
000056F_4273526_SNP S_36291067	4273526	T	A
000056F_870544_SNP	870544	A	T
000056F_174050_SNP S_35869533	174050	C	G
000056F_1580609_SNP S_36003737	1580609	T	A
000056F_896460_SNP S_35936744	896460	T	C
000056F_1624649_SNP S_36007726	1624649	C	A
000056F_718202_SNP S_35920076	718202	C	T
000056F_2911372_SNP S_36129431	2911372	C	G
000056F_387648_SNP S_35888778	387648	G	A
000056F_2180581_SNP S_36060249	2180581	C	T
000056F_867699_SNP S_35934075	867699	T	C
000056F_1463062_SNP S_35989490	1463062	G	A
000056F_856561_SNP S_35933124	856561	C	T
000056F_1741749_SNP S_36018139	1741749	T	A
000056F_1799878_SNP S_36023099	1799878	C	T
000056F_1272829_SNP S_35971418	1272829	T	C
000056F_4039343_SNP S_36267731	4039343	G	T
000056F_1687873_SNP S_36013560	1687873	A	C
000056F_2712563_SNP S_36110930	2712563	C	T
000056F_2435209_SNP	2435209	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1794761_SNP S_36022656	1794761	T	A
000056F_2712530_SNP S_36110928	2712530	A	T
000056F_2219042_SNP S_36064948	2219042	A	T
000056F_2009193_SNP S_36044070	2009193	G	T
000056F_2183111_SNP S_36060468	2183111	A	C
000056F_2659472_SNP S_36106428	2659472	A	T
000056F_1127888_SNP S_35956754	1127888	A	G
000056F_2582315_SNP S_36099311	2582315	C	T
000056F_1464796_SNP S_35989698	1464796	T	A
000056F_3197210_SNP S_36161570	3197210	T	C
000056F_4436841_SNP S_36306521	4436841	G	A
000056F_871195_SNP S_35934380	871195	T	C
000056F_4124446_SNP S_36275180	4124446	C	T
000056F_1101133_SNP S_35954444	1101133	A	G
000056F_2025504_SNP S_36045586	2025504	G	A
000056F_1940466_SNP S_36035574	1940466	T	A
000056F_3387153_SNP S_36182861	3387153	C	A
000056F_1552739_SNP	1552739	G	C
000056F_688140_SNP	688140	C	T
000056F_4722264_SNP S_36334570	4722264	T	C
000056F_1934336_SNP S_36034887	1934336	T	A
000056F_2638212_SNP S_36104152	2638212	T	A
000056F_2280592_SNP	2280592	A	G
000056F_2280590_SNP	2280590	T	A
000056F_3674194_SNP S_36209632	3674194	T	A
000056F_2026122_SNP S_36045623	2026122	G	C
000056F_2706894_SNP S_36110534	2706894	G	C
000056F_1820124_SNP S_36025166	1820124	A	G
000056F_2944930_SNP S_36132463	2944930	A	G
000056F_98323_SNP S_35860335	98323	A	G
000056F_1910578_SNP S_36032879	1910578	A	C
000056F_1642005_SNP S_36009519	1642005	C	A
000056F_1687918_SNP S_36013562	1687918	G	A
000056F_1277999_SNP S_35972090	1277999	C	T
000056F_2387019_SNP S_36081012	2387019	T	C
000056F_4844891_SNP S_36349098	4844891	G	A
000056F_1772741_SNP S_36020752	1772741	T	G
000056F_2734237_SNP S_36113003	2734237	A	T
000056F_2734236_SNP S_36113001	2734236	C	A
000056F_1828717_SNP S_36025822	1828717	C	T
000056F_1494323_SNP S_35995068	1494323	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4823026_SNP S_36347202	4823026	A	G
000056F_377022_SNP S_35887800	377022	T	C
000056F_1026617_SNP S_35947728	1026617	C	T
000056F_4551933_SNP S_36318082	4551933	T	C
000056F_2029709_SNP S_36046095	2029709	C	G
000056F_2758976_SNP S_36115415	2758976	C	G
000056F_1631178_SNP S_36008248	1631178	A	C
000056F_1760221_SNP S_36019592	1760221	G	T
000056F_248924_SNP S_35876293	248924	G	T
000056F_2930563_SNP S_36131295	2930563	A	G
000056F_641119_SNP S_35912887	641119	A	G
000056F_1399874_SNP S_35983650	1399874	G	A
000056F_1167251_SNP S_35960451	1167251	T	G
000056F_1244039_SNP S_35968178	1244039	T	A
000056F_1399327_SNP S_35983604	1399327	G	C
000056F_3421634_SNP S_36185651	3421634	C	G
000056F_1062724_SNP S_35950766	1062724	T	A
000056F_1327222_SNP S_35976492	1327222	T	C
000056F_1872367_SNP S_36029452	1872367	G	A
000056F_3276718_SNP S_36170671	3276718	A	G
000056F_2024965_SNP S_36045543	2024965	T	C
000056F_1858968_SNP S_36028397	1858968	T	A
000056F_1973213_SNP S_36040734	1973213	G	A
000056F_1755652_SNP S_36019224	1755652	G	C
000056F_1634127_SNP S_36008527	1634127	T	C
000056F_648550_SNP S_35913464	648550	C	T
000056F_391242_SNP S_35889343	391242	T	G
000056F_1664573_SNP S_36011325	1664573	G	T
000056F_1631232_SNP S_36008250	1631232	C	T
000056F_2582322_SNP S_36099312	2582322	C	A
000056F_1690344_SNP S_36013697	1690344	G	A
000056F_950212_SNP S_35941306	950212	A	G
000056F_1846472_SNP S_36027194	1846472	T	C
000056F_1805136_SNP S_36023558	1805136	G	C
000056F_1302870_SNP S_35974405	1302870	G	A
000056F_2811355_SNP S_36120094	2811355	A	G
000056F_571535_SNP S_35906739	571535	A	T
000056F_1641704_SNP S_36009487	1641704	G	A
000056F_1642007_SNP S_36009520	1642007	G	A
000056F_1741802_SNP S_36018143	1741802	A	T
000056F_2435206_SNP	2435206	G	A

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_4730911_SNP S_36335395	4730911	G	T
000056F_1794766_SNP S_36022658	1794766	G	A
000056F_2602953_SNP S_36101099	2602953	A	C
000056F_2191591_SNP S_36061291	2191591	C	T
000056F_2626624_SNP S_36103053	2626624	G	A
000056F_3257543_SNP S_36168810	3257543	A	G
000056F_3276717_SNP S_36170670	3276717	T	G
000056F_1838637_SNP S_36026445	1838637	G	A
000056F_1019303_SNP S_35947129	1019303	T	A
000056F_2665184_SNP S_36106950	2665184	C	T
000056F_317217_SNP S_35882603	317217	G	T
000056F_125820_SNP S_35863607	125820	T	A
000056F_2280594_SNP	2280594	T	A
000056F_2280593_SNP	2280593	G	T
000056F_4021739_SNP S_36266361	4021739	A	G
000056F_2863026_SNP S_36124862	2863026	T	A
000056F_1541206_SNP S_36000583	1541206	T	C
000056F_2132119_SNP S_36055830	2132119	T	G
000056F_51039_SNP S_35855808	51039	G	T
000056F_2040314_SNP S_36046950	2040314	T	C
000056F_5772981_SNP S_36444001	5772981	C	T
000056F_1937717_SNP S_36035392	1937717	G	A
000056F_1937716_SNP S_36035391	1937716	G	C
000056F_1111355_SNP	1111355	C	A
000056F_1704192_SNP S_36015201	1704192	G	A
000056F_387420_SNP S_35888761	387420	T	A
000056F_1141324_SNP S_35957770	1141324	C	T
000056F_4521563_SNP S_36315545	4521563	A	C
000056F_1805063_SNP S_36023553	1805063	G	C
000056F_1669510_SNP S_36011850	1669510	G	A
000056F_2014805_SNP S_36044540	2014805	C	T
000056F_650611_SNP S_35913668	650611	T	A
000056F_3708025_SNP S_36213208	3708025	T	C
000056F_1355830_SNP S_35979612	1355830	A	T
000056F_5439826_SNP S_36410290	5439826	G	A
000056F_1647089_SNP S_36009975	1647089	A	C
000056F_1323700_SNP S_35976257	1323700	C	A
000056F_2033194_SNP S_36046349	2033194	C	T
000056F_3052050_SNP	3052050	A	C
000056F_2033526_SNP S_36046380	2033526	T	C
000056F_943331_SNP S_35940679	943331	C	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2537853_SNP S_36095104	2537853	G	C
000056F_1580603_SNP S_36003736	1580603	C	T
000056F_2327264_SNP S_36075359	2327264	G	A
000056F_1382782_SNP S_35981987	1382782	G	C
000056F_3822943_SNP S_36228034	3822943	G	C
000056F_1302680_SNP S_35974389	1302680	G	A
000056F_1279088_SNP S_35972187	1279088	A	G
000056F_1291502_SNP S_35973230	1291502	A	C
000056F_1195299_SNP S_35963521	1195299	C	T
000056F_3841931_SNP S_36230577	3841931	C	G
000056F_1071507_SNP S_35951531	1071507	A	G
000056F_248906_SNP S_35876291	248906	G	A
000056F_1071515_SNP S_35951534	1071515	A	G
000056F_1541194_SNP S_36000582	1541194	T	C
000056F_958588_SNP S_35942091	958588	A	G
000056F_1802361_SNP S_36023333	1802361	T	A
000056F_922007_SNP S_35938971	922007	A	G
000056F_2339072_SNP S_36076283	2339072	C	G
000056F_1241298_SNP S_35968009	1241298	A	T
000056F_3007686_SNP S_36141124	3007686	A	C
000056F_5739396_SNP S_36440411	5739396	A	C
000056F_2759795_SNP S_36115488	2759795	A	G
000056F_1647086_SNP S_36009974	1647086	C	G
000056F_3351933_SNP S_36179289	3351933	C	A
000056F_2280595_SNP	2280595	A	T
000056F_1456737_SNP S_35988939	1456737	T	G
000056F_2783268_SNP S_36117597	2783268	A	G
000056F_2067520_SNP S_36049670	2067520	C	A
000056F_2227515_SNP	2227515	C	A
000056F_2976792_SNP S_36137040	2976792	A	T
000056F_2831403_SNP S_36121947	2831403	T	G
000056F_2192935_SNP S_36061382	2192935	T	A
000056F_4521570_SNP S_36315546	4521570	C	T
000056F_1720622_SNP S_36016457	1720622	C	A
000056F_713588_SNP S_35919675	713588	T	C
000056F_4599308_SNP S_36322855	4599308	G	A
000056F_935811_SNP S_35940228	935811	G	C
000056F_1098042_SNP S_35954233	1098042	G	T
000056F_3194417_SNP S_36161330	3194417	G	C
000056F_1216055_SNP S_35965342	1216055	A	G
000056F_2033517_SNP S_36046379	2033517	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2660403_SNP S_36106498	2660403	G	A
000056F_942507_SNP S_35940621	942507	G	A
000056F_2141238_SNP S_36056592	2141238	G	A
000056F_2412794_SNP S_36083367	2412794	G	A
000056F_1687886_SNP S_36013561	1687886	A	C
000056F_1840914_SNP S_36026593	1840914	G	A
000056F_1197262_SNP S_35963665	1197262	T	A
000056F_1062733_SNP S_35950767	1062733	C	T
000056F_1440290_SNP S_35987461	1440290	A	T
000056F_2478383_SNP S_36089618	2478383	A	C
000056F_801784_SNP S_35928355	801784	A	T
000056F_3332669_SNP S_36177270	3332669	T	A
000056F_476680_SNP S_35897253	476680	T	C
000056F_958574_SNP S_35942089	958574	A	C
000056F_2068103_SNP S_36049705	2068103	T	A
000056F_1343036_SNP S_35978606	1343036	G	A
000056F_1559668_SNP S_36002187	1559668	T	G
000056F_2067642_SNP S_36049676	2067642	C	T
000056F_387703_SNP	387703	T	A
000056F_2632613_SNP S_36103667	2632613	G	A
000056F_1104700_SNP S_35954721	1104700	A	T
000056F_3639000_SNP S_36206582	3639000	A	G
000056F_1436767_SNP S_35987125	1436767	G	A
000056F_1975707_SNP S_36040951	1975707	T	A
000056F_4177649_SNP S_36280439	4177649	G	C
000056F_2885557_SNP S_36126818	2885557	G	A
000056F_1277975_SNP S_35972088	1277975	T	C
000056F_1442328_SNP	1442328	A	C
000056F_1819209_SNP S_36025099	1819209	A	T
000056F_2404950_SNP S_36082784	2404950	T	C
000056F_708081_SNP S_35919165	708081	C	A
000056F_1906946_SNP S_36032546	1906946	C	T
000056F_3822887_SNP S_36228029	3822887	C	G
000056F_3822889_SNP S_36228030	3822889	A	G
000056F_2237460_SNP S_36066530	2237460	T	C
000056F_1244827_SNP S_35968257	1244827	C	T
000056F_1101070_SNP S_35954425	1101070	T	C
000056F_1101071_SNP S_35954426	1101071	A	G
000056F_2072964_SNP S_36050079	2072964	C	A
000056F_706711_SNP S_35919071	706711	G	A
000056F_2035670_SNP S_36046500	2035670	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_990527_SNP S_35944852	990527	T	A
000056F_972555_SNP S_35942970	972555	T	A
000056F_1142188_SNP S_35957935	1142188	G	T
000056F_607649_SNP S_35909809	607649	T	A
000056F_2141248_SNP S_36056594	2141248	C	T
000056F_1303998_SNP	1303998	A	G
000056F_1006714_SNP S_35946297	1006714	C	T
000056F_1451158_SNP S_35988459	1451158	G	T
000056F_1101074_SNP S_35954427	1101074	C	A
000056F_2062622_SNP S_36049306	2062622	A	G
000056F_1541185_SNP S_36000581	1541185	A	G
000056F_3115241_SNP S_36153964	3115241	T	A
000056F_1567105_SNP S_36002564	1567105	G	C
000056F_1823787_SNP S_36025459	1823787	C	T
000056F_2622331_SNP S_36102692	2622331	T	C
000056F_3586841_SNP S_36202233	3586841	T	G
000056F_2402528_SNP S_36082549	2402528	A	T
000056F_476741_SNP S_35897257	476741	G	A
000056F_1820071_SNP S_36025161	1820071	G	A
000056F_1820070_SNP S_36025160	1820070	T	A
000056F_392594_SNP S_35889482	392594	A	G
000056F_2281557_SNP S_36069747	2281557	A	G
000056F_1583380_SNP S_36003887	1583380	C	G
000056F_2417759_SNP S_36083871	2417759	T	C
000056F_2033201_SNP S_36046353	2033201	C	T
000056F_1788863_SNP S_36022203	1788863	A	G
000056F_1016037_SNP S_35946938	1016037	G	T
000056F_2629437_SNP S_36103317	2629437	T	C
000056F_881640_SNP S_35935393	881640	A	G
000056F_2480408_SNP S_36089756	2480408	A	C
000056F_990529_SNP S_35944853	990529	T	A
000056F_4105421_SNP S_36273214	4105421	T	A
000056F_2945252_SNP S_36132514	2945252	T	A
000056F_1000013_SNP S_35945775	1000013	G	A
000056F_1464498_SNP S_35989669	1464498	G	A
000056F_2650096_SNP S_36105395	2650096	T	A
000056F_1975713_SNP S_36040953	1975713	T	A
000056F_1325262_SNP S_35976355	1325262	G	T
000056F_1142224_SNP S_35957936	1142224	C	T
000056F_3239121_SNP S_36166824	3239121	T	C
000056F_2814672_SNP S_36120437	2814672	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_395449_SNP S_35889683	395449	A	C
000056F_2200860_SNP S_36062722	2200860	T	A
000056F_2495785_SNP S_36091027	2495785	T	A
000056F_2272114_SNP S_36069283	2272114	T	G
000056F_1643653_SNP S_36009626	1643653	T	G
000056F_2039970_SNP S_36046930	2039970	C	G
000056F_1098079_SNP S_35954236	1098079	G	C
000056F_3089725_SNP S_36151807	3089725	T	C
000056F_2935850_SNP	2935850	C	T
000056F_394109_SNP S_35889596	394109	C	A
000056F_3431349_SNP	3431349	A	C
000056F_3431348_SNP	3431348	T	A
000056F_612198_SNP S_35910259	612198	G	C
000056F_2119980_SNP S_36054610	2119980	A	T
000056F_1427343_SNP S_35986111	1427343	A	G
000056F_4975668_SNP S_36363078	4975668	T	C
000056F_2656019_SNP S_36106037	2656019	C	A
000056F_1000012_SNP S_35945774	1000012	G	A
000056F_2572600_SNP S_36098435	2572600	G	T
000056F_4411781_SNP S_36303980	4411781	C	T
000056F_312922_SNP S_35882145	312922	A	C
000056F_933686_SNP S_35940073	933686	A	G
000056F_1341120_SNP S_35978415	1341120	T	C
000056F_1258969_SNP S_35969719	1258969	C	A
000056F_2965523_SNP	2965523	G	T
000056F_2402552_SNP S_36082552	2402552	C	A
000056F_1101290_SNP S_35954467	1101290	G	C
000056F_1557908_SNP S_36001892	1557908	A	C
000056F_1906637_SNP S_36032528	1906637	C	T
000056F_2104780_SNP S_36052792	2104780	A	C
000056F_1484192_SNP S_35994158	1484192	G	A
000056F_4177689_SNP S_36280443	4177689	G	T
000056F_1691813_SNP S_36013815	1691813	A	T
000056F_3469741_SNP S_36191301	3469741	C	T
000056F_4177687_SNP S_36280442	4177687	A	T
000056F_4196785_SNP S_36281969	4196785	C	G
000056F_2593378_SNP S_36100246	2593378	A	G
000056F_1047724_SNP S_35949363	1047724	G	A
000056F_2810741_SNP S_36120052	2810741	A	C
000056F_3117546_SNP S_36154141	3117546	A	G
000056F_1029155_SNP S_35947861	1029155	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_902208_SNP S_35937130	902208	T	G
000056F_1559614_SNP S_36002184	1559614	C	T
000056F_3333521_SNP	3333521	T	G
000056F_1025793_SNP S_35947657	1025793	A	G
000056F_2765710_SNP S_36116072	2765710	A	C
000056F_3216165_SNP	3216165	T	C
000056F_996914_SNP S_35945561	996914	A	G
000056F_1859523_SNP S_36028434	1859523	C	A
000056F_1321052_SNP S_35976020	1321052	A	T
000056F_2563740_SNP S_36097566	2563740	G	A
000056F_1009947_SNP S_35946521	1009947	G	A
000056F_1214788_SNP S_35965186	1214788	C	A
000056F_3135396_SNP S_36155644	3135396	A	G
000056F_2652987_SNP S_36105763	2652987	T	C
000056F_1009962_SNP S_35946522	1009962	C	T
000056F_248907_SNP S_35876292	248907	T	G
000056F_2810709_SNP S_36120049	2810709	A	G
000056F_1595271_SNP S_36004918	1595271	T	A
000056F_1831960_SNP S_36026119	1831960	C	T
000056F_1225535_SNP S_35966420	1225535	A	G
000056F_1464512_SNP S_35989672	1464512	A	G
000056F_2016484_SNP S_36044701	2016484	A	C
000056F_1222205_SNP S_35965987	1222205	T	A
000056F_1238792_SNP S_35967814	1238792	G	A
000056F_1198326_SNP S_35963724	1198326	T	C
000056F_2119983_SNP S_36054611	2119983	A	T
000056F_998244_SNP S_35945664	998244	G	A
000056F_1870238_SNP S_36029267	1870238	T	C
000056F_617664_SNP S_35910840	617664	T	C
000056F_1399356_SNP	1399356	G	C
000056F_1399359_SNP S_35983611	1399359	T	G
000056F_5004645_SNP	5004645	G	A
000056F_1402779_SNP	1402779	G	T
000056F_1402780_SNP	1402780	T	A
000056F_1820102_SNP S_36025164	1820102	A	G
000056F_2999925_SNP	2999925	T	G
000056F_2999931_SNP S_36139655	2999931	A	C
000056F_1026034_SNP S_35947666	1026034	C	G
000056F_2013679_SNP	2013679	A	T
000056F_2040343_SNP S_36046952	2040343	C	G
000056F_3674180_SNP S_36209631	3674180	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_476713_SNP S_35897255	476713	G	A
000056F_2092716_SNP S_36051726	2092716	T	C
000056F_1184355_SNP S_35962566	1184355	T	G
000056F_1933398_SNP S_36034836	1933398	T	A
000056F_2031443_SNP S_36046205	2031443	T	G
000056F_2675344_SNP	2675344	G	T
000056F_2678107_SNP S_36108087	2678107	G	C
000056F_1101856_SNP S_35954508	1101856	A	T
000056F_1279796_SNP S_35972242	1279796	T	A
000056F_1225574_SNP S_35966424	1225574	C	T
000056F_3007489_SNP S_36141088	3007489	A	G
000056F_895260_SNP S_35936668	895260	T	G
000056F_895262_SNP S_35936669	895262	C	T
000056F_3145445_SNP S_36156763	3145445	G	A
000056F_5004636_SNP S_36366596	5004636	G	A
000056F_1741305_SNP S_36018111	1741305	C	T
000056F_1029739_SNP S_35947914	1029739	T	C
000056F_1029158_SNP S_35947862	1029158	A	G
000056F_1029159_SNP S_35947863	1029159	C	G
000056F_1617451_SNP S_36007107	1617451	G	A
000056F_1870198_SNP S_36029265	1870198	A	C
000056F_3310296_SNP S_36174065	3310296	G	A
000056F_2901895_SNP S_36128474	2901895	A	G
000056F_2280520_SNP S_36069637	2280520	C	T
000056F_1198434_SNP S_35963738	1198434	T	A
000056F_1047914_SNP S_35949389	1047914	A	G
000056F_1279083_SNP S_35972186	1279083	A	G
000056F_1238793_SNP S_35967815	1238793	G	A
000056F_2495815_SNP S_36091052	2495815	A	G
000056F_2667830_SNP S_36107152	2667830	T	A
000056F_1968611_SNP S_36040348	1968611	C	T
000056F_1134669_SNP S_35957216	1134669	G	C
000056F_1129901_SNP S_35956921	1129901	C	A
000056F_1197207_SNP S_35963664	1197207	G	A
000056F_928043_SNP S_35939524	928043	A	T
000056F_1819196_SNP S_36025098	1819196	A	T
000056F_1947965_SNP S_36036645	1947965	G	C
000056F_3007689_SNP S_36141125	3007689	A	G
000056F_1757042_SNP	1757042	G	T
000056F_1241038_SNP S_35967987	1241038	T	C
000056F_1659014_SNP S_36010977	1659014	A	G

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2661557_SNP S_36106590	2661557	G	T
000056F_3007685_SNP S_36141123	3007685	T	G
000056F_2014315_SNP S_36044497	2014315	T	C
000056F_1017534_SNP S_35946993	1017534	T	G
000056F_1390894_SNP S_35982446	1390894	T	G
000056F_1668795_SNP	1668795	A	G
000056F_1694714_SNP S_36014081	1694714	A	G
000056F_706701_SNP S_35919069	706701	T	A
000056F_706706_SNP S_35919070	706706	G	A
000056F_1029745_SNP S_35947915	1029745	G	T
000056F_4412083_SNP S_36304001	4412083	T	C
000056F_1127870_SNP S_35956753	1127870	A	G
000056F_1192998_SNP S_35963273	1192998	C	A
000056F_1870194_SNP S_36029263	1870194	G	A
000056F_1664601_SNP S_36011327	1664601	T	C
000056F_1968566_SNP S_36040342	1968566	A	T
000056F_2655967_SNP S_36106032	2655967	T	C
000056F_1647670_SNP S_36010040	1647670	C	A
000056F_1759268_SNP S_36019503	1759268	G	C
000056F_1017194_SNP S_35946974	1017194	A	G
000056F_856615_SNP S_35933129	856615	T	A
000056F_1947973_SNP S_36036647	1947973	T	A
000056F_955632_SNP S_35941842	955632	C	T
000056F_1686442_SNP S_36013430	1686442	T	A
000056F_1072997_SNP S_35951684	1072997	C	G
000056F_3008659_SNP S_36141308	3008659	G	T
000056F_2141659_SNP S_36056738	2141659	T	A
000056F_1228759_SNP S_35966813	1228759	T	G
000056F_1228746_SNP S_35966811	1228746	T	C
000056F_482869_SNP S_35897946	482869	T	A
000056F_2281543_SNP S_36069744	2281543	G	A
000056F_1241044_SNP S_35967988	1241044	T	C
000056F_706653_SNP S_35919067	706653	T	A
000056F_2901913_SNP S_36128477	2901913	G	C
000056F_2007479_SNP S_36043949	2007479	G	A
000056F_1486406_SNP S_35994307	1486406	G	T
000056F_1907011_SNP S_36032553	1907011	C	T
000056F_1094248_SNP S_35953898	1094248	C	T
000056F_2007480_SNP S_36043950	2007480	T	C
000056F_1535506_SNP S_36000093	1535506	A	C
000056F_706685_SNP S_35919068	706685	C	T

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_2708069_SNP S_36110636	2708069	A	C
000056F_2708070_SNP S_36110637	2708070	T	C
000056F_2783065_SNP S_36117573	2783065	G	A
000056F_2438233_SNP S_36085744	2438233	C	T
000056F_3007709_SNP S_36141126	3007709	G	A
000056F_1783255_SNP S_36021584	1783255	T	A
000056F_2040306_SNP S_36046948	2040306	A	C
000056F_1693165_SNP S_36013920	1693165	A	G
000056F_1693154_SNP S_36013918	1693154	T	A
000056F_1094244_SNP S_35953897	1094244	C	A
000056F_2033686_SNP S_36046393	2033686	G	A
000056F_1402777_SNP	1402777	T	A
000056F_1855263_SNP	1855263	G	A
000056F_2040307_SNP S_36046949	2040307	C	A
000056F_1402776_SNP	1402776	A	T
000056F_2141251_SNP S_36056596	2141251	C	T
000056F_2859185_SNP S_36124500	2859185	C	A
000056F_1583349_SNP S_36003885	1583349	G	A
000056F_1668782_SNP S_36011714	1668782	C	T
000056F_1668785_SNP	1668785	G	A
000056F_1402775_SNP	1402775	T	A
000056F_3137999_SNP S_36155955	3137999	G	A
000056F_2082476_SNP S_36050809	2082476	C	T
000056F_1843634_SNP S_36026852	1843634	T	A
000056F_1565338_SNP S_36002372	1565338	A	C
000056F_633735_SNP S_35912257	633735	G	T
000056F_3086055_SNP S_36151528	3086055	A	G
000056F_2067661_SNP S_36049678	2067661	C	T
000056F_3172842_SNP S_36159281	3172842	A	G
000056F_2440491_SNP S_36085877	2440491	C	T
000056F_1135218_SNP S_35957266	1135218	C	T
000056F_4111772_SNP S_36273846	4111772	G	T
000056F_3282987_SNP S_36171105	3282987	G	A
000056F_1135202_SNP S_35957263	1135202	C	A
000056F_2430089_SNP S_36085141	2430089	G	A
000056F_2665161_SNP S_36106947	2665161	T	A
000056F_1668726_SNP S_36011702	1668726	A	C
000056F_1171922_SNP S_35960921	1171922	C	T
000056F_1017496_SNP S_35946992	1017496	T	C
000056F_2652975_SNP S_36105762	2652975	T	G
000056F_1668725_SNP S_36011701	1668725	T	C

SNP Name	Position (SEQ ID NO: 1)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
000056F_1641733_SNP S_36009489	1641733	A	G
000056F_1509812_SNP S_35996542	1509812	A	G
000056F_633713_SNP S_35912255	633713	A	G
000056F_4177697_SNP S_36280444	4177697	C	T
000056F_2765701_SNP S_36116070	2765701	A	G
000056F_2765703_SNP S_36116071	2765703	G	A
000056F_1509817_SNP S_35996543	1509817	T	C
000056F_1135192_SNP S_35957262	1135192	G	C
000056F_1509823_SNP S_35996544	1509823	T	A
000056F_1509843_SNP S_35996546	1509843	T	A
000056F_1017473_SNP S_35946991	1017473	T	C

**Table 2: SNP Positions within SEQ ID NO: 2 that are associated with increased resistance to
ASR**

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22911862 S_61301213	908	C	A
S_22911888 S_61301282	1288	T	A
S_22911889 S_61301286	1300	C	A
S_22911890 S_61301288	1313	G	C
S_22911891 S_61301289	1314	T	A
S_22911894 S_61301299	1354	G	A
S_22911902 S_61301312	1430	A	T
S_22911914 S_61301349	1687	A	C
S_22911929 S_61301393	2069	T	A
S_22911937 S_61301419	2219	G	T
S_22911981 S_61301492	2641	A	G
S_22911997 S_61301544	2799	T	A
S_22912000 S_61301560	2870	A	G
S_22912002 S_61301561	2878	A	C
S_22912056 S_61301715	3423	C	G
S_22912059 S_61301727	3449	T	G
S_22912195 S_61302099	4816	G	T
S_22912196 S_61302100	4817	A	C
I_1463111 I_2435895	4959	T	TG
S_22912218 S_61302144	5016	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22912291 S_61302295	5443	A	T
S_22912401 S_61302658	6904	A	G
S_22912430 S_61302824	7424	C	A
S_22912536 S_61303156	8660	G	A
S_22912539 S_61303174	8731	C	A
S_22912541 S_61303181	8779	C	T
S_22912668 S_61303640	10343	G	T
S_22912672 S_61303650	10390	G	C
S_22912710 S_61303752	10753	T	C
S_22912722 S_61303783	10925	A	G
S_22912724 S_61303784	10929	C	A
S_22912727 S_61303804	11028	G	T
S_22912736 S_61303835	11212	T	A
S_22912738 S_61303844	11243	A	C
S_22912788 S_61304002	12025	G	T
S_22912853 S_61304203	12744	A	G
S_22912862 S_61304223	12942	T	G
S_22912865 S_61304228	12970	A	G
S_22912893 S_61304282	13384	A	G
S_22913136 S_61304586	15143	G	C
S_22913137 S_61304589	15165	A	G
S_22913145 S_61304613	15295	G	A
S_22913147 S_61304619	15327	A	G
S_22913148 S_61304620	15328	T	C
S_22913151 S_61304624	15371	A	G
S_22913152 S_61304628	15379	C	T
S_22913153 S_61304629	15380	G	T
S_22913169 S_61304732	15690	A	G
S_22913219 S_61304930	16357	A	T
S_22913223 S_61304938	16390	T	C
S_22913225 S_61304946	16425	C	G
S_22913232 S_61304972	16533	C	G
S_22913233 S_61304978	16560	T	A
S_22913234 S_61304988	16619	T	A
S_22913236 S_61304990	16655	G	A
S_22913248 S_61305014	16805	C	T
S_22913257 S_61305035	16957	C	A
S_22913258 S_61305043	17003	G	T
S_22913435 S_61305485	19313	C	A
S_22913508 S_61305683	20107	A	G
S_22913626 S_61305962	21519	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22913643 S_61305994	21701	T	A
S_22913719 S_61306023	21959	A	C
S_22913750 S_61306111	22147	T	C
S_22913751 S_61306112	22150	G	C
S_22913773 S_61306161	22357	T	A
S_22913830 S_61306252	22706	A	C
S_22913839 S_61306256	22764	A	C
S_22913840 S_61306257	22766	C	T
S_22913841 S_61306258	22768	T	A
S_22913851 S_61306309	22928	A	G
S_22913852 S_61306315	22942	C	T
S_22913913 S_61306436	23433	T	C
S_22914007 S_61306615	24165	C	T
S_22914013 S_61306623	24219	C	T
S_22914035 S_61306660	24529	T	A
S_22914091 S_61306725	24808	A	T
S_22914105 S_61306795	24952	G	A
S_22914106 S_61306800	24955	T	C
S_22914175 S_61307124	26005	T	G
S_22914206 S_61307286	26614	C	A
S_22914308 S_61307513	27060	G	A
S_22914478 S_61307942	28538	T	A
S_22914544 S_61308125	29328	C	A
S_22914570 S_61308170	29562	T	A
S_22914600 S_61308270	29949	T	G
S_22914664 S_61308435	30567	G	T
S_22914666 S_61308452	30636	A	G
S_22914668 S_61308455	30661	G	A
S_22914682 S_61308508	30817	G	A
S_22914683 S_61308510	30828	A	T
S_22914693 S_61308529	30968	C	A
S_22914695 S_61308530	30973	T	A
S_22914696 S_61308531	30979	A	T
S_22914706 S_61308545	31107	C	A
S_22914707 S_61308547	31120	G	A
S_22914711 S_61308557	31267	T	A
S_22914726 S_61308616	31630	T	A
S_22914729 S_61308621	31658	T	G
S_22914756 S_61308684	32156	A	C
S_22914786 S_61308772	32965	A	C
S_22914787 S_61308776	32968	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22914811 S_61308823	33234	A	C
S_22914812 S_61308824	33235	A	T
S_22914840 S_61308933	33551	T	G
S_22914841 S_61308939	33556	T	G
S_22914843 S_61308957	33586	G	T
S_22914852 S_61308995	33738	C	T
S_22914919 S_61309091	34016	T	A
S_22914924 S_61309099	34054	A	G
S_22914951 S_61309147	34299	C	A
S_22914971 S_61309210	34696	C	A
S_22915003 S_61309290	35273	G	T
S_22915194 S_61309849	37176	C	T
S_22915197 S_61309858	37222	A	T
S_22915267 S_61309991	37838	G	C
S_22915268 S_61309992	37841	C	T
S_22915274 S_61310013	37989	G	T
S_22915309 S_61310104	38358	C	T
S_22915328 S_61310167	38695	A	C
S_22915409 S_61310441	39728	T	G
S_22915463 S_61310659	40292	A	G
S_22915582 S_61310957	41519	G	A
S_22915594 S_61311005	41681	A	G
S_22915629 S_61311113	42173	G	T
S_22915697 S_61311280	42941	A	G
S_22915716 S_61311355	43335	T	G
S_22915917 S_61311670	44077	G	A
S_22915987 S_61311788	44457	T	A
S_22916155 S_61312249	46524	A	T
S_22916162 S_61312288	46648	A	T
S_22916217 S_61312388	47080	G	A
S_22916218 S_61312389	47082	G	T
S_22916276 S_61312565	47684	G	A
S_22916292 S_61312593	47816	A	G
S_22916293 S_61312596	47831	G	T
S_22916347 S_61312728	48562	A	T
S_22916370 S_61312788	48923	G	A
S_22916371 S_61312789	48925	C	T
S_22916372 S_61312791	48931	A	T
S_22916374 S_61312801	48953	G	T
S_22916404 S_61312949	49525	A	T
S_22916430 S_61312987	49803	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22916482 S_61313175	50435	G	C
S_22916484 S_61313180	50446	T	C
S_22916714 S_61314075	53534	T	C
S_22916724 S_61314112	53667	C	T
S_22916730 S_61314154	53779	C	A
S_22916937 S_61314747	55977	T	C
S_22916965 S_61314796	56089	G	A
S_22917003 S_61314848	56194	T	C
S_22917004 S_61314856	56213	T	G
S_22917005 S_61314860	56236	C	T
S_22917040 S_61314998	56728	A	G
S_22917043 S_61315012	56794	A	G
S_22917045 S_61315013	56800	A	T
S_22917075 S_61315138	57271	G	C
S_22917123 S_61315300	57731	A	G
S_22917140 S_61315342	57886	A	C
S_22917215 S_61315534	58448	A	G
I_2436465	58568	C	CACAT
S_22917234 S_61315625	58704	T	G
S_22917239 S_61315633	58752	G	A
S_22917255 S_61315699	58962	G	T
S_22917262 S_61315715	58997	G	C
S_22917312 S_61315881	59824	G	T
S_22917364 S_61316001	60437	C	G
S_22917366 S_61316006	60471	A	C
S_22917390 S_61316042	60788	G	A
S_22917394 S_61316056	60868	A	C
S_22917418 S_61316161	61316	C	T
S_22917447 S_61316244	61628	T	C
S_22917449 S_61316247	61645	T	G
S_22917471 S_61316370	62172	T	G
S_22917473 S_61316374	62190	A	T
S_22917545 S_61316556	63166	T	A
S_22917625 S_61316897	64356	G	T
S_22917635 S_61316947	64469	A	G
S_22917642 S_61316958	64514	T	C
S_22917655 S_61317038	64735	G	C
S_22917656 S_61317042	64738	T	G
S_22917659 S_61317055	64769	G	C
S_22917693 S_61317179	65208	T	C
S_22917694 S_61317180	65209	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22917763 S_61317420	65910	T	C
S_22917856 S_61317741	67074	C	T
S_22917927 S_61317921	67873	A	G
S_22917987 S_61318108	68965	T	C
S_22917995 S_61318126	69045	T	C
S_22918142 S_61318447	69951	A	G
S_22918152 S_61318496	70075	C	T
S_22918157 S_61318502	70118	C	A
S_22918158 S_61318511	70138	G	A
S_22918159 S_61318517	70156	C	A
S_22918547 S_61319316	73104	A	G
S_22918602 S_61319435	73725	A	T
S_22918626 S_61319533	74057	T	C
S_22918635 S_61319564	74246	C	A
S_22918657 S_61319678	74653	A	T
S_22918749 S_61320004	75858	T	A
S_22918826 S_61320156	76519	G	A
S_22918946 S_61320428	77497	A	T
S_22918958 S_61320456	77642	C	T
S_22919109 S_61320887	79615	T	C
S_22919130 S_61320906	79728	T	A
I_1463612 I_2436784	80865	A	ACTC
S_22919250 S_61321243	80875	A	C
S_22919336 S_61321455	81561	C	G
S_22919644 S_61322008	83228	G	T
S_22919645 S_61322009	83229	C	A
S_22919648 S_61322019	83285	T	C
S_22919651 S_61322033	83334	G	T
S_22919666 S_61322231	83658	T	A
S_22919668 S_61322233	83667	T	A
S_22919684 S_61322273	83765	A	G
S_22919719 S_61322411	84492	G	A
S_22919720 S_61322412	84493	A	C
S_22919740 S_61322454	84711	T	G
S_22919754 S_61322473	84777	C	G
S_22919765 S_61322487	84795	T	A
S_22919777 S_61322517	84890	T	C
S_22919818 S_61322599	85259	T	C
S_22921322 S_61325762	91678	G	A
S_22921326 S_61325772	91743	C	T
S_22921403 S_61325993	93028	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22921404 S_61326004	93062	C	T
S_22921406 S_61326017	93076	C	T
S_22921408 S_61326043	93116	G	C
S_22921421 S_61326093	93343	T	G
S_22921429 S_61326108	93422	C	T
S_22921446 S_61326139	93566	C	T
S_22921515 S_61326354	94157	C	T
S_22921525 S_61326403	94311	G	A
S_22921537 S_61326419	94383	C	T
S_22921540 S_61326421	94390	A	G
S_22921656 S_61326632	95027	T	C
S_22921674 S_61326680	95122	A	G
S_22921709 S_61326808	95627	C	A
S_22921725 S_61326858	95844	C	A
S_22921728 S_61326865	95861	T	G
I_1463780 I_2437079	95891	A	AT
S_22921778 S_61326998	96416	T	G
S_22921824 S_61327097	96773	A	G
S_22921828 S_61327101	96785	C	T
S_22921898 S_61327236	97333	G	C
S_22921952 S_61327346	97595	A	C
S_22922032 S_61327594	98689	C	T
S_22922117 S_61327781	99371	G	A
S_22922118 S_61327784	99386	T	G
S_22922128 S_61327830	99569	T	C
S_22922137 S_61327854	99679	T	A
S_22922222 S_61328109	100910	G	C
S_22922226 S_61328116	100928	A	C
S_22922340 S_61328526	102534	G	A
S_22922427 S_61328733	103393	A	T
S_22922455 S_61328804	103666	A	G
S_22922458 S_61328809	103703	G	T
S_22922461 S_61328823	103780	C	A
S_22922697 S_61329546	105840	C	G
S_22922721 S_61329622	106083	C	A
S_22922733 S_61329633	106197	G	A
S_22922798 S_61329792	106949	C	A
S_22922802 S_61329801	107011	A	C
S_22922811 S_61329810	107055	A	G
S_22922813 S_61329814	107085	A	G
S_22922875 S_61329960	107735	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22922878 S_61329966	107757	G	C
S_22922879 S_61329967	107759	G	A
S_22922897 S_61330025	107979	T	C
S_22922898 S_61330026	107981	T	A
S_22922899 S_61330027	107987	A	C
S_22922933 S_61330140	108452	T	G
S_22923004 S_61330365	109620	T	A
S_22923005 S_61330366	109621	T	A
S_22923023 S_61330412	109832	C	T
S_22923052 S_61330575	110189	C	T
S_22923398 S_61331336	113074	G	A
S_22923408 S_61331361	113253	T	C
S_22923563 S_61331714	114852	A	G
S_22923566 S_61331730	114981	A	T
S_22923811 S_61332392	117077	A	G
S_22923826 S_61332457	117385	T	G
S_22923854 S_61332500	117905	C	A
S_22923943 S_61332959	123256	G	T
S_22923944 S_61332961	123258	T	A
S_22923946 S_61332966	123280	C	A
S_22923980 S_61333065	123780	A	G
S_22923997 S_61333119	123930	A	G
S_22923998 S_61333121	123933	A	G
S_22924003 S_61333134	123985	G	A
S_22924004 S_61333137	123992	C	T
S_22924016 S_61333159	124078	A	G
S_22924017 S_61333163	124088	T	C
S_22924065 S_61333301	124623	T	C
S_22924066 S_61333305	124653	C	A
S_22924067 S_61333309	124657	A	G
S_22924193 S_61333685	127594	A	T
S_22924194 S_61333686	127610	A	C
S_22924195 S_61333689	127642	C	A
S_22924197 S_61333692	127675	G	A
S_22924201 S_61333700	127750	T	C
S_22924202 S_61333701	127753	G	A
S_22924209 S_61333712	127837	T	A
S_22924224 S_61333730	128177	A	C
S_22924249 S_61333843	128559	G	C
S_22924259 S_61333864	128623	T	A
S_22924260 S_61333865	128626	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22924532 S_61334416	131305	T	C
S_22924534 S_61334423	131340	G	T
S_22924535 S_61334425	131353	T	C
S_22924554 S_61334462	131571	A	C
S_22924637 S_61334633	132288	T	A
S_22924806 S_61335196	134484	A	G
S_22924856 S_61335323	135152	A	G
S_22924889 S_61335423	135783	T	C
S_22924892 S_61335433	135801	T	G
S_22924902 S_61335478	135955	G	C
S_22924903 S_61335482	135958	A	T
S_22924932 S_61335542	136263	C	T
S_22924953 S_61335575	136315	T	A
S_22924955 S_61335590	136344	A	T
S_22924960 S_61335605	136406	C	T
S_22924961 S_61335615	136447	T	C
S_22924984 S_61335654	136609	C	A
S_22925046 S_61335881	137644	G	T
S_22925047 S_61335883	137648	T	G
S_22925048 S_61335885	137676	T	G
S_22925051 S_61335889	137695	T	C
S_22925065 S_61335916	137860	A	G
S_22925090 S_61335966	138089	T	A
S_22925102 S_61335993	138224	C	G
S_22925104 S_61335996	138239	C	T
S_22925113 S_61336015	138309	A	C
S_22925128 S_61336058	138518	T	C
S_22925129 S_61336059	138519	T	A
S_22925132 S_61336063	138563	T	C
S_22925152 S_61336240	139142	G	A
S_22925155 S_61336246	139163	T	C
S_22925157 S_61336251	139181	A	C
S_22925184 S_61336329	139528	A	G
S_22925200 S_61336380	139877	G	A
S_22925201 S_61336389	139912	A	G
S_22925210 S_61336431	140142	T	A
S_22925222 S_61336478	140392	T	C
S_22925223 S_61336482	140418	A	C
S_22925241 S_61336529	140613	A	G
S_22925250 S_61336538	140673	C	A
S_22925253 S_61336547	140704	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22925254 S_61336548	140726	C	G
S_22925255 S_61336549	140730	T	C
S_22925271 S_61336593	140939	C	T
S_22925272 S_61336594	140940	A	C
S_22925320 S_61336709	141390	T	C
S_22925323 S_61336723	141442	A	G
S_22925341 S_61336803	142042	A	G
S_22925343 S_61336811	142092	G	A
S_22925373 S_61336905	142520	A	G
S_22925375 S_61336906	142521	A	T
S_22925395 S_61336947	142762	C	A
S_22925436 S_61337041	143040	T	A
S_22925439 S_61337046	143060	A	G
S_22925441 S_61337061	143137	T	A
S_22925447 S_61337070	143170	G	T
S_22925452 S_61337081	143203	G	T
S_22925455 S_61337085	143245	G	A
S_22925479 S_61337151	143588	G	T
S_22925480 S_61337153	143598	T	A
S_22925481 S_61337159	143641	C	G
S_22925484 S_61337167	143683	T	A
S_22925486 S_61337173	143721	G	C
S_22925488 S_61337187	143793	T	C
S_22925491 S_61337197	143852	A	G
S_22925492 S_61337199	143853	C	T
S_22925493 S_61337200	143855	A	G
S_22925542 S_61337426	144735	G	C
S_22925595 S_61337562	145303	A	C
S_22925600 S_61337587	145378	G	A
S_22925644 S_61337684	146014	T	A
S_22925647 S_61337686	146034	G	A
S_22925648 S_61337687	146035	C	A
S_22925686 S_61337766	146620	T	A
S_22925690 S_61337771	146679	T	C
S_22925691 S_61337772	146680	G	C
S_22925695 S_61337787	146744	A	G
S_22925715 S_61337913	147144	T	G
S_22925716 S_61337919	147176	T	G
I_1464094 I_2437625	147208	A	AG
S_22925719 S_61337925	147209	A	T
S_22925752 S_61338040	147842	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22925850 S_61338331	148968	G	A
S_22925875 S_61338486	149659	T	G
S_22926145 S_61339378	152785	T	C
S_22926173 S_61339481	153007	A	T
S_22926174 S_61339495	153024	C	A
S_22926175 S_61339496	153027	A	C
S_22926200 S_61339558	153335	G	A
S_22926201 S_61339560	153337	G	A
S_22926235 S_61339656	153668	G	A
S_22926247 S_61339691	153855	A	G
S_22926255 S_61339719	153963	C	T
S_22926268 S_61339771	154237	C	T
S_22926275 S_61339776	154273	T	A
S_22926279 S_61339799	154370	A	G
S_22926288 S_61339813	154416	T	G
S_22926292 S_61339823	154461	C	T
S_22926294 S_61339825	154470	T	C
S_22926312 S_61339863	154654	A	G
S_22926314 S_61339869	154680	A	C
S_22926315 S_61339870	154682	A	T
I_1464152 I_2437721	156001	T	TTGCA
S_22926451 S_61340171	156002	C	T
S_22926467 S_61340199	156154	C	T
S_22926528 S_61340261	156414	G	A
S_22926640 S_61340420	157291	C	T
S_22926680 S_61340528	157835	A	G
S_22926683 S_61340543	157893	G	A
S_22926708 S_61340616	158202	T	C
S_22926711 S_61340617	158215	A	T
S_22926712 S_61340618	158216	G	T
S_22926728 S_61340669	158423	C	T
S_22926732 S_61340674	158449	G	T
S_22926733 S_61340675	158465	G	A
S_22926738 S_61340701	158588	G	T
S_22926761 S_61340742	158841	A	G
S_22926763 S_61340785	158910	A	T
S_22926764 S_61340788	158914	A	C
S_22926772 S_61340833	159092	A	T
S_22926910 S_61341183	160461	G	T
S_22926947 S_61341384	161293	G	C
S_22926957 S_61341433	161602	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22926959 S_61341437	161650	T	C
S_22926969 S_61341453	161784	C	T
S_22926976 S_61341462	161827	G	A
S_22926985 S_61341476	161928	C	A
S_22926986 S_61341478	161939	A	G
S_22926993 S_61341490	162020	C	T
S_22926994 S_61341492	162029	T	C
S_22926995 S_61341493	162030	A	G
S_22927061 S_61341637	162523	A	T
S_22927064 S_61341650	162576	A	G
S_22927124 S_61341852	163349	G	T
D_1464195 D_2437799	163371	CTT	C
S_22927127 S_61341866	163425	G	A
S_22927174 S_61341926	163570	T	C
S_22927222 S_61342048	164062	C	A
S_22927224 S_61342051	164081	C	A
S_22927290 S_61342397	165209	A	T
S_22927291 S_61342401	165231	G	C
I_1464203 I_2437821	166363	G	GA
S_22927423 S_61342869	166860	T	A
S_22927509 S_61343196	168118	C	T
S_22927512 S_61343213	168186	G	A
S_22927517 S_61343246	168256	G	T
S_22927573 S_61343446	169064	A	G
S_22927592 S_61343467	169149	A	G
S_22927662 S_61343752	170133	C	T
S_22927663 S_61343753	170134	G	A
S_22927667 S_61343760	170178	A	C
S_22927672 S_61343771	170277	G	A
S_22927677 S_61343778	170322	C	T
S_22927679 S_61343779	170331	A	G
S_22927691 S_61343796	170461	T	C
S_22927692 S_61343797	170469	G	A
S_22927831 S_61344273	171760	T	C
S_22927887 S_61344516	172478	G	A
S_22927908 S_61344577	172743	A	C
S_22927938 S_61344679	173129	G	A
S_22927939 S_61344682	173137	T	G
S_22927940 S_61344683	173139	C	T
S_22927962 S_61344737	173412	G	C
S_22928000 S_61344894	173915	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22928020 S_61344962	174163	G	A
S_22928021 S_61344963	174164	C	A
S_22928087 S_61345039	174516	C	A
S_22928122 S_61345087	174648	G	A
S_22928239 S_61345357	176028	A	G
S_22928313 S_61345593	176890	G	C
S_22928573 S_61346155	178900	T	C
S_22928575 S_61346161	178928	C	T
S_22928578 S_61346164	178938	G	A
S_22928579 S_61346165	178941	C	G
S_22928585 S_61346193	179067	A	G
S_22928586 S_61346194	179069	G	A
S_22928704 S_61346716	180337	G	A
I_2437957	180348	A	ATT
S_22928797 S_61347006	181083	C	T
S_22928805 S_61347025	181189	A	T
S_22929050 S_61347554	183095	A	T
S_22929091 S_61347687	183616	A	T
S_22929106 S_61347752	183917	C	A
S_22929116 S_61347776	183987	T	G
S_22929166 S_61347833	184222	T	A
S_22929168 S_61347835	184235	T	A
S_22929169 S_61347836	184236	G	A
S_22929192 S_61347888	184620	G	A
S_22929194 S_61347891	184625	A	T
S_22929195 S_61347893	184629	C	T
S_22929215 S_61347949	184858	G	A
S_22929218 S_61347961	184920	G	A
S_22929590 S_61348770	188072	G	C
S_22929699 S_61349061	188843	T	A
S_22929848 S_61349505	190279	A	G
S_22929906 S_61349615	190654	C	T
S_22929972 S_61349699	190844	A	G
S_22930065 S_61349921	191494	T	G
S_22930078 S_61349960	191603	A	T
S_22930086 S_61349980	191729	T	C
S_22930087 S_61349982	191733	A	G
S_22930098 S_61350014	191849	T	C
S_22930099 S_61350021	191891	G	T
S_22930101 S_61350036	191948	A	G
S_22930107 S_61350072	192057	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22930132 S_61350141	192166	G	A
S_22930145 S_61350195	192391	C	A
S_22930146 S_61350197	192394	A	C
S_22930147 S_61350199	192396	A	T
S_22930173 S_61350298	192808	G	T
S_22930174 S_61350304	192827	T	A
S_22930175 S_61350308	192845	T	C
S_22930177 S_61350312	192866	G	A
S_22930179 S_61350315	192886	G	A
S_22930379 S_61350695	194469	G	C
S_22930823 S_61351439	195366	T	A
S_22931648 S_61352642	197193	G	A
S_22931649 S_61352643	197197	G	A
S_22931650 S_61352645	197210	A	G
S_22931652 S_61352647	197232	G	C
S_22931662 S_61352666	197319	G	A
S_22931670 S_61352686	197418	A	G
S_22931676 S_61352703	197471	C	T
S_22931709 S_61352896	198048	A	C
S_22931789 S_61353080	198823	A	T
S_22931809 S_61353113	198930	C	T
S_22931810 S_61353119	198954	A	G
S_22931811 S_61353122	198968	A	C
S_22931825 S_61353149	199227	A	G
S_22931923 S_61353447	200338	C	G
S_22931931 S_61353450	200369	G	T
S_22931936 S_61353454	200402	T	A
S_22931941 S_61353474	200498	A	C
S_22931967 S_61353560	200897	A	G
S_22932005 S_61353681	201751	T	A
S_22932006 S_61353682	201755	C	T
S_22932007 S_61353683	201761	A	G
S_22932008 S_61353685	201773	G	A
S_22932015 S_61353710	201927	T	C
S_22932018 S_61353713	201949	C	T
S_22932019 S_61353718	201962	C	T
S_22932020 S_61353719	201966	T	A
S_22932023 S_61353724	202012	T	A
S_22932026 S_61353726	202029	T	C
S_22932027 S_61353731	202053	C	T
S_22932028 S_61353734	202076	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22932029 S_61353735	202078	G	A
S_22932032 S_61353739	202100	T	C
S_22932033 S_61353740	202108	T	A
S_22932037 S_61353753	202163	G	C
S_22932114 S_61353902	202870	A	T
S_22932123 S_61353968	203046	C	G
S_22932125 S_61353972	203080	T	C
S_22932127 S_61353978	203122	C	T
S_22932129 S_61353979	203136	G	A
S_22932133 S_61353989	203215	G	A
S_22932134 S_61353990	203232	G	T
S_22932144 S_61354039	203551	A	G
S_22932145 S_61354041	203553	T	G
S_22932146 S_61354043	203558	A	G
S_22932177 S_61354115	203922	C	T
S_22932180 S_61354137	204107	C	T
S_22932211 S_61354183	204410	T	A
S_22932290 S_61354369	205229	C	T
S_22932304 S_61354422	205454	C	T
S_22932306 S_61354436	205565	A	G
S_22932309 S_61354444	205607	G	C
S_22932312 S_61354457	205634	C	T
S_22932345 S_61354590	206361	G	A
S_22932346 S_61354591	206362	A	C
S_22932355 S_61354619	206488	C	T
S_22932356 S_61354622	206503	T	C
S_22932578 S_61355160	208609	A	G
S_22932882 S_61356096	210834	C	A
S_22934209 S_61359014	216818	T	G
S_22934221 S_61359053	217043	A	T
S_22934222 S_61359058	217055	T	G
S_22934237 S_61359109	217215	C	A
S_22934289 S_61359243	217599	T	G
S_22934290 S_61359244	217600	T	A
S_22934328 S_61359310	217868	C	A
S_22934330 S_61359312	217922	T	G
S_22934331 S_61359314	217924	A	T
S_22934334 S_61359318	217942	A	G
S_22934355 S_61359400	218260	T	C
S_22934398 S_61359513	218674	A	G
S_22934438 S_61359645	219113	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22934530 S_61359852	220309	T	G
S_22934532 S_61359856	220343	C	A
S_22934533 S_61359857	220356	A	T
S_22934544 S_61359887	220491	T	C
S_22934545 S_61359890	220500	C	T
S_22934546 S_61359891	220506	A	G
S_22934549 S_61359907	220558	C	G
S_22934550 S_61359908	220562	T	G
S_22934556 S_61359932	220664	C	T
S_22934560 S_61359936	220698	A	G
S_22934618 S_61360016	221017	T	G
S_22934623 S_61360028	221109	G	T
S_22934624 S_61360029	221112	T	C
S_22934625 S_61360030	221118	T	C
S_22934632 S_61360039	221223	G	A
S_22934647 S_61360058	221376	A	T
S_22934654 S_61360067	221411	G	T
S_22934724 S_61360190	221653	T	G
S_22934742 S_61360226	221800	A	G
S_22934791 S_61360447	222397	G	C
S_22934792 S_61360448	222400	G	T
S_22934842 S_61360663	223170	C	T
S_22934851 S_61360685	223227	T	C
S_22934884 S_61360777	223524	A	G
S_22934890 S_61360784	223552	C	T
I_1464686 I_2438590	224210	T	TG
S_22934965 S_61361137	224743	G	T
S_22935010 S_61361305	225382	G	C
S_22935060 S_61361518	226148	C	A
S_22935061 S_61361559	226213	A	G
S_22935070 S_61361581	226240	A	G
S_22935085 S_61361620	226391	T	A
S_22935109 S_61361680	226676	A	T
S_22935134 S_61361739	226916	C	A
S_22935151 S_61361785	227187	C	T
S_22935165 S_61361823	227474	G	T
S_22935167 S_61361841	227579	A	G
S_22935172 S_61361858	227668	C	T
S_22935196 S_61361919	228094	A	C
S_22935202 S_61361940	228233	G	A
S_22935222 S_61361981	228552	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22935223 S_61361982	228554	G	A
S_22935224 S_61361983	228558	A	G
S_22935276 S_61362091	229089	G	C
S_22935277 S_61362093	229098	T	A
S_22935345 S_61362254	229709	G	C
S_22935347 S_61362261	229749	T	C
S_22935348 S_61362262	229759	T	G
S_61362282	229898	G	A
S_22935379 S_61362351	230153	G	A
S_22935400 S_61362411	230350	C	A
S_22935402 S_61362421	230377	T	C
S_22935554 S_61362767	231907	C	T
S_22935555 S_61362769	231913	C	T
S_22935556 S_61362770	231914	T	C
S_22935557 S_61362781	231953	G	T
S_22935558 S_61362783	231970	A	T
S_22935559 S_61362784	231973	T	C
S_22935568 S_61362809	232138	G	A
S_22935573 S_61362815	232178	A	C
S_22935811 S_61363456	235706	T	C
S_22935850 S_61363553	236123	T	C
S_22935859 S_61363591	236212	C	T
S_22935881 S_61363640	236527	T	G
S_22935882 S_61363641	236530	C	T
S_22935898 S_61363703	236794	T	A
S_22935907 S_61363711	236844	T	G
S_22935923 S_61363781	237074	T	C
S_22935955 S_61363894	237263	T	C
S_22935976 S_61363914	237308	G	A
S_22936005 S_61363952	237449	A	T
S_22936052 S_61364070	237762	A	G
S_22936053 S_61364071	237771	A	G
S_22936069 S_61364112	237969	G	A
S_22936071 S_61364115	237981	T	A
S_22936073 S_61364122	238017	C	A
S_22936111 S_61364311	238692	C	A
S_22936112 S_61364312	238699	A	C
S_22936352 S_61365194	241330	A	C
S_22936416 S_61365370	242570	C	T
S_22936417 S_61365378	242608	A	C
S_22936433 S_61365426	242821	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22936442 S_61365508	243152	C	G
S_22936444 S_61365536	243225	G	A
S_22936445 S_61365537	243231	T	A
S_22936473 S_61365650	243693	C	A
S_22936474 S_61365661	243769	A	G
S_22936475 S_61365663	243793	A	T
S_22936477 S_61365670	243821	G	C
S_22936478 S_61365672	243825	A	C
S_22936494 S_61365693	243901	T	G
S_22936507 S_61365726	244103	C	G
S_22936533 S_61365807	244345	T	C
S_22936534 S_61365808	244352	T	C
S_22936554 S_61365837	244645	C	T
S_22936555 S_61365838	244648	G	A
S_22936559 S_61365849	244699	A	G
S_22936677 S_61366176	245887	A	G
S_22936686 S_61366181	245928	G	A
S_22936703 S_61366215	246041	G	C
S_22936731 S_61366318	246403	T	A
S_22936756 S_61366390	246752	G	C
S_22936761 S_61366407	246824	A	C
S_22936765 S_61366421	246883	T	A
S_22936820 S_61366726	248143	T	G
S_22936858 S_61366868	248688	T	C
S_22936899 S_61367017	249280	A	T
S_22936902 S_61367032	249333	A	G
S_22936933 S_61367124	249770	A	G
S_22936965 S_61367227	250092	G	C
S_22937015 S_61367400	250756	A	C
S_22937016 S_61367408	250764	C	T
S_22937083 S_61367577	251325	T	G
S_22937087 S_61367582	251364	T	C
S_22937094 S_61367592	251462	G	C
S_22937107 S_61367651	251670	G	C
I_2438881	251866	G	GAA
S_22937117 S_61367671	251954	T	G
S_22937124 S_61367680	252006	A	T
S_22937131 S_61367697	252084	A	T
S_22937137 S_61367707	252173	T	A
S_22937170 S_61367846	252755	G	C
S_22937179 S_61367887	252936	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22937206 S_61367957	253366	T	A
S_22937322 S_61368344	254773	A	G
S_22937353 S_61368423	255162	G	A
S_22937355 S_61368429	255197	C	T
S_22937356 S_61368430	255200	A	G
S_22937357 S_61368433	255241	C	T
S_22937358 S_61368434	255242	T	A
S_22937360 S_61368435	255276	A	T
I_2438963	255427	A	AC
S_22937368 S_61368465	255430	T	A
S_22937370 S_61368468	255432	C	G
S_22937387 S_61368525	255874	A	T
S_22937393 S_61368538	255939	G	T
S_22937401 S_61368559	256036	C	T
S_22937403 S_61368560	256051	C	T
S_22937416 S_61368584	256198	G	A
S_22937425 S_61368599	256257	G	A
S_22937430 S_61368615	256284	G	T
S_22937443 S_61368636	256350	A	T
S_22937444 S_61368639	256355	C	T
S_22937456 S_61368683	256477	A	G
S_22937464 S_61368687	256549	G	T
S_22937465 S_61368688	256550	G	A
S_22937471 S_61368699	256602	A	G
S_22937478 S_61368739	256786	C	T
S_22937479 S_61368742	256794	G	T
S_22937481 S_61368749	256845	C	T
S_22937482 S_61368750	256851	C	T
S_22937488 S_61368755	256871	G	A
S_22937490 S_61368761	256903	T	C
S_22937491 S_61368763	256919	T	A
S_22937496 S_61368770	256982	T	C
S_22937498 S_61368772	257005	C	T
S_22937499 S_61368777	257049	A	G
S_22937500 S_61368779	257055	A	G
S_22937503 S_61368783	257105	C	G
S_22937548 S_61368868	257426	T	C
S_22937567 S_61368921	257689	G	A
S_22937571 S_61368933	257802	T	A
S_22937573 S_61368936	257818	T	C
S_22937580 S_61368952	257941	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22937583 S_61368961	257985	T	C
S_22937590 S_61369000	258311	G	T
S_22937592 S_61369004	258335	C	A
S_22937595 S_61369018	258415	T	A
S_22937596 S_61369021	258431	C	T
S_22937597 S_61369024	258473	C	T
S_22937740 S_61369207	258942	A	G
S_22937742 S_61369209	258945	C	A
S_22937920 S_61369729	260305	C	A
S_22937934 S_61369784	260509	G	C
S_22937988 S_61369966	261347	A	T
S_22938102 S_61370384	263104	T	G
S_22938103 S_61370385	263106	T	A
S_22938119 S_61370476	263484	T	C
S_22938131 S_61370528	263768	C	G
S_22938137 S_61370544	263875	T	C
S_22938155 S_61370622	264273	A	C
S_22938170 S_61370686	264501	C	T
S_22938287 S_61371018	265180	T	C
S_22938341 S_61371175	265699	A	G
S_22938418 S_61371432	266519	C	G
S_22938440 S_61371528	266860	G	T
I_2439084	266878	T	TA
S_22938458 S_61371598	267136	C	T
S_22938460 S_61371600	267141	C	A
S_22938462 S_61371618	267162	G	C
S_22938479 S_61371746	267529	T	G
S_22938488 S_61371771	267642	A	T
S_22938541 S_61371932	268521	G	T
S_22938576 S_61372024	269079	G	A
S_22938584 S_61372037	269209	C	A
S_22938629 S_61372144	269624	G	C
S_22938630 S_61372146	269633	T	C
S_22938631 S_61372152	269676	C	G
I_2439118	270102	G	GATAAA
S_22938684 S_61372257	270361	G	C
S_22938685 S_61372258	270365	A	T
S_22938772 S_61372441	270778	T	C
S_22938815 S_61372562	271191	G	A
S_22938844 S_61372708	271673	A	T
S_22938863 S_61372797	272008	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
D_1465002 D_2439153	272032	CTT	C
S_22938881 S_61372865	272350	A	T
S_22938955 S_61372965	272980	A	T
S_22938969 S_61372995	273193	T	C
S_22939009 S_61373070	273643	A	G
S_22939025 S_61373103	273872	G	A
S_22939203 S_61373582	275348	A	G
S_22939204 S_61373583	275358	A	G
S_22939206 S_61373587	275364	A	C
S_22939214 S_61373610	275476	T	A
S_22939217 S_61373616	275491	T	C
S_22939223 S_61373632	275539	T	A
S_22939238 S_61373689	275732	G	C
S_22939239 S_61373696	275746	A	C
S_22939244 S_61373703	275758	A	C
S_22939271 S_61373749	276066	T	A
S_22939286 S_61373774	276273	G	A
S_22939292 S_61373783	276345	A	C
S_22939302 S_61373815	276555	C	G
D_1465052 D_2439217	276598	CT	C
S_22939362 S_61373980	277035	T	C
S_22939416 S_61374152	277527	A	G
S_22939435 S_61374213	277729	T	C
S_22939466 S_61374290	277981	T	A
S_22939475 S_61374302	278037	C	A
S_22939539 S_61374424	278487	T	C
S_22939578 S_61374488	278830	A	G
S_22939593 S_61374533	279030	C	T
S_22939596 S_61374547	279067	G	T
S_22939597 S_61374553	279083	A	G
S_22939600 S_61374556	279102	T	C
S_22939609 S_61374600	279269	C	A
S_22939783 S_61374933	280638	A	T
S_22939802 S_61374983	280861	G	A
S_22939803 S_61374985	280867	A	C
S_22939804 S_61374989	280888	C	T
S_22939805 S_61374994	280906	A	G
S_22939806 S_61374995	280920	T	C
S_22939807 S_61374998	280931	C	G
S_22939891 S_61375027	281208	A	T
S_22939913 S_61375074	281570	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22939916 S_61375078	281598	T	C
S_22940293 S_61375972	284448	T	C
S_22940294 S_61375973	284467	A	C
S_22940296 S_61375976	284476	C	G
S_22940297 S_61375979	284491	G	A
S_22940298 S_61375982	284507	A	G
S_22940299 S_61375983	284512	C	T
S_22940314 S_61376002	284646	C	T
S_22940318 S_61376009	284679	T	G
S_22940335 S_61376068	284938	C	A
S_22940337 S_61376075	284991	G	T
S_22940340 S_61376078	285007	A	G
S_22940341 S_61376079	285012	C	A
S_22940342 S_61376082	285039	G	T
S_22940344 S_61376083	285052	A	G
S_22940345 S_61376085	285055	G	A
S_22940354 S_61376116	285224	A	G
S_22940355 S_61376127	285283	T	C
S_22940357 S_61376129	285294	A	T
S_22940358 S_61376130	285297	G	A
S_22940373 S_61376165	285496	A	G
S_22940397 S_61376235	285706	T	C
S_22940399 S_61376247	285721	A	G
S_22940404 S_61376263	285773	T	C
S_22940406 S_61376272	285803	T	C
S_22940424 S_61376338	286163	T	C
S_22940427 S_61376350	286229	G	C
S_22940595 S_61376759	287524	T	C
S_22941246 S_61378151	292018	T	C
S_22941247 S_61378153	292027	T	G
S_22941256 S_61378169	292140	A	T
S_22941285 S_61378225	292604	A	C
S_22941546 S_61378731	294256	T	A
S_22941547 S_61378732	294261	G	A
S_22941548 S_61378735	294263	A	G
I_1465204 I_2439425	294970	T	TA
S_22941612 S_61378908	295010	A	C
S_22941622 S_61378927	295121	A	T
S_22941631 S_61378961	295293	G	T
S_22941684 S_61379122	296291	A	T
S_22941706 S_61379219	296671	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22941754 S_61379416	297267	G	T
S_22941770 S_61379468	297612	C	T
S_22941772 S_61379474	297628	G	A
S_22941786 S_61379505	297768	A	G
S_22941787 S_61379506	297773	A	T
S_22941794 S_61379572	298472	C	A
S_22941795 S_61379576	298484	C	T
S_22941796 S_61379578	298495	T	G
S_22941810 S_61379616	298663	C	A
S_22941812 S_61379626	298700	C	T
S_22941819 S_61379662	298815	A	C
S_22941828 S_61379699	298943	G	T
S_22941829 S_61379703	298952	C	T
S_22941836 S_61379726	299057	G	A
S_22941841 S_61379773	299232	A	G
S_22941842 S_61379777	299244	T	A
S_22941859 S_61379822	299436	T	G
S_22941860 S_61379840	299501	C	T
S_22941877 S_61379882	299693	C	T
S_22941881 S_61379893	299727	T	C
S_22941882 S_61379901	299756	C	T
S_22941884 S_61379904	299771	T	C
S_22941885 S_61379909	299784	T	C
S_22941887 S_61379931	299842	C	T
S_22941889 S_61379940	299870	A	G
S_22941895 S_61379949	299910	G	T
S_22941966 S_61380154	300780	C	T
S_22941967 S_61380158	300789	T	A
S_22941994 S_61380314	301210	G	T
S_22942054 S_61380492	301673	G	C
S_22942057 S_61380501	301709	C	A
S_22942063 S_61380523	301801	T	C
S_22942074 S_61380553	301956	A	T
S_22942081 S_61380578	302085	G	T
S_22942114 S_61380620	302295	G	A
S_22942115 S_61380621	302305	C	A
S_22942117 S_61380622	302312	G	T
S_22942140 S_61380684	302577	A	T
S_22942142 S_61380693	302617	A	G
S_22942159 S_61380751	302861	G	A
S_22942181 S_61380834	303019	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22942194 S_61380854	303144	T	G
S_22942200 S_61380861	303185	C	A
S_22942201 S_61380862	303188	T	A
S_22942234 S_61380912	303490	A	G
S_22942275 S_61381010	303796	T	A
S_22942276 S_61381017	303818	T	C
S_22942329 S_61381132	304174	T	C
S_22942421 S_61381486	305524	C	T
S_22942454 S_61381582	305743	T	C
S_22942637 S_61381959	306741	C	G
S_22942642 S_61381970	306803	T	C
S_22942643 S_61381971	306805	G	A
S_22942714 S_61382137	307463	T	C
S_22942781 S_61382250	307929	G	A
S_22942808 S_61382287	307977	T	A
S_22942875 S_61382506	308762	T	A
S_22942890 S_61382572	309077	C	T
S_22942891 S_61382573	309078	A	G
S_22942949 S_61382817	309933	T	C
S_22942953 S_61382828	309974	T	C
S_22942987 S_61383027	310559	A	G
S_22943015 S_61383139	310926	C	T
S_22943026 S_61383172	311107	T	C
S_22943077 S_61383336	311829	G	T
I_1465294 I_2439580	312507	T	TG
S_61383530	312754	G	C
S_22943153 S_61383531	312758	T	C
S_22943189 S_61383595	313149	G	A
S_22943195 S_61383611	313235	C	T
S_22943196 S_61383614	313253	A	T
S_22943197 S_61383617	313275	T	C
S_22943198 S_61383622	313286	A	T
S_22943418 S_61384068	314877	G	A
S_22943447 S_61384146	315224	T	A
S_22943470 S_61384218	315615	C	T
S_22943501 S_61384362	316059	A	T
S_22943503 S_61384365	316081	G	A
S_22943506 S_61384371	316110	G	A
S_22943510 S_61384380	316184	A	T
S_22943536 S_61384413	316408	G	C
S_22943556 S_61384527	316619	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22943561 S_61384543	316661	G	A
S_22943574 S_61384612	316789	T	A
S_22943661 S_61384811	317973	T	C
S_22943664 S_61384816	317996	T	G
S_22943815 S_61385080	319325	C	G
S_22943816 S_61385081	319327	T	G
S_22943824 S_61385127	319491	C	T
S_22943850 S_61385240	319820	A	G
S_22943875 S_61385294	320187	C	A
S_22943885 S_61385321	320352	G	A
S_22943893 S_61385359	320551	C	T
S_22943894 S_61385362	320558	A	G
S_22943915 S_61385476	320891	A	G
S_22943918 S_61385477	320908	A	G
S_22943919 S_61385479	320913	G	A
S_22943933 S_61385511	321070	T	C
S_22944052 S_61385736	321999	G	A
S_22944071 S_61385796	322370	T	A
S_22944072 S_61385804	322413	G	T
S_22944202 S_61386243	323941	A	C
S_22944227 S_61386365	324329	T	A
S_22944292 S_61386572	325336	A	G
S_22944303 S_61386588	325396	T	G
S_22944305 S_61386600	325453	A	G
S_22944327 S_61386665	325823	T	G
S_22944329 S_61386672	325866	T	G
S_22944334 S_61386686	325963	A	G
S_22944345 S_61386705	326086	G	C
S_22944379 S_61386796	326640	C	T
S_22944384 S_61386821	326758	A	G
S_22944386 S_61386825	326798	A	T
S_22944388 S_61386828	326805	C	G
S_22944401 S_61386889	326970	T	A
S_22944403 S_61386893	327004	T	A
S_22944419 S_61386916	327162	A	T
S_22944423 S_61386922	327216	C	A
S_22944430 S_61386953	327367	G	T
S_22944436 S_61386965	327432	A	T
S_22944453 S_61387038	327760	C	T
S_22944455 S_61387041	327782	G	A
S_22944459 S_61387048	327826	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22944474 S_61387099	328064	G	A
S_22944487 S_61387124	328160	C	T
S_22944536 S_61387287	328836	G	A
S_22944557 S_61387329	329027	G	C
S_22944559 S_61387331	329033	G	T
S_22944561 S_61387340	329068	C	A
S_22944567 S_61387390	329269	G	A
S_22944569 S_61387391	329281	C	T
S_22944571 S_61387408	329350	G	C
S_22944632 S_61387597	330088	A	T
S_22944709 S_61387763	331055	C	T
S_22944712 S_61387764	331090	T	C
S_22944823 S_61387919	331714	G	T
S_22944880 S_61388026	332101	C	T
S_22944884 S_61388031	332176	T	A
S_22944889 S_61388039	332236	T	C
S_22944890 S_61388040	332237	A	T
S_22944892 S_61388044	332252	G	A
S_22944893 S_61388047	332277	A	C
S_22944899 S_61388059	332365	C	A
S_22944903 S_61388079	332433	C	A
S_22944904 S_61388082	332453	G	C
S_22944918 S_61388098	332497	T	C
S_22944949 S_61388139	332679	G	A
S_22944950 S_61388144	332698	G	A
S_22944957 S_61388161	332820	G	T
S_22944959 S_61388172	332859	A	T
S_22944962 S_61388185	332900	A	T
S_22944964 S_61388191	332921	T	A
S_22945070 S_61388401	333689	G	A
S_22945087 S_61388496	334230	A	G
S_22945088 S_61388502	334266	A	C
S_22945099 S_61388553	334439	A	G
S_22945153 S_61388658	334812	A	C
S_22945156 S_61388677	334861	T	C
S_22945159 S_61388678	334877	T	C
S_22945221 S_61388890	335624	T	C
S_22945298 S_61389130	336374	T	G
S_22945299 S_61389131	336377	G	T
S_22945310 S_61389150	336512	A	T
S_22945312 S_61389160	336530	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22945329 S_61389202	336904	T	C
S_22945364 S_61389299	337399	T	C
S_22945368 S_61389310	337472	T	C
S_22945369 S_61389311	337475	A	T
S_22945388 S_61389362	337794	G	C
S_22945391 S_61389370	337817	C	A
S_22945400 S_61389400	337968	A	G
S_22945401 S_61389401	337969	A	G
S_22945402 S_61389402	337970	A	G
S_22945411 S_61389421	338119	A	G
S_22945434 S_61389510	338580	A	G
S_22945439 S_61389531	338696	A	G
S_22945446 S_61389556	338810	C	A
S_22945482 S_61389641	339513	T	A
I_2439906	339522	A	ATT
S_22945485 S_61389649	339551	T	C
S_22945492 S_61389681	339665	A	G
S_22945499 S_61389749	339785	A	T
S_22945500 S_61389760	339849	T	C
S_22945501 S_61389761	339850	G	T
S_22945534 S_61389865	340589	G	A
S_22945535 S_61389870	340623	G	A
S_22945537 S_61389877	340664	C	T
S_22945538 S_61389878	340665	G	T
S_22945617 S_61390135	341555	G	A
S_22945618 S_61390136	341556	C	A
S_22945697 S_61390304	342263	A	G
S_22945726 S_61390420	342577	A	G
S_22945730 S_61390423	342588	A	G
S_22945758 S_61390506	342935	A	G
S_22945781 S_61390571	343248	C	A
S_22945782 S_61390573	343254	T	C
S_22945783 S_61390575	343265	T	C
S_22945784 S_61390580	343278	T	C
S_22945785 S_61390581	343297	A	G
S_22945786 S_61390582	343317	A	G
S_22945793 S_61390594	343373	T	C
S_22945794 S_61390596	343376	T	C
S_22945797 S_61390602	343389	A	G
S_22945799 S_61390605	343397	T	C
S_22945811 S_61390626	343453	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22945813 S_61390630	343479	T	C
S_22945821 S_61390642	343555	A	G
S_22945822 S_61390643	343562	A	G
S_22945823 S_61390647	343571	T	A
S_22945824 S_61390648	343574	G	A
S_22945827 S_61390661	343627	T	C
S_22945830 S_61390674	343687	C	G
S_22945861 S_61390807	344187	C	A
S_22945868 S_61390816	344227	A	C
S_22945878 S_61390843	344303	G	C
S_22945940 S_61390970	344713	C	A
S_22945959 S_61391002	344943	A	T
S_22945961 S_61391012	345015	G	C
S_22945974 S_61391030	345165	A	G
S_22945975 S_61391034	345195	C	A
S_22945994 S_61391071	345410	C	T
S_22945995 S_61391072	345414	A	G
S_22946089 S_61391318	346349	T	A
S_22946092 S_61391328	346375	A	G
S_22946097 S_61391397	346467	A	G
S_22946115 S_61391487	346684	A	G
S_22946125 S_61391520	346795	C	T
S_22946273 S_61391867	348295	T	C
S_22946377 S_61392171	349620	G	A
S_22946437 S_61392320	350189	T	C
S_22946512 S_61392535	351215	T	C
S_22946543 S_61392602	351566	A	C
S_22946704 S_61393071	353182	C	G
S_22946804 S_61393395	354320	T	G
S_22946837 S_61393482	354686	T	C
S_22946850 S_61393508	354827	C	T
S_22946934 S_61393704	355862	G	A
S_22946966 S_61393745	356168	A	G
S_22946989 S_61393766	356232	G	T
S_22947012 S_61393815	356596	C	A
S_22947013 S_61393816	356599	G	A
S_22947015 S_61393817	356604	T	C
S_22947066 S_61394008	357238	A	G
S_22947071 S_61394024	357297	A	C
S_22947080 S_61394069	357458	C	T
S_22947114 S_61394193	357860	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22947117 S_61394204	357910	G	A
S_22947299 S_61395033	360325	C	T
S_22947300 S_61395035	360335	T	A
S_22947313 S_61395083	360593	G	A
S_22947340 S_61395157	360968	A	C
S_22947342 S_61395158	360969	T	G
S_22947375 S_61395249	361386	A	G
S_22947383 S_61395267	361573	A	G
S_22947388 S_61395296	361719	G	A
S_22947400 S_61395399	362039	C	A
S_22947414 S_61395421	362205	T	C
S_22947415 S_61395422	362221	A	T
S_22947417 S_61395426	362245	A	T
S_22947419 S_61395431	362284	C	T
S_22947436 S_61395478	362570	G	A
S_22947444 S_61395502	362776	T	C
S_22947475 S_61395596	363218	C	T
S_22947476 S_61395598	363273	G	A
S_22947477 S_61395599	363276	G	T
S_22947478 S_61395609	363317	G	T
S_22947497 S_61395647	363617	T	C
S_22947498 S_61395650	363681	G	A
S_22947499 S_61395652	363691	A	G
S_22947500 S_61395653	363711	G	A
S_22947501 S_61395658	363744	T	A
S_22947504 S_61395665	363801	G	T
S_22947507 S_61395666	363816	G	A
S_22947530 S_61395723	364082	T	A
S_22947532 S_61395727	364130	C	T
S_22947534 S_61395735	364154	T	C
S_22947536 S_61395738	364181	C	A
S_22947537 S_61395740	364187	G	C
S_22947553 S_61395782	364427	G	T
S_22947575 S_61395848	364941	A	T
S_22947579 S_61395877	365133	C	A
S_22947580 S_61395879	365148	C	A
S_22947581 S_61395881	365153	T	G
S_22947604 S_61395908	365235	C	T
S_22947617 S_61395925	365279	G	T
S_22947627 S_61395945	365412	C	T
S_22947628 S_61395946	365414	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22947629 S_61395947	365422	A	G
S_22947638 S_61395973	365544	T	C
S_22947639 S_61395974	365559	T	C
S_22947640 S_61395976	365563	G	A
S_22947641 S_61395980	365596	A	G
S_22947642 S_61395982	365614	C	T
S_22947643 S_61395983	365617	A	G
S_22947646 S_61395991	365661	A	T
S_22947647 S_61395999	365691	G	A
S_22947648 S_61396000	365694	C	T
S_22947649 S_61396007	365730	G	A
S_22947650 S_61396010	365740	A	G
S_22947651 S_61396011	365742	A	G
S_22947652 S_61396012	365743	T	C
S_22947660 S_61396029	365849	T	C
S_22947661 S_61396030	365867	A	G
S_22947663 S_61396034	365901	G	A
I_1465640 I_2440165	365926	T	TG
S_22947665 S_61396040	365943	C	T
S_22947674 S_61396084	366053	T	A
S_22947675 S_61396085	366056	T	A
S_22947678 S_61396100	366101	A	G
S_22947679 S_61396102	366110	A	G
S_22947680 S_61396128	366201	T	C
S_22947687 S_61396138	366269	G	A
S_22947688 S_61396139	366277	A	G
S_22947689 S_61396142	366279	A	T
S_22947704 S_61396169	366426	G	A
S_22947706 S_61396173	366433	G	A
S_22947717 S_61396206	366539	C	T
S_22947766 S_61396282	366703	T	A
S_22947775 S_61396301	366808	T	C
S_22947776 S_61396303	366811	C	T
S_22947777 S_61396304	366813	T	G
S_22947796 S_61396367	367057	G	A
S_22947800 S_61396385	367131	G	T
S_22947801 S_61396386	367132	A	G
S_22947802 S_61396398	367172	T	C
S_22947803 S_61396399	367176	G	A
S_22947804 S_61396400	367182	G	A
S_22947805 S_61396402	367188	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22947806 S_61396404	367192	T	C
S_22947810 S_61396433	367300	G	A
S_22947812 S_61396439	367326	G	A
S_22947813 S_61396442	367327	C	T
S_22947814 S_61396443	367329	G	A
S_22947815 S_61396444	367343	G	C
S_22947816 S_61396445	367344	C	G
S_22947861 S_61396607	367939	T	A
S_22947917 S_61396771	368880	G	C
S_22947937 S_61396832	369102	T	C
S_22947974 S_61396984	369777	A	C
S_22948001 S_61397024	369915	A	G
S_22948005 S_61397030	369932	G	C
S_22948070 S_61397377	370909	G	T
S_22948114 S_61397463	371201	T	C
S_22948116 S_61397475	371248	C	T
S_22948118 S_61397485	371285	A	G
S_22948123 S_61397487	371304	C	T
S_22948124 S_61397489	371315	G	A
S_22948130 S_61397502	371382	C	A
S_22948131 S_61397504	371386	C	A
S_22948289 S_61397809	371965	G	C
S_22948292 S_61397817	372007	T	C
S_22948382 S_61398070	372882	G	T
S_22948385 S_61398079	372916	C	A
S_22948429 S_61398180	373522	C	G
S_22948451 S_61398268	373908	C	G
S_22948465 S_61398293	374110	T	C
S_22948466 S_61398299	374140	C	T
S_22948467 S_61398300	374154	T	C
S_22948468 S_61398315	374243	T	C
S_22948472 S_61398321	374301	T	C
S_22948482 S_61398378	374455	G	A
S_22948483 S_61398379	374456	A	G
S_22948490 S_61398400	374482	A	G
S_22948492 S_61398402	374485	T	A
S_22948526 S_61398481	374844	C	T
S_22948527 S_61398484	374864	A	G
S_22948544 S_61398545	375108	G	A
S_22948545 S_61398547	375115	T	A
S_22948567 S_61398580	375389	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22948614 S_61398648	375632	C	T
S_22948623 S_61398660	375679	A	G
S_22948633 S_61398681	375814	A	G
S_22948710 S_61398841	376507	G	C
S_22948713 S_61398852	376610	T	G
S_22948718 S_61398863	376672	C	A
S_22948725 S_61398880	376750	C	A
S_22948762 S_61399091	377255	A	G
S_22948766 S_61399108	377401	A	T
S_22948767 S_61399109	377407	A	C
S_22948768 S_61399111	377421	C	T
S_22948769 S_61399113	377429	G	A
S_22948786 S_61399162	377647	T	C
S_22948818 S_61399307	378204	T	A
S_22948822 S_61399328	378243	A	T
S_22948831 S_61399348	378312	A	C
S_22948838 S_61399397	378461	T	C
S_22948841 S_61399415	378541	T	C
S_22948844 S_61399423	378573	T	C
S_22948846 S_61399430	378596	T	A
S_22948876 S_61399531	379008	C	T
S_22948877 S_61399533	379010	A	C
S_22948880 S_61399540	379060	A	C
S_22948881 S_61399543	379061	C	T
S_22948894 S_61399583	379315	A	G
S_22948944 S_61399713	379676	T	C
S_22949010 S_61399829	379972	G	C
S_22949154 S_61400111	381010	C	A
S_22949156 S_61400115	381031	G	T
S_22949157 S_61400117	381047	G	A
S_22949159 S_61400120	381051	T	G
S_22949160 S_61400121	381054	C	G
S_22949176 S_61400182	381293	G	A
S_22949178 S_61400183	381298	C	T
S_22949213 S_61400296	381725	T	A
S_22949255 S_61400369	382053	T	C
S_22949279 S_61400419	382288	C	T
S_22949285 S_61400436	382398	C	A
S_22949318 S_61400536	382832	C	T
S_22949319 S_61400539	382838	A	G
S_22949322 S_61400544	382857	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22949328 S_61400579	383019	C	A
S_22949330 S_61400582	383030	C	G
S_22949333 S_61400589	383102	A	G
S_22949334 S_61400599	383141	C	T
S_22949335 S_61400605	383160	T	G
S_22949336 S_61400608	383168	A	G
I_2440331	383202	T	TAA
S_22949351 S_61400645	383413	A	G
S_22949354 S_61400658	383451	A	T
S_22949356 S_61400661	383466	A	T
S_22949362 S_61400687	383588	G	A
S_22949363 S_61400691	383602	G	A
S_22949365 S_61400697	383619	A	C
S_22949393 S_61400790	383900	G	A
S_22949454 S_61400955	384300	C	T
S_22949469 S_61401017	384529	G	C
S_22949470 S_61401024	384554	T	A
S_22949571 S_61401337	386112	T	C
S_22949574 S_61401361	386207	C	T
S_22949621 S_61401525	386769	T	G
S_22949622 S_61401542	386787	C	T
S_22949623 S_61401553	386845	C	T
S_22949634 S_61401590	386993	G	T
S_22949636 S_61401591	386997	C	T
S_22949637 S_61401592	386998	C	T
S_22949639 S_61401593	387008	A	G
S_22949682 S_61401686	387400	A	G
S_22949706 S_61401756	387647	A	G
S_22949713 S_61401790	387855	G	A
S_22949744 S_61401909	388294	T	A
S_22949745 S_61401913	388301	G	A
S_22949814 S_61402158	389048	A	G
S_22949833 S_61402214	389227	C	T
S_22949834 S_61402220	389244	T	C
S_22949858 S_61402308	389392	T	A
S_22949868 S_61402324	389477	C	T
S_22949925 S_61402525	390226	T	C
S_22949926 S_61402527	390239	C	T
S_22949943 S_61402578	390475	C	A
S_22949960 S_61402667	390816	G	A
S_22949962 S_61402690	390876	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22949964 S_61402692	390889	T	G
S_22949968 S_61402710	390959	T	C
S_22949969 S_61402716	390976	G	C
S_22949973 S_61402733	391036	C	G
S_22949976 S_61402743	391061	G	T
S_22950004 S_61402816	391269	A	T
S_22950019 S_61402865	391418	G	C
S_22950032 S_61402931	391549	A	C
S_22950033 S_61402933	391555	A	C
S_22950036 S_61402936	391583	T	A
S_22950048 S_61403015	391742	A	G
S_22950050 S_61403020	391756	T	A
S_22950056 S_61403078	391891	C	T
S_22950077 S_61403163	392201	C	T
S_61403178	392251	A	T
S_22950091 S_61403199	392329	T	G
S_61403209	392361	A	C
S_22950096 S_61403212	392369	T	A
S_22950107 S_61403247	392463	G	A
S_22950108 S_61403249	392466	C	G
S_22950109 S_61403251	392467	C	T
S_22950122 S_61403287	392645	A	G
S_22950123 S_61403291	392663	A	G
S_22950125 S_61403294	392701	C	T
S_22950127 S_61403300	392733	G	A
S_22950129 S_61403303	392748	A	G
S_22950145 S_61403338	392932	G	C
S_22950148 S_61403343	392961	A	T
S_22950149 S_61403345	392964	G	A
S_22950161 S_61403367	393139	G	T
S_22950166 S_61403374	393188	G	A
S_22950219 S_61403518	393821	C	T
S_22950228 S_61403536	393874	A	T
S_22950229 S_61403539	393877	T	G
S_22950239 S_61403569	393963	G	A
S_22950240 S_61403571	393975	C	G
S_22950248 S_61403582	394037	A	T
S_22950249 S_61403592	394063	T	A
S_22950250 S_61403593	394066	A	G
S_22950252 S_61403606	394122	T	A
S_22950253 S_61403607	394123	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22950256 S_61403626	394181	G	A
S_22950260 S_61403642	394253	C	T
S_22950285 S_61403723	394567	A	G
S_22950287 S_61403731	394588	G	T
S_22950301 S_61403789	394762	C	T
S_22950303 S_61403802	394819	A	G
S_22950336 S_61403933	395355	T	A
S_22950338 S_61403940	395384	C	T
S_22950363 S_61403951	395463	T	C
S_22950418 S_61404061	396012	T	C
S_22950430 S_61404118	396299	C	T
S_22950455 S_61404189	396586	T	G
S_22950464 S_61404204	396647	G	C
S_22950489 S_61404263	396859	T	G
S_22950492 S_61404281	397024	C	G
S_22950509 S_61404306	397162	A	T
S_22950517 S_61404326	397221	T	C
S_22950518 S_61404329	397230	G	T
S_22950557 S_61404430	397726	T	C
S_22950558 S_61404431	397730	A	T
S_22950601 S_61404587	398348	T	C
S_22950682 S_61404812	399102	C	T
S_22950683 S_61404815	399118	T	A
S_22950684 S_61404816	399119	G	A
S_22950706 S_61404870	399424	T	C
S_22950707 S_61404872	399425	T	G
S_22950726 S_61404932	399661	G	A
S_22950727 S_61404939	399697	T	C
S_22950729 S_61404941	399720	T	C
S_22950731 S_61404944	399746	T	A
S_22950748 S_61404979	399911	A	G
S_22950752 S_61404998	399987	T	C
S_22950795 S_61405134	400564	T	A
S_22950811 S_61405190	400854	G	C
S_22950813 S_61405202	400913	A	G
S_22950837 S_61405311	401144	A	C
S_22950863 S_61405394	401538	C	A
S_22950866 S_61405404	401575	A	G
S_22950877 S_61405463	401742	C	T
S_22950902 S_61405534	402036	A	G
S_22950912 S_61405555	402123	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22950930 S_61405608	402375	T	C
S_22950931 S_61405612	402382	G	T
S_22950932 S_61405616	402390	C	A
S_22950933 S_61405625	402413	C	T
S_22950959 S_61405689	402574	C	G
S_22951020 S_61405801	402952	G	A
S_22951077 S_61405976	403745	A	G
S_22951090 S_61406028	403906	A	T
S_22951098 S_61406045	403985	T	G
S_22951100 S_61406058	404021	T	C
S_22951102 S_61406069	404050	A	T
S_22951103 S_61406077	404092	C	T
S_22951111 S_61406096	404170	A	G
S_22951113 S_61406110	404214	G	A
S_22951147 S_61406293	404818	G	A
S_22951148 S_61406308	404854	A	G
S_22951149 S_61406318	404872	G	A
S_22951228 S_61406420	405078	G	A
S_22951312 S_61406615	405821	G	A
S_22951315 S_61406616	405825	C	T
S_22951433 S_61406853	406407	T	A
S_22951452 S_61406901	406536	G	A
S_22951577 S_61407152	407212	A	T
S_22951578 S_61407153	407219	A	T
S_22951594 S_61407183	407401	C	T
S_22951638 S_61407307	408070	A	C
S_22951665 S_61407375	408194	T	G
S_22951667 S_61407381	408239	T	C
S_22951668 S_61407383	408246	C	T
S_22951768 S_61407685	409523	T	C
S_22951770 S_61407687	409535	T	G
S_22951775 S_61407717	409656	A	G
S_22951781 S_61407744	409811	G	C
S_22951786 S_61407751	409864	G	T
S_22951797 S_61407783	410025	T	C
S_22951801 S_61407794	410061	T	C
S_22951805 S_61407810	410140	C	A
S_22951809 S_61407824	410196	C	T
S_22951827 S_61407960	410607	G	T
S_22951828 S_61407962	410616	T	A
S_22951849 S_61408047	410939	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22951880 S_61408158	411503	A	G
S_22951882 S_61408159	411507	A	G
S_22951917 S_61408241	411905	A	G
S_22951925 S_61408252	411981	A	T
S_22951934 S_61408267	412145	C	G
S_22951935 S_61408268	412146	A	T
S_22951941 S_61408295	412288	A	T
S_22951945 S_61408304	412302	T	C
S_22951947 S_61408323	412343	G	A
S_22951953 S_61408349	412456	C	A
S_22952073 S_61408563	414001	T	C
S_22952074 S_61408569	414025	A	G
S_22952081 S_61408593	414156	G	A
S_22952082 S_61408596	414167	A	G
S_22952083 S_61408597	414174	A	G
S_22952086 S_61408598	414182	T	A
S_22952092 S_61408607	414278	T	A
S_22952093 S_61408608	414279	G	T
S_22952096 S_61408610	414289	T	A
S_22952099 S_61408615	414310	C	A
S_22952102 S_61408630	414365	C	A
S_22952133 S_61408711	414907	C	T
S_22952135 S_61408713	414912	T	C
S_22952142 S_61408720	414921	A	G
S_22952152 S_61408731	414934	A	C
S_22952180 S_61408767	415121	G	A
S_22952253 S_61408900	416142	T	C
S_22952254 S_61408912	416163	G	C
S_22952256 S_61408914	416172	C	G
S_22952258 S_61408916	416178	C	G
S_22952281 S_61408975	416400	C	T
S_22952290 S_61408995	416564	C	T
S_22952320 S_61409091	416952	C	T
S_22952324 S_61409107	417010	C	T
S_22952345 S_61409170	417437	C	T
S_22952348 S_61409175	417478	A	T
S_22952349 S_61409176	417479	A	G
S_22952792 S_61409866	419839	A	G
S_22952808 S_61409929	420235	T	C
S_22952815 S_61409969	420326	G	A
S_22952826 S_61409989	420470	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22952829 S_61410002	420549	T	A
S_22952834 S_61410006	420580	A	C
S_22952836 S_61410007	420590	T	G
S_22952843 S_61410038	420783	C	T
S_22952844 S_61410044	420824	A	G
S_22952845 S_61410045	420830	G	T
S_22952846 S_61410046	420837	G	C
S_22952848 S_61410050	420851	G	T
S_22952851 S_61410057	420908	A	G
S_22952853 S_61410059	420923	T	C
S_22952854 S_61410060	420924	T	C
S_22952859 S_61410067	421001	T	G
S_22952863 S_61410077	421041	A	T
S_22952885 S_61410144	421439	C	A
S_22954440 S_61413408	425731	A	C
S_22954465 S_61413507	426108	T	C
S_22954473 S_61413574	426183	A	C
S_22954496 S_61413703	426530	C	T
S_22954497 S_61413706	426552	T	A
S_22954498 S_61413708	426562	G	A
S_22954499 S_61413710	426582	A	T
S_22954500 S_61413711	426584	G	C
S_22954501 S_61413712	426604	C	A
S_22954502 S_61413717	426618	C	A
S_22954504 S_61413733	426712	G	A
S_22954518 S_61413765	426821	C	G
S_22954532 S_61413811	426960	G	A
S_22954537 S_61413817	426984	A	G
S_22954540 S_61413847	427113	C	A
S_22954544 S_61413854	427146	A	C
S_22954576 S_61413927	427437	T	A
S_22954598 S_61413953	427531	T	C
S_22954603 S_61413964	427577	C	T
S_22954606 S_61413967	427586	T	A
S_22954607 S_61413972	427620	T	C
S_22954611 S_61413979	427678	T	C
S_22954613 S_61413980	427685	T	G
S_22954614 S_61413983	427708	A	T
S_22954616 S_61413987	427725	C	T
S_22954632 S_61414031	427933	G	C
S_22954649 S_61414093	428240	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22954662 S_61414140	428437	A	G
S_22954663 S_61414143	428451	A	G
S_22954664 S_61414145	428472	C	T
S_22954693 S_61414273	428972	C	T
S_22954718 S_61414354	429300	G	T
S_22954719 S_61414355	429302	G	A
S_22954724 S_61414361	429378	A	T
S_22954727 S_61414368	429412	A	T
S_22954737 S_61414397	429593	C	A
S_22954738 S_61414398	429597	G	A
S_22954739 S_61414400	429620	T	G
S_22954744 S_61414419	429747	A	C
S_22954757 S_61414451	429905	A	T
S_22954781 S_61414507	430065	C	T
I_1466062 I_2440908	430236	A	AT
S_22954864 S_61414619	430241	C	T
S_22954866 S_61414631	430278	G	A
S_22954879 S_61414650	430382	A	G
S_22954882 S_61414652	430397	T	G
S_22954901 S_61414680	430620	C	T
S_22954930 S_61414759	430983	T	G
S_22954932 S_61414762	431002	T	C
S_22954945 S_61414829	431249	T	C
S_22954947 S_61414830	431251	A	G
S_22954950 S_61414838	431290	G	A
S_22954973 S_61414907	431533	G	C
S_22954993 S_61414988	431900	C	A
S_22955014 S_61415040	432061	C	G
S_22955024 S_61415061	432171	A	C
S_22955028 S_61415100	432300	C	T
S_22955105 S_61415427	433244	T	G
S_22955138 S_61415549	433716	G	A
S_22955148 S_61415570	433795	T	G
S_22955159 S_61415612	433941	A	G
S_22955173 S_61415647	434035	C	T
S_22955180 S_61415673	434127	G	A
S_22955256 S_61415778	434479	A	G
S_22955266 S_61415799	434620	G	A
S_22955268 S_61415803	434647	T	A
S_22955269 S_61415807	434662	G	A
S_22955271 S_61415812	434712	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22955272 S_61415813	434724	G	A
S_22955273 S_61415815	434743	C	G
S_22955274 S_61415820	434778	G	A
S_22955282 S_61415842	434888	C	A
S_22955286 S_61415864	434987	C	G
S_22955288 S_61415869	435026	G	C
S_22955290 S_61415877	435068	A	G
S_22955302 S_61415900	435192	G	A
S_22955317 S_61415964	435413	A	G
S_22955319 S_61415970	435459	C	T
S_22955321 S_61415971	435468	T	C
S_22955329 S_61415991	435560	A	C
S_22955338 S_61416010	435633	A	G
S_22955339 S_61416012	435641	C	T
S_22955340 S_61416013	435650	T	A
S_22955342 S_61416014	435659	C	G
S_22955354 S_61416053	435819	G	A
S_22955355 S_61416055	435833	A	G
S_22955356 S_61416056	435834	G	A
S_22955357 S_61416057	435842	A	T
S_22955358 S_61416058	435850	T	G
S_22955362 S_61416074	435941	G	T
S_22955371 S_61416106	436013	C	T
S_22955377 S_61416123	436065	A	T
S_22955380 S_61416136	436104	T	C
S_22955390 S_61416155	436217	C	A
S_22955394 S_61416174	436290	A	C
S_22955395 S_61416177	436299	C	T
S_22955398 S_61416180	436322	C	T
S_22955399 S_61416181	436331	A	T
S_22955401 S_61416182	436337	C	T
S_22955404 S_61416191	436385	G	A
S_22955422 S_61416240	436586	T	C
S_22955437 S_61416287	436813	C	G
S_22955449 S_61416318	436980	T	G
S_22955466 S_61416391	437174	A	G
S_22955468 S_61416401	437198	G	C
S_22955475 S_61416420	437286	A	T
S_22955476 S_61416425	437300	C	T
S_22955478 S_61416427	437313	A	G
S_22955479 S_61416430	437327	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22955480 S_61416438	437358	A	G
S_22955484 S_61416454	437422	A	G
S_22955502 S_61416479	437494	A	C
S_22955503 S_61416481	437502	C	T
S_22955505 S_61416485	437515	T	G
S_22955520 S_61416500	437631	C	G
S_22955551 S_61416638	438043	G	A
S_22955564 S_61416657	438120	C	T
S_22955583 S_61416733	438392	G	C
S_22955584 S_61416735	438398	A	G
S_22955629 S_61416868	438689	T	C
S_22955636 S_61416885	438740	G	A
S_22955640 S_61416922	438788	A	G
S_22955645 S_61416953	438850	A	G
S_22955661 S_61417054	439031	A	T
S_22955687 S_61417135	439316	A	G
S_22956074 S_61418015	440854	C	T
S_22956075 S_61418020	440875	T	C
S_22956080 S_61418042	441023	T	G
S_22956086 S_61418054	441102	C	T
S_22956141 S_61418126	441428	G	T
S_22956151 S_61418163	441517	A	G
S_22956152 S_61418170	441560	G	A
S_22956180 S_61418205	441613	A	G
S_22956200 S_61418266	441842	T	A
S_22956201 S_61418271	441876	T	A
S_22956208 S_61418283	441938	T	G
S_22956223 S_61418325	442138	A	C
S_22956227 S_61418347	442232	A	C
S_22956290 S_61418406	442794	A	G
S_22956330 S_61418425	442968	T	A
S_22956334 S_61418435	443024	C	G
S_22956337 S_61418440	443048	G	A
S_22956348 S_61418460	443245	T	A
S_22956350 S_61418472	443320	A	T
S_22956354 S_61418480	443379	T	C
S_22956355 S_61418481	443381	A	G
S_22956358 S_61418489	443438	G	C
S_22956470 S_61418722	444832	C	G
S_22956471 S_61418724	444836	A	T
S_22956474 S_61418739	444920	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22956497 S_61418796	445225	T	A
S_22956558 S_61418953	445749	T	C
S_22956563 S_61418964	445800	T	C
S_22956676 S_61419268	446984	G	A
S_22956704 S_61419361	447278	T	A
S_22956707 S_61419368	447314	G	A
S_22956713 S_61419385	447466	A	G
S_22956714 S_61419390	447475	A	G
S_22956717 S_61419394	447487	A	G
S_22956718 S_61419396	447493	T	A
S_22956723 S_61419414	447563	A	G
S_22956831 S_61419741	448653	A	T
S_22956847 S_61419815	448977	T	G
S_22956850 S_61419817	449006	A	G
S_22956861 S_61419860	449189	A	G
S_22956867 S_61419888	449254	C	A
I_2441082	449591	C	CG
S_22956910 S_61419994	449666	A	G
S_22956930 S_61420059	450020	C	T
S_22956943 S_61420093	450269	C	A
S_22956945 S_61420102	450307	C	A
S_22956957 S_61420156	450554	C	T
S_22956962 S_61420185	450700	A	C
S_22956966 S_61420204	450810	C	A
S_22956970 S_61420209	450835	G	A
S_22956971 S_61420210	450857	G	A
S_22956973 S_61420217	450906	G	A
S_22956979 S_61420227	450959	C	G
S_22956984 S_61420235	450996	A	T
S_22956985 S_61420251	451094	G	A
S_22957011 S_61420340	451353	C	T
S_22957012 S_61420341	451354	C	G
S_22957017 S_61420363	451423	A	T
S_22957019 S_61420371	451470	C	T
S_22957022 S_61420375	451488	T	A
S_22957024 S_61420378	451519	C	A
S_22957374 S_61420941	452967	G	T
S_22957469 S_61421140	454448	A	T
S_22957470 S_61421142	454456	G	T
S_22957540 S_61421253	455002	T	G
S_22957541 S_61421255	455013	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22957542 S_61421257	455027	A	G
S_22957563 S_61421281	455326	T	A
S_22957564 S_61421284	455341	T	C
S_22957565 S_61421285	455342	A	G
S_22957566 S_61421288	455351	A	G
S_22957567 S_61421291	455373	T	G
S_22957614 S_61421374	455683	A	T
S_22957621 S_61421392	455815	A	C
S_22957622 S_61421397	455827	A	T
S_22957651 S_61421444	456131	T	C
S_22957652 S_61421445	456142	G	C
S_22957655 S_61421454	456184	T	C
S_22957657 S_61421466	456219	C	T
S_22957658 S_61421469	456234	C	A
S_22957666 S_61421507	456360	G	A
S_22957671 S_61421529	456424	G	T
S_22957731 S_61421702	457151	A	G
S_22957741 S_61421734	457270	G	A
S_22957742 S_61421737	457288	T	A
S_22957777 S_61421872	457712	C	T
S_22957911 S_61422268	459763	G	A
S_22957920 S_61422286	459830	G	C
S_22957952 S_61422386	460026	A	G
S_22957954 S_61422390	460050	A	C
S_22958004 S_61422565	460669	T	C
S_22958146 S_61423008	461969	G	A
S_22958177 S_61423121	462477	T	G
S_22958178 S_61423128	462500	C	G
S_22958200 S_61423208	462900	A	T
S_22958201 S_61423209	462901	T	A
S_22958202 S_61423210	462903	A	T
S_22958203 S_61423211	462904	T	A
S_22958227 S_61423289	463481	G	T
S_22958229 S_61423306	463555	G	A
S_22958230 S_61423307	463557	A	T
S_22958276 S_61423402	464115	G	A
S_22958277 S_61423407	464148	A	G
S_22958284 S_61423433	464307	A	G
S_22958287 S_61423450	464372	C	T
S_22958320 S_61423534	464805	T	C
S_22958323 S_61423552	464864	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22958360 S_61423627	465147	C	T
S_22958361 S_61423628	465148	T	C
S_22958364 S_61423635	465173	C	T
S_22958365 S_61423636	465178	G	A
S_22958366 S_61423638	465182	C	T
S_22958370 S_61423643	465230	C	T
S_61423673	465307	A	T
S_22958390 S_61423677	465315	G	A
S_22958442 S_61423829	466018	T	A
S_22958445 S_61423834	466033	G	A
S_22958446 S_61423835	466034	T	A
S_22958483 S_61423864	466189	T	A
S_22958484 S_61423865	466190	T	A
S_22958508 S_61423904	466496	A	G
S_22958510 S_61423908	466538	T	C
S_22958511 S_61423909	466539	T	A
S_22958513 S_61423916	466583	C	A
S_22958521 S_61423927	466700	T	C
S_22958525 S_61423932	466766	C	T
S_22958567 S_61424096	467665	T	A
S_22958578 S_61424121	467880	T	G
S_22958579 S_61424125	467888	C	G
S_22958582 S_61424130	467922	G	A
S_22958584 S_61424132	467953	G	A
S_22958594 S_61424158	468054	C	T
S_22958657 S_61424289	468463	T	C
S_22958670 S_61424327	468641	A	T
S_22958707 S_61424426	468942	T	G
S_22958723 S_61424477	469159	T	A
S_22958727 S_61424483	469184	A	C
S_22958733 S_61424524	469285	C	T
S_22958735 S_61424529	469304	A	T
S_22958736 S_61424531	469312	G	A
S_22958738 S_61424543	469368	T	C
S_22958743 S_61424556	469424	G	A
S_22958744 S_61424559	469444	A	C
S_22958745 S_61424564	469460	T	A
S_22958759 S_61424620	469671	A	G
S_22958767 S_61424644	469795	G	A
S_22958768 S_61424645	469798	C	G
S_22958795 S_61424757	470151	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22958796 S_61424758	470154	A	G
S_22958841 S_61424908	470667	C	T
S_22958954 S_61425101	471251	A	G
S_22959001 S_61425180	471626	G	A
S_22959005 S_61425188	471657	A	G
I_1466326 I_2441332	471831	C	CA
S_22959020 S_61425221	471834	C	T
S_22959023 S_61425236	471900	A	G
S_22959038 S_61425310	472162	G	A
S_22959044 S_61425338	472264	C	T
S_22959047 S_61425364	472375	T	A
S_22959048 S_61425368	472381	A	T
S_22959049 S_61425373	472410	G	T
S_22959051 S_61425389	472441	T	C
S_22959057 S_61425425	472517	G	A
S_22959061 S_61425458	472604	A	G
S_22959063 S_61425465	472647	A	G
S_22959077 S_61425482	472786	T	C
S_22959081 S_61425484	472793	T	C
S_22959086 S_61425488	472829	A	G
S_22959088 S_61425491	472849	G	A
S_22959120 S_61425585	473310	G	A
S_22959214 S_61425967	474776	G	A
S_22959226 S_61426026	475003	G	C
S_22959267 S_61426146	475447	A	T
S_22959269 S_61426158	475487	C	T
S_22959278 S_61426194	475712	C	T
S_22959284 S_61426214	475789	T	A
S_22959303 S_61426272	476072	T	A
S_22959439 S_61426538	476954	A	C
I_1466346 I_2441371	477146	T	TG
S_22959462 S_61426574	477147	A	T
S_22959463 S_61426579	477212	C	T
S_22959468 S_61426592	477295	T	C
S_22959469 S_61426593	477308	A	G
S_22959502 S_61426651	477619	T	A
S_22959506 S_61426653	477660	A	G
S_22959510 S_61426659	477725	A	T
S_22959512 S_61426665	477763	T	A
S_22959514 S_61426669	477804	T	A
S_22959530 S_61426698	477942	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22959535 S_61426710	478025	C	T
S_22959551 S_61426729	478160	C	T
S_22959555 S_61426743	478222	T	C
S_22959588 S_61426803	478643	C	T
S_22959589 S_61426804	478645	C	T
S_22959602 S_61426829	478773	C	T
S_22959618 S_61426859	478945	A	C
S_22959664 S_61426950	479215	T	G
S_22959677 S_61426987	479421	T	A
S_22959695 S_61427046	479904	T	G
S_22959760 S_61427276	480814	G	T
S_22959766 S_61427295	480929	C	T
S_22959778 S_61427313	481002	A	T
S_22959780 S_61427326	481054	T	A
S_22959784 S_61427332	481079	T	C
S_22959791 S_61427356	481196	A	T
S_22959792 S_61427366	481221	A	T
S_22959821 S_61427443	481508	G	C
S_22959933 S_61427691	482474	T	A
S_22959992 S_61428041	483272	A	T
S_22960146 S_61428500	484982	C	A
S_22960173 S_61428551	485193	T	G
S_22960174 S_61428557	485213	G	A
S_22960188 S_61428619	485487	A	G
S_22960457 S_61429503	488823	T	C
S_22960472 S_61429564	489060	T	C
S_22960475 S_61429583	489088	C	G
S_22960591 S_61429945	490666	T	G
S_22960592 S_61429948	490688	C	T
S_22960626 S_61429988	491023	T	G
S_22960712 S_61430188	492014	G	T
S_22960729 S_61430224	492195	G	A
I_2441480	492203	T	TA
S_22960741 S_61430265	492409	A	G
S_22960742 S_61430267	492426	G	A
S_22960767 S_61430314	492643	A	T
S_22960814 S_61430443	493167	T	C
S_22960816 S_61430454	493206	A	T
S_22960902 S_61430720	494132	A	C
S_22960935 S_61430889	494743	G	T
S_22960940 S_61430898	494793	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22960941 S_61430912	494827	T	A
S_22960955 S_61430985	495157	G	T
S_22960970 S_61431040	495350	G	T
S_22961024 S_61431184	495996	A	G
S_22961026 S_61431186	496002	C	T
S_22961032 S_61431195	496035	T	C
S_22961095 S_61431442	496943	T	A
S_22961302 S_61431910	498217	G	T
S_22961352 S_61432064	498726	T	C
S_22961448 S_61432341	499735	T	A
S_22961581 S_61432594	500833	G	T
S_22961592 S_61432616	500928	G	C
S_22961606 S_61432638	501084	G	A
S_22961633 S_61432688	501372	C	T
S_22961662 S_61432778	501842	A	G
S_22961664 S_61432786	501877	G	A
S_22961666 S_61432797	501908	G	A
S_22961680 S_61432827	502021	A	T
S_22961684 S_61432835	502067	G	A
S_22961685 S_61432846	502106	C	T
S_22961692 S_61432887	502283	T	C
S_61432925	502466	A	G
S_61432930	502486	T	A
S_22961705 S_61432936	502506	G	A
S_22961740 S_61433013	502746	G	A
S_22961748 S_61433030	502815	C	A
S_22961750 S_61433037	502857	C	T
S_22961752 S_61433042	502882	G	T
S_22961754 S_61433043	502902	G	A
S_22961756 S_61433072	503062	A	T
S_22961771 S_61433115	503294	G	C
S_22961804 S_61433208	503702	T	C
S_22961816 S_61433237	503830	A	T
S_22961823 S_61433250	503868	C	A
S_22961824 S_61433251	503869	T	G
S_22961826 S_61433257	503920	A	T
S_22961827 S_61433258	503921	T	G
S_22961828 S_61433259	503929	T	C
S_22961924 S_61433520	505510	T	C
S_22961928 S_61433526	505559	A	G
S_22961938 S_61433553	505650	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22961941 S_61433562	505671	T	C
S_22961976 S_61433815	506239	G	A
S_22962010 S_61433856	506492	G	T
S_22962040 S_61433970	506815	G	C
S_22962140 S_61434365	508353	A	G
S_22962147 S_61434394	508453	C	T
S_22962383 S_61434985	510143	T	A
S_22962473 S_61435211	510830	T	C
S_22962476 S_61435223	510888	G	T
S_22962547 S_61435380	511454	C	G
S_22962557 S_61435431	511612	A	G
S_22962560 S_61435440	511667	A	G
S_22962576 S_61435483	511872	A	T
S_22962578 S_61435485	511880	C	A
S_22962584 S_61435491	511939	T	C
S_22962607 S_61435533	512090	G	A
S_22962611 S_61435539	512127	G	A
S_22962617 S_61435549	512158	T	G
S_22962618 S_61435552	512166	T	G
S_61435811	512833	A	T
S_22962988 S_61436475	514541	T	C
S_22962989 S_61436555	515202	A	G
S_22962998 S_61436575	515314	G	A
I_1466551 I_2441740	515679	C	CAACTT
S_22963016 S_61436647	515719	T	A
S_22963021 S_61436654	515783	C	T
S_22963024 S_61436659	515799	A	T
S_22963029 S_61436701	515879	C	T
S_22963037 S_61436739	516072	A	C
S_22963039 S_61436751	516106	C	A
S_22963042 S_61436754	516148	A	C
S_22963043 S_61436756	516159	G	C
S_22963044 S_61436764	516176	C	T
S_22963045 S_61436771	516218	T	G
S_22963046 S_61436781	516283	C	A
S_22963050 S_61436816	516433	G	A
S_22963051 S_61436829	516486	A	G
S_22963052 S_61436845	516559	T	C
S_22963053 S_61436846	516566	A	C
S_22963238 S_61437100	517318	A	C
S_22963264 S_61437158	517569	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22963347 S_61437307	517938	G	A
S_22963352 S_61437329	518007	A	C
S_22963388 S_61437480	518626	T	C
S_22963408 S_61437523	518884	G	A
S_22963417 S_61437553	519019	T	G
S_22963419 S_61437555	519023	C	T
S_22963434 S_61437644	519880	G	A
S_22963469 S_61437732	520196	A	G
S_22963471 S_61437745	520226	C	G
S_22963473 S_61437746	520243	A	T
S_22963476 S_61437753	520265	C	T
S_22963493 S_61437790	520432	A	C
S_22963505 S_61437844	520657	C	A
S_22963515 S_61437861	520724	T	A
S_22963522 S_61437899	520922	T	C
S_22963523 S_61437901	520925	G	T
S_22963539 S_61437973	521187	G	T
S_22963541 S_61437975	521195	G	A
S_22963591 S_61438183	521895	G	C
S_22963602 S_61438213	522046	A	G
S_22963613 S_61438242	522179	C	T
S_22963614 S_61438244	522200	G	A
S_22963617 S_61438251	522231	C	T
S_22963644 S_61438325	522476	A	G
S_22963684 S_61438518	523072	A	C
S_22963695 S_61438561	523158	C	A
S_22963731 S_61438772	523912	A	G
S_22963732 S_61438774	523918	G	C
S_22963786 S_61438978	524639	G	A
S_22963810 S_61439068	524960	A	T
S_22963812 S_61439076	525007	T	C
S_22964020 S_61439492	526775	T	A
S_22964021 S_61439494	526804	C	A
S_22964056 S_61439570	527339	C	A
S_22964058 S_61439577	527384	T	A
S_22964071 S_61439619	527529	C	T
S_22964073 S_61439627	527567	C	G
S_22964075 S_61439628	527569	G	A
S_22964101 S_61439684	528348	T	C
S_22964104 S_61439692	528411	C	G
S_22964105 S_61439698	528422	C	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22964131 S_61439752	528714	A	T
S_22964133 S_61439755	528719	C	T
S_22964134 S_61439756	528720	G	T
S_22964136 S_61439758	528729	A	G
S_22964153 S_61439816	528966	T	C
S_22964155 S_61439818	528978	G	A
S_22964164 S_61439860	529131	A	G
S_22964166 S_61439863	529142	G	T
S_22964184 S_61439918	529340	A	G
S_22964188 S_61439922	529364	A	C
S_22964206 S_61440000	529587	G	A
S_22964207 S_61440002	529590	G	A
S_22964215 S_61440026	529673	C	T
S_22964216 S_61440034	529688	G	T
S_22964217 S_61440043	529719	T	G
S_22964219 S_61440047	529729	G	A
S_22964232 S_61440089	529919	C	G
S_22964242 S_61440107	530041	C	T
S_22964247 S_61440135	530158	A	T
S_22964253 S_61440150	530243	A	T
S_22964328 S_61440296	530594	C	G
S_22964365 S_61440364	530876	T	G
S_22964366 S_61440374	530906	T	G
S_22964376 S_61440442	531120	T	C
S_22964386 S_61440493	531314	T	G
S_22964387 S_61440495	531319	T	A
S_22964391 S_61440502	531351	C	T
S_22964396 S_61440509	531412	G	A
S_22964399 S_61440519	531459	C	T
S_22964429 S_61440560	531594	A	T
S_22964431 S_61440568	531643	G	A
S_22964432 S_61440569	531646	C	A
S_22964435 S_61440571	531662	A	T
S_22964437 S_61440576	531686	A	C
S_22964451 S_61440592	531776	A	G
S_22964458 S_61440618	531840	G	T
S_22964462 S_61440621	531860	G	A
S_22964481 S_61440683	532206	G	A
S_22964482 S_61440684	532216	A	C
S_22964484 S_61440699	532238	G	A
S_22964485 S_61440700	532239	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22964490 S_61440728	532276	A	G
S_22964504 S_61440753	532374	A	T
S_22964507 S_61440767	532455	T	A
S_22964524 S_61440815	532778	G	A
S_22964530 S_61440829	532833	T	C
S_22964543 S_61440873	532985	A	G
S_22964570 S_61440926	533218	A	T
S_22964573 S_61440946	533262	G	C
S_22964574 S_61440947	533263	G	A
S_22964581 S_61440954	533319	G	A
S_22964582 S_61440958	533329	G	T
S_22964583 S_61440962	533337	G	A
S_22964594 S_61440990	533433	A	G
S_22964595 S_61440994	533443	C	A
S_22964596 S_61440995	533453	A	G
S_22964597 S_61440997	533482	T	C
S_22964605 S_61441061	533710	T	G
S_22964610 S_61441077	533749	T	C
S_22964621 S_61441096	533853	A	T
S_22964669 S_61441182	534089	C	T
S_22964675 S_61441198	534177	C	A
S_22964679 S_61441211	534231	C	A
S_22964680 S_61441212	534241	G	A
S_22964681 S_61441215	534249	G	A
S_22964684 S_61441227	534375	A	G
S_22964686 S_61441228	534378	G	A
S_22964687 S_61441231	534411	A	T
S_22964692 S_61441259	534564	T	C
S_22964693 S_61441265	534616	T	A
S_22964694 S_61441266	534620	G	T
S_22964700 S_61441270	534647	A	G
S_22964715 S_61441313	534805	C	T
S_22964741 S_61441376	535086	T	G
S_22964751 S_61441388	535130	G	A
S_22964766 S_61441419	535299	G	A
S_22964767 S_61441421	535303	G	A
S_22964769 S_61441424	535333	A	G
S_22964771 S_61441430	535349	A	T
S_22964775 S_61441437	535384	G	C
S_22964782 S_61441457	535480	A	T
S_22964783 S_61441458	535491	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22964784 S_61441461	535498	T	C
S_22964789 S_61441470	535569	A	C
S_22964805 S_61441504	535688	G	T
S_22964806 S_61441509	535715	G	T
S_22964807 S_61441511	535731	A	T
S_22964816 S_61441548	535875	T	G
S_22964825 S_61441601	536016	C	T
S_22964858 S_61441654	536157	A	G
S_22964861 S_61441658	536177	A	G
S_22964878 S_61441728	536453	A	C
S_22964881 S_61441751	536548	A	G
S_22964901 S_61441810	536924	A	C
S_22964902 S_61441813	536934	T	C
S_22964920 S_61441885	537258	G	T
S_22964921 S_61441888	537290	A	C
S_22964923 S_61441889	537303	A	T
S_22964926 S_61441892	537325	A	G
S_22964927 S_61441893	537334	A	C
S_22964931 S_61441904	537369	A	T
S_22964958 S_61441964	537632	C	T
S_22964966 S_61441995	537779	A	C
S_22964969 S_61442001	537808	C	T
S_22965014 S_61442076	538183	A	T
S_22965016 S_61442082	538219	T	C
S_22965020 S_61442095	538272	A	C
S_22965024 S_61442106	538314	G	A
S_22965026 S_61442113	538344	A	G
S_22965032 S_61442125	538379	T	A
S_22965035 S_61442134	538412	G	C
S_22965039 S_61442149	538485	C	T
S_22965041 S_61442152	538517	C	T
S_22965042 S_61442155	538537	A	C
S_22965069 S_61442249	538893	C	G
S_22965070 S_61442253	538906	T	C
S_22965071 S_61442254	538907	T	A
S_22965085 S_61442300	539068	A	G
S_22965090 S_61442310	539107	G	T
S_22965092 S_61442314	539137	T	C
S_22965097 S_61442318	539156	G	A
S_22965098 S_61442323	539171	C	T
S_22965110 S_61442366	539317	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22965113 S_61442375	539342	A	G
S_22965138 S_61442443	539674	C	T
S_22965140 S_61442447	539700	A	G
S_22965143 S_61442457	539730	T	A
S_22965153 S_61442492	539846	A	T
S_22965156 S_61442495	539875	A	G
S_22965158 S_61442501	539897	T	C
S_22965159 S_61442506	539916	T	C
S_22965170 S_61442549	540104	T	G
S_22965179 S_61442577	540221	G	A
S_22965182 S_61442594	540270	T	C
S_22965185 S_61442601	540300	C	T
S_22965190 S_61442610	540333	T	C
S_22965232 S_61442677	540716	T	G
S_22965233 S_61442678	540717	A	T
S_22965236 S_61442684	540735	C	T
S_22965238 S_61442698	540812	G	A
S_22965243 S_61442714	540916	T	C
S_22965248 S_61442730	540970	T	C
S_22965252 S_61442769	541042	T	C
S_22965255 S_61442773	541059	T	C
S_22965256 S_61442774	541060	G	A
S_22965262 S_61442804	541165	G	A
S_22965265 S_61442814	541207	T	C
S_22965298 S_61442872	541441	T	A
S_22965311 S_61442924	541504	A	G
S_22965312 S_61442928	541509	C	A
S_22965315 S_61442951	541538	G	A
S_22965317 S_61442957	541566	C	G
S_22965319 S_61442971	541603	T	A
S_22965325 S_61442980	541653	C	T
S_22965331 S_61442984	541700	C	A
S_22965332 S_61442985	541701	C	T
S_22965338 S_61442997	541756	C	T
S_22965339 S_61443000	541763	G	A
S_22965414 S_61443175	542484	T	C
S_22965418 S_61443183	542509	A	G
S_22965426 S_61443199	542593	G	A
S_22965427 S_61443205	542615	C	A
S_22965433 S_61443218	542664	T	G
S_22965436 S_61443221	542708	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22965438 S_61443225	542720	T	A
S_22965439 S_61443233	542756	C	G
S_22965443 S_61443242	542789	C	T
S_22965444 S_61443247	542807	A	T
S_22965459 S_61443264	542898	A	G
S_22965464 S_61443287	542970	G	A
S_22965472 S_61443307	543071	T	C
S_22965484 S_61443350	543236	A	G
S_22965485 S_61443357	543255	T	C
S_22965490 S_61443372	543326	A	G
S_22965491 S_61443374	543339	G	T
S_22965493 S_61443379	543380	G	A
S_22965505 S_61443400	543464	C	A
S_22965530 S_61443433	543614	T	A
I_1466706 I_2442006	543618	A	AG
S_22965644 S_61443773	544626	G	T
S_22965645 S_61443774	544627	T	G
S_22965656 S_61443802	544713	T	A
S_22965687 S_61443896	544939	T	C
S_22965690 S_61443901	544955	T	G
S_22965691 S_61443904	544984	G	A
S_22965702 S_61443935	545155	T	G
S_61443980	545244	T	A
S_22965739 S_61443991	545344	C	T
S_22965741 S_61443992	545351	C	T
S_22965743 S_61443995	545359	T	G
S_22965766 S_61444065	545658	A	T
S_22965778 S_61444099	545857	G	C
S_22965782 S_61444109	545903	T	G
S_22965790 S_61444170	546098	G	A
S_22965794 S_61444182	546145	T	C
S_22965799 S_61444214	546231	A	T
S_22965800 S_61444216	546236	A	G
S_22965802 S_61444218	546242	A	G
S_22965808 S_61444224	546261	T	C
S_22965818 S_61444243	546361	A	T
S_22965819 S_61444245	546367	C	T
S_22965829 S_61444286	546476	C	T
S_22965830 S_61444288	546493	G	A
S_22965892 S_61444501	546982	A	T
S_22965896 S_61444505	547006	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22965900 S_61444513	547040	G	C
S_22965901 S_61444521	547064	C	A
S_22965902 S_61444525	547073	A	G
S_22965907 S_61444549	547166	A	G
S_22965908 S_61444551	547175	C	T
S_22965909 S_61444560	547216	G	A
S_22965942 S_61444612	547644	G	A
S_22965943 S_61444616	547661	T	C
S_22965953 S_61444640	547798	C	T
S_22965954 S_61444644	547815	G	A
S_22965955 S_61444650	547847	A	T
S_22965959 S_61444672	547901	G	A
S_22966005 S_61444744	548039	T	C
S_22966011 S_61444765	548125	G	A
S_22966027 S_61444807	548279	C	T
S_22966032 S_61444822	548325	A	G
S_22966045 S_61444870	548485	T	C
S_22966087 S_61445018	549154	A	G
S_22966088 S_61445019	549156	T	A
S_22966100 S_61445065	549339	A	G
S_22966103 S_61445068	549362	G	T
S_22966107 S_61445082	549440	T	A
S_22966114 S_61445096	549515	T	C
S_22966127 S_61445120	549655	T	G
S_22966134 S_61445163	549854	G	C
S_22966137 S_61445164	549863	C	A
S_22966138 S_61445170	549885	A	T
S_22966139 S_61445171	549887	T	A
S_22966140 S_61445172	549895	G	A
S_22966141 S_61445175	549902	T	A
S_22966144 S_61445182	549942	C	A
S_22966145 S_61445185	549957	A	G
S_22966146 S_61445198	549988	G	C
S_22966147 S_61445202	550008	A	C
S_22966149 S_61445210	550059	G	A
I_1466745 I_2442075	550094	T	TC
S_22966150 S_61445222	550096	G	A
S_22966151 S_61445225	550115	T	A
S_22966153 S_61445246	550180	A	T
S_22966154 S_61445248	550183	A	G
S_22966175 S_61445281	550322	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22966178 S_61445290	550356	T	G
S_22966181 S_61445298	550395	T	G
S_22966201 S_61445367	550793	A	T
S_22966221 S_61445489	551220	G	T
S_22966224 S_61445502	551274	A	C
S_22966247 S_61445571	551719	G	C
S_22966248 S_61445574	551735	A	C
S_22966249 S_61445576	551742	T	C
S_22966256 S_61445593	551859	C	T
S_22966257 S_61445596	551889	C	G
S_22966258 S_61445597	551892	T	A
S_22966282 S_61445689	552400	A	G
S_22966284 S_61445693	552427	A	G
S_22966286 S_61445700	552457	C	A
S_22966287 S_61445706	552478	T	C
S_22966288 S_61445709	552498	T	A
S_22966289 S_61445711	552503	T	C
S_22966328 S_61445926	555040	A	G
S_22966329 S_61445927	555041	A	G
S_22966331 S_61445930	555073	T	G
S_22966333 S_61445931	555080	T	C
S_22966337 S_61445952	555169	T	C
S_22966339 S_61445953	555181	G	A
S_22966340 S_61445955	555191	T	A
S_22966343 S_61445963	555237	T	C
S_22966346 S_61445966	555250	C	G
S_22966359 S_61445998	555409	G	C
S_22966362 S_61446013	555511	T	G
S_22966363 S_61446017	555531	G	A
S_22966374 S_61446030	555603	G	C
S_22966385 S_61446071	555744	T	G
S_22966470 S_61446238	556445	A	C
S_22966472 S_61446239	556446	C	A
S_22966505 S_61446317	556827	A	T
S_22966507 S_61446320	556861	G	A
S_22966508 S_61446324	556874	A	T
S_22966531 S_61446383	557169	A	T
S_22966532 S_61446384	557170	A	G
S_22966799 S_61447041	560064	T	G
S_22966825 S_61447148	560304	A	G
S_22966837 S_61447177	560410	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22966851 S_61447218	560536	G	T
S_22966871 S_61447268	560975	C	T
S_22966872 S_61447269	560980	T	C
S_22966873 S_61447270	560983	C	T
S_22966875 S_61447271	560986	A	C
S_22966877 S_61447281	561135	G	A
S_22966878 S_61447282	561136	G	A
S_22966879 S_61447284	561138	C	T
S_22966888 S_61447298	561235	T	C
S_22966889 S_61447300	561242	T	G
S_22966890 S_61447302	561248	G	C
S_22966893 S_61447316	561310	T	A
S_22966902 S_61447335	561408	A	T
S_22966903 S_61447337	561418	A	C
S_22966906 S_61447349	561461	A	G
S_22966907 S_61447351	561465	G	T
S_22966909 S_61447355	561480	G	T
S_22966911 S_61447368	561540	G	A
S_22966920 S_61447389	561659	T	C
S_22966933 S_61447429	561834	A	G
S_22966940 S_61447454	561960	T	A
S_22966942 S_61447455	561964	T	A
S_22967009 S_61447607	562713	A	C
S_22967029 S_61447628	562896	T	C
S_22967046 S_61447689	563275	G	C
S_22967048 S_61447699	563304	C	G
S_22967049 S_61447703	563319	G	A
S_22967059 S_61447714	563420	A	G
S_22967085 S_61447787	563912	T	C
S_22967086 S_61447793	563921	T	C
S_22967147 S_61448003	565027	T	G
S_22967148 S_61448004	565031	A	T
S_22967154 S_61448008	565062	C	T
S_22967203 S_61448101	565421	G	A
S_22967204 S_61448117	565467	G	C
S_22967250 S_61448218	565893	C	T
I_1466829 I_2442216	565930	A	AATTTAAT
S_22967258 S_61448237	565998	T	C
S_22967263 S_61448251	566076	C	T
S_22967264 S_61448255	566085	C	G
S_22967274 S_61448290	566264	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22967276 S_61448301	566287	T	G
S_22967291 S_61448358	566569	A	G
S_22967316 S_61448442	566948	T	A
S_22967325 S_61448470	567054	A	C
S_22967333 S_61448480	567103	T	C
S_22967374 S_61448595	567457	G	A
S_22967392 S_61448652	567643	T	G
S_22967404 S_61448690	567788	A	T
S_22967407 S_61448692	567797	G	A
S_22967410 S_61448695	567818	T	C
S_22967412 S_61448700	567853	T	G
S_22967414 S_61448702	567870	G	C
S_22967422 S_61448718	567957	C	G
S_22967423 S_61448719	567958	T	A
S_22967424 S_61448720	567965	G	T
S_22967431 S_61448742	568096	T	C
S_22967432 S_61448744	568111	G	T
S_22967433 S_61448746	568116	C	T
S_22967434 S_61448747	568131	T	C
S_22967440 S_61448753	568192	G	A
S_22967441 S_61448755	568198	T	G
S_22967442 S_61448760	568219	T	A
S_22967443 S_61448762	568225	A	G
S_22967446 S_61448775	568280	T	C
S_22967464 S_61448815	568498	A	C
S_22967465 S_61448816	568500	G	C
S_22967468 S_61448826	568550	G	A
S_22967470 S_61448832	568559	T	C
S_22967472 S_61448836	568582	T	A
S_22967474 S_61448837	568585	C	T
S_22967480 S_61448857	568732	A	G
S_22967500 S_61448899	568972	A	C
S_22967515 S_61448952	569202	A	C
S_22967523 S_61448976	569300	A	C
I_1466842 I_2442240	569322	C	CA
S_22967532 S_61449021	569501	T	A
S_22967533 S_61449024	569509	C	G
S_22967534 S_61449025	569510	A	G
S_22967535 S_61449037	569559	C	T
S_22967536 S_61449038	569561	A	G
S_22967538 S_61449039	569575	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22967542 S_61449045	569606	C	T
S_22967543 S_61449046	569621	C	T
S_22967546 S_61449063	569684	T	C
S_22967550 S_61449070	569721	A	G
S_22967551 S_61449071	569729	T	C
S_22967553 S_61449078	569747	G	C
S_22967555 S_61449085	569781	G	C
S_22967558 S_61449093	569806	C	T
S_22967561 S_61449096	569841	C	A
S_22967562 S_61449097	569845	G	A
S_22967567 S_61449108	569902	A	T
S_22967571 S_61449116	569957	C	A
S_22967573 S_61449123	569998	T	A
S_22967574 S_61449125	570011	T	A
S_22967581 S_61449160	570104	G	T
S_22967600 S_61449237	570418	A	T
S_22967601 S_61449238	570420	A	G
S_22967603 S_61449242	570446	C	A
S_22967606 S_61449250	570493	G	A
S_22967607 S_61449251	570514	A	G
S_22967608 S_61449252	570520	C	T
S_22967609 S_61449253	570525	T	C
S_22967610 S_61449254	570529	A	G
S_22967612 S_61449263	570571	G	A
S_22967692 S_61449427	571057	A	C
S_22967693 S_61449429	571058	A	G
S_22967699 S_61449454	571118	T	C
S_22967701 S_61449460	571142	T	A
S_22967725 S_61449542	571471	G	A
S_22967727 S_61449577	571628	C	G
S_22967728 S_61449578	571640	A	G
S_22967732 S_61449589	571729	C	T
S_22967734 S_61449596	571741	T	A
S_22967736 S_61449599	571752	C	T
S_22967738 S_61449610	571827	A	G
S_22967739 S_61449621	571864	A	C
S_22967740 S_61449627	571887	A	G
S_22967787 S_61449721	572135	A	G
S_22967805 S_61449749	572258	C	T
S_22967810 S_61449780	572359	A	G
S_22967813 S_61449793	572396	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22967816 S_61449805	572432	C	A
S_22967818 S_61449809	572448	C	T
S_22967824 S_61449838	572622	A	T
S_22967825 S_61449842	572641	T	A
S_22967827 S_61449844	572666	T	C
S_22967830 S_61449851	572695	G	T
S_22967832 S_61449856	572714	A	G
S_22967835 S_61449862	572738	G	A
S_22967838 S_61449881	572791	G	A
S_22967851 S_61449946	572971	T	C
S_22967852 S_61449947	572974	A	C
S_22967865 S_61449994	573033	A	G
S_22967869 S_61450008	573082	C	T
S_22967927 S_61450179	573656	G	A
S_22967932 S_61450199	573713	C	T
S_22967936 S_61450217	573783	T	A
S_22967937 S_61450221	573792	A	G
S_61450241	573853	C	T
S_22967945 S_61450245	573889	A	G
S_22967946 S_61450246	573895	G	C
S_22967953 S_61450277	573966	T	C
S_22967955 S_61450283	573987	A	T
S_22970028 S_61452627	575551	A	G
S_22970094 S_61452722	576059	A	T
S_22970095 S_61452723	576060	T	A
S_22970096 S_61452724	576066	A	T
S_22970098 S_61452726	576086	G	A
S_22970099 S_61452729	576101	G	T
S_22970102 S_61452734	576170	C	T
S_22970103 S_61452735	576172	G	A
S_22970104 S_61452737	576174	G	C
S_22970105 S_61452738	576175	T	A
S_22970106 S_61452740	576192	G	C
S_22970114 S_61452756	576344	G	C
S_22970130 S_61452800	576549	G	T
S_22970146 S_61452828	576693	G	A
S_22970148 S_61452836	576717	G	T
S_22970151 S_61452839	576727	G	A
S_22970161 S_61452866	576824	C	T
S_22970163 S_61452877	576913	A	C
S_22970165 S_61452884	576943	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22970166 S_61452885	576945	C	T
S_22970171 S_61452893	577004	C	T
S_22970173 S_61452902	577072	C	T
S_22970176 S_61452918	577156	T	A
S_22970210 S_61453062	577979	G	A
S_22970304 S_61453283	579955	A	T
S_61453287	579980	G	A
S_61453410	580327	A	C
S_22970379 S_61453469	580599	T	C
S_22970382 S_61453474	580631	C	A
S_22970387 S_61453488	580749	G	C
S_22970389 S_61453500	580828	G	A
S_22970391 S_61453501	580840	A	T
S_22970392 S_61453502	580842	A	T
S_22970396 S_61453516	580955	C	A
S_22970397 S_61453527	580992	A	G
S_22970407 S_61453553	581149	A	G
S_22970424 S_61453601	581465	C	G
S_22970426 S_61453603	581474	G	A
S_22970441 S_61453647	581690	T	C
S_22970468 S_61453759	582559	T	A
S_22970469 S_61453760	582560	A	T
S_22970470 S_61453761	582561	T	A
S_22970471 S_61453762	582575	T	C
S_22970472 S_61453765	582600	A	G
S_22970479 S_61453781	582713	A	G
S_22970480 S_61453782	582720	A	G
S_22970494 S_61453815	582902	T	C
S_22970495 S_61453824	582932	T	A
S_22970499 S_61453846	583005	A	G
S_22970500 S_61453848	583017	C	T
S_22970507 S_61453858	583123	G	A
S_22970508 S_61453860	583146	C	T
S_22970509 S_61453861	583158	G	A
S_22970526 S_61453908	583543	A	G
S_22970527 S_61453909	583544	G	A
S_22970581 S_61454084	584324	A	C
S_22970600 S_61454135	584593	G	T
S_22970601 S_61454139	584608	C	A
S_22970602 S_61454140	584612	G	A
S_22970616 S_61454180	584782	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22970622 S_61454223	584900	C	A
S_22970623 S_61454224	584901	G	T
S_22970624 S_61454226	584904	C	T
S_22970627 S_61454244	584984	A	G
S_22970629 S_61454254	584999	C	T
S_22970630 S_61454258	585004	A	G
S_22970632 S_61454270	585040	A	G
S_22970633 S_61454273	585052	G	A
S_22970640 S_61454297	585136	A	G
S_22970711 S_61454511	585976	A	C
S_22970715 S_61454518	585995	T	C
S_22970740 S_61454602	586320	T	C
S_22970741 S_61454605	586332	G	T
S_22970768 S_61454632	586551	A	G
S_22970771 S_61454639	586603	C	G
S_22970773 S_61454648	586629	A	G
S_22970785 S_61454690	586814	C	G
S_22970786 S_61454695	586829	A	G
S_22970788 S_61454696	586840	C	T
S_22970789 S_61454698	586861	A	T
S_22970792 S_61454723	586962	A	G
S_22970799 S_61454753	587125	G	T
S_22970800 S_61454763	587159	T	G
S_22970806 S_61454783	587263	C	T
S_22970816 S_61454810	587354	T	C
S_22970821 S_61454824	587388	A	T
S_22970887 S_61454991	587982	A	T
S_22970890 S_61454997	588000	G	T
S_22970910 S_61455024	588151	C	G
S_22970913 S_61455027	588171	C	T
S_22970958 S_61455186	588768	G	T
S_22971011 S_61455285	589075	C	T
S_61455355	589313	A	G
S_22971045 S_61455361	589329	A	C
S_22971047 S_61455364	589345	G	A
S_22971054 S_61455383	589437	T	C
S_22971067 S_61455436	589638	T	G
S_22971090 S_61455490	589861	T	C
S_22971096 S_61455502	589916	C	A
S_22971102 S_61455539	589985	C	T
S_22971106 S_61455555	590057	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22971125 S_61455642	590408	T	C
S_22971128 S_61455648	590433	T	A
S_22971130 S_61455664	590485	T	G
S_22971135 S_61455673	590528	G	T
S_22971138 S_61455674	590539	T	G
S_22971155 S_61455728	590733	A	T
S_22971160 S_61455748	590780	T	G
S_22971169 S_61455791	590915	C	A
S_22971174 S_61455810	590975	A	G
S_22971206 S_61455971	591412	C	G
S_22971207 S_61455978	591442	A	C
S_22971215 S_61456081	591613	T	A
S_22971230 S_61456200	591964	T	C
S_22971235 S_61456205	592006	T	C
S_22971273 S_61456357	592507	A	C
S_22971287 S_61456412	592684	C	T
S_22971289 S_61456420	592710	T	A
S_22971290 S_61456421	592711	C	T
S_22971292 S_61456424	592736	T	C
S_22971298 S_61456437	592810	G	T
S_22971299 S_61456440	592816	T	C
S_22971300 S_61456442	592825	G	C
S_22971303 S_61456454	592864	C	T
S_22971304 S_61456461	592877	G	A
S_22971310 S_61456478	592959	T	C
S_22971341 S_61456641	593388	G	C
S_22971370 S_61456765	593629	C	T
S_22971376 S_61456780	593679	A	G
S_22971401 S_61456850	593893	T	C
S_22971415 S_61456892	594205	A	C
S_22971419 S_61456908	594297	A	G
S_22971423 S_61456931	594407	T	C
S_22971425 S_61456936	594423	C	T
S_22971427 S_61456937	594428	A	T
S_22971433 S_61456952	594539	A	G
S_22971435 S_61456955	594559	A	G
S_22971440 S_61456972	594714	G	A
S_22971472 S_61457044	594915	G	A
S_22971478 S_61457070	594975	T	C
S_22971507 S_61457165	595364	C	A
S_22971526 S_61457274	595702	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22971562 S_61457383	596090	T	C
S_22971568 S_61457438	596229	C	A
S_22971571 S_61457445	596272	A	G
S_22971573 S_61457447	596279	A	T
S_22971575 S_61457451	596296	G	T
S_22971588 S_61457491	596467	T	C
S_22971597 S_61457505	596515	T	G
S_22971651 S_61457712	597283	G	T
S_22971655 S_61457717	597313	C	T
S_22971668 S_61457753	597478	C	T
S_22971711 S_61457921	598011	A	G
S_22971721 S_61458006	598250	C	T
S_22971727 S_61458045	598340	A	G
S_22971771 S_61458221	598870	C	T
S_22971772 S_61458222	598873	C	A
S_22971802 S_61458411	599232	T	A
S_22971896 S_61458597	599827	C	T
S_22971906 S_61458670	600088	T	C
S_22971961 S_61458814	600946	G	C
I_2442671	601075	A	AAAT
S_22971969 S_61458838	601078	G	A
S_22971973 S_61458846	601127	T	A
S_22971990 S_61458875	601279	T	C
S_22971991 S_61458881	601305	G	A
S_22971992 S_61458884	601312	C	G
S_22971994 S_61458890	601346	G	T
S_22971995 S_61458893	601379	T	C
S_22971997 S_61458903	601439	G	C
S_22972006 S_61458940	601611	A	G
S_22972008 S_61458946	601645	A	C
S_22972009 S_61458949	601667	A	T
S_22972012 S_61458955	601703	G	T
S_22972029 S_61458983	601875	A	G
S_22972030 S_61458986	601882	T	G
S_22972034 S_61458992	601938	C	T
S_22972036 S_61458994	601942	G	T
S_22972084 S_61459118	602500	G	A
S_22972112 S_61459170	602721	C	T
S_22972113 S_61459172	602725	G	A
S_22972122 S_61459198	602855	A	T
S_22972124 S_61459201	602882	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22972127 S_61459220	602949	A	T
S_22972131 S_61459238	603005	C	A
S_22972132 S_61459242	603017	A	T
S_22972139 S_61459260	603091	A	G
S_22972144 S_61459299	603243	A	G
S_22972145 S_61459300	603246	G	C
S_22972146 S_61459301	603247	C	A
S_22972147 S_61459302	603248	G	A
S_22972157 S_61459354	603432	A	T
S_22972158 S_61459356	603435	T	C
S_22972278 S_61459542	604235	T	C
S_22972283 S_61459545	604252	G	C
S_22972289 S_61459563	604321	G	A
S_22972312 S_61459599	604544	T	C
S_22972328 S_61459623	604675	A	G
S_22972330 S_61459628	604696	T	C
I_1467089 I_2442724	604742	T	TG
S_22972337 S_61459643	604764	G	A
S_22972347 S_61459669	604909	C	G
S_22972349 S_61459673	604931	T	C
S_22972350 S_61459676	604952	T	G
S_22972351 S_61459682	604969	T	C
S_22972353 S_61459685	604986	A	T
S_22972354 S_61459687	605007	G	T
S_22972369 S_61459723	605239	T	C
S_22972370 S_61459726	605264	T	C
S_22972376 S_61459733	605365	C	A
S_22972377 S_61459734	605367	T	A
S_22972391 S_61459761	605477	G	C
S_22972404 S_61459795	605605	C	T
S_22972405 S_61459798	605613	T	C
S_22972439 S_61459854	606011	A	T
S_22972441 S_61459857	606030	A	C
S_22972442 S_61459860	606037	T	A
S_22972443 S_61459862	606051	A	C
S_22972474 S_61460015	606587	A	G
S_22972489 S_61460037	606721	C	G
S_22972490 S_61460045	606754	T	C
S_22972492 S_61460047	606761	T	C
S_22972493 S_61460054	606781	T	G
S_22972495 S_61460057	606831	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22972496 S_61460058	606833	A	G
S_22972594 S_61460171	607467	C	T
S_22972609 S_61460208	607631	G	A
S_22972612 S_61460211	607642	C	T
S_22972617 S_61460222	607699	G	T
S_22972643 S_61460279	607996	T	C
S_22972644 S_61460294	608039	C	T
S_22972653 S_61460325	608190	G	A
S_22972655 S_61460330	608211	A	G
S_22972663 S_61460345	608260	T	A
S_22972698 S_61460480	608759	A	T
S_22972711 S_61460517	608931	G	A
S_22972715 S_61460555	609153	T	G
S_22972718 S_61460567	609209	G	C
S_22972727 S_61460610	609349	G	A
S_22972751 S_61460662	609595	G	C
S_22972756 S_61460670	609638	T	C
S_22972778 S_61460705	609821	T	A
S_22972781 S_61460716	609850	A	C
S_22972816 S_61460853	610188	T	C
S_22972846 S_61460966	610681	T	G
S_22972873 S_61461068	611271	C	T
S_22972877 S_61461076	611349	C	T
S_22972922 S_61461204	611889	C	T
S_22972926 S_61461206	611907	T	C
S_22972935 S_61461245	612083	G	A
S_22972982 S_61461356	612611	C	A
S_22972985 S_61461361	612627	C	T
S_22972987 S_61461368	612640	C	G
S_22972997 S_61461402	612813	A	C
S_22973009 S_61461427	612969	G	T
S_22973077 S_61461636	613604	T	G
S_22973079 S_61461648	613667	C	T
S_22973081 S_61461652	613691	G	A
S_22973092 S_61461684	613823	G	C
S_22973099 S_61461721	613950	T	G
S_22973109 S_61461747	614084	T	G
S_22973110 S_61461749	614091	T	A
S_22973114 S_61461764	614170	C	G
S_22973158 S_61461830	614639	G	T
S_22973159 S_61461833	614649	C	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22973173 S_61461860	614793	A	G
S_22973177 S_61461867	614824	T	C
S_22973202 S_61461941	615210	C	T
S_22973205 S_61461947	615275	A	C
S_22973211 S_61461956	615320	G	A
S_22973212 S_61461959	615334	G	A
S_22973215 S_61461967	615404	G	A
S_22973217 S_61461969	615416	G	A
S_22973218 S_61461971	615433	G	C
S_22973221 S_61461985	615555	C	T
S_22973223 S_61461995	615581	T	C
S_22973225 S_61461997	615588	T	C
S_22973227 S_61462006	615642	G	T
S_22973242 S_61462053	615844	T	C
S_22973287 S_61462179	616411	T	C
S_22973288 S_61462181	616420	A	G
S_22973294 S_61462189	616484	T	G
S_22973295 S_61462191	616489	A	C
S_22973313 S_61462218	616697	C	G
S_22973315 S_61462219	616710	C	A
S_22973318 S_61462229	616744	G	T
S_22973337 S_61462273	617055	A	T
S_22973346 S_61462301	617199	C	T
S_22973353 S_61462321	617319	T	A
S_22973367 S_61462376	617449	T	C
S_22973379 S_61462403	617582	T	A
S_22973413 S_61462491	618036	C	T
S_22973415 S_61462494	618063	C	G
S_22973437 S_61462595	618479	A	C
S_22973443 S_61462618	618531	T	A
S_22973444 S_61462619	618535	T	G
S_22973450 S_61462626	618635	G	C
S_22973474 S_61462684	619072	T	C
S_22973476 S_61462687	619099	T	C
S_22973480 S_61462693	619113	C	T
S_22973483 S_61462702	619135	T	C
S_22973492 S_61462722	619193	T	A
S_22973501 S_61462729	619249	A	G
S_22973502 S_61462740	619268	G	T
S_22973503 S_61462742	619269	T	C
S_22973504 S_61462746	619303	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22973505 S_61462751	619322	T	C
S_22973506 S_61462753	619328	G	T
S_22973521 S_61462835	619535	C	T
S_22973522 S_61462844	619545	C	G
S_22973589 S_61463121	620620	A	G
S_22973591 S_61463127	620650	G	C
S_22973602 S_61463148	620742	T	C
S_22973608 S_61463155	620815	C	G
S_22973617 S_61463222	620977	A	G
S_22973677 S_61463438	621847	G	T
S_22973681 S_61463446	621923	T	A
S_22973682 S_61463453	621968	G	C
S_22973684 S_61463457	621979	G	C
S_22973686 S_61463466	622030	A	C
S_22973687 S_61463467	622035	G	A
S_22973751 S_61463628	622792	T	G
S_22973752 S_61463635	622819	A	C
S_22973756 S_61463644	622880	A	G
S_22973757 S_61463645	622894	T	G
S_22973758 S_61463646	622895	T	C
S_22973759 S_61463647	622896	G	A
S_22973760 S_61463648	622902	A	G
S_22973761 S_61463649	622904	T	A
S_22973779 S_61463764	623272	G	T
S_22973908 S_61463952	623870	T	C
S_22973909 S_61463955	623888	A	G
S_22973912 S_61463962	623915	T	A
S_22973913 S_61463964	623917	G	C
S_22973931 S_61464100	624248	T	C
S_22973932 S_61464114	624266	G	T
S_22973939 S_61464185	624454	T	A
S_22973941 S_61464196	624469	A	G
S_22973942 S_61464205	624479	T	A
S_22973961 S_61464342	624819	A	T
S_22973967 S_61464366	624868	G	A
S_22973970 S_61464377	624889	T	A
S_22973989 S_61464495	625202	A	T
S_22973990 S_61464497	625215	G	A
S_22974024 S_61464592	625627	T	C
S_22974027 S_61464593	625631	C	T
S_22974175 S_61464993	626732	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22974176 S_61464994	626733	C	A
S_22974177 S_61464995	626743	G	A
S_22974187 S_61465053	626945	T	A
S_61465366	628044	T	C
S_22974288 S_61465385	628072	A	G
S_22974294 S_61465412	628122	T	C
S_22974319 S_61465486	628287	G	T
S_22974345 S_61465558	628684	A	T
S_22974346 S_61465559	628688	A	G
S_22974348 S_61465566	628730	C	A
S_22974351 S_61465573	628753	T	C
S_22974358 S_61465605	628865	A	G
S_22974359 S_61465609	628879	A	G
S_22974363 S_61465632	628938	C	G
S_22974366 S_61465637	628971	G	A
S_22974370 S_61465645	629006	A	C
S_22974388 S_61465693	629269	A	G
S_22974424 S_61465814	629653	T	A
S_22974436 S_61465843	629796	T	C
S_22974451 S_61465885	629977	A	T
S_22974452 S_61465886	629985	T	A
S_22974455 S_61465891	630015	A	C
S_22974474 S_61465963	630336	G	A
S_22974475 S_61465964	630340	C	A
S_22974491 S_61466011	630745	A	G
S_22974507 S_61466040	630932	A	T
S_22974508 S_61466053	631000	G	C
S_22974542 S_61466139	631783	A	G
S_22974544 S_61466142	631823	A	G
S_22974545 S_61466151	631850	C	A
S_22974595 S_61466245	632176	A	T
S_22974613 S_61466296	632399	C	A
S_22974615 S_61466298	632424	A	C
S_22974619 S_61466310	632524	G	C
S_22974621 S_61466313	632534	A	T
S_22974622 S_61466319	632561	A	C
S_22974628 S_61466339	632706	G	T
S_22974630 S_61466350	632733	T	C
S_22974638 S_61466383	632824	G	T
S_22974639 S_61466386	632832	T	G
S_22974641 S_61466397	632851	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22974643 S_61466402	632857	G	A
S_22974653 S_61466438	632977	T	C
S_22974665 S_61466465	633165	T	C
S_22974770 S_61466611	633850	A	G
S_22974774 S_61466620	633916	G	A
S_22974782 S_61466639	634087	A	T
S_22974783 S_61466640	634095	A	G
S_22974795 S_61466668	634233	G	T
S_22974806 S_61466707	634420	C	T
S_22974808 S_61466712	634479	G	C
S_22974841 S_61466818	634810	G	A
S_22974843 S_61466821	634824	G	T
S_22974844 S_61466824	634885	C	T
S_22974847 S_61466826	634908	G	T
S_22974848 S_61466828	634925	G	A
S_22974854 S_61466857	635130	T	G
S_22974857 S_61466872	635221	T	C
S_22974866 S_61466913	635389	A	C
S_22974876 S_61466956	635524	A	G
S_22974877 S_61466958	635540	G	T
S_22974878 S_61466960	635549	A	G
S_22974901 S_61467020	635844	T	C
S_22974902 S_61467023	635847	G	T
S_22974962 S_61467201	636529	G	A
S_22974981 S_61467261	636699	C	T
S_22974988 S_61467317	636821	C	T
S_22975039 S_61467419	637099	C	T
S_22975068 S_61467524	637409	A	G
S_22975069 S_61467528	637417	T	G
S_22975076 S_61467539	637457	A	G
S_22975136 S_61467627	637694	A	G
S_22975164 S_61467709	638017	C	T
S_22975189 S_61467794	638424	T	C
S_22975191 S_61467798	638454	C	A
S_22975193 S_61467799	638467	T	C
S_22975194 S_61467805	638493	T	A
S_22975195 S_61467806	638503	A	G
S_22975196 S_61467810	638541	G	A
S_22975197 S_61467813	638544	A	C
S_22975204 S_61467833	638665	T	C
S_22975243 S_61467934	638965	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22975246 S_61467953	639028	C	G
S_22975274 S_61468027	639341	G	A
S_22975275 S_61468043	639425	C	T
S_22975284 S_61468059	639534	C	T
S_22975285 S_61468060	639535	C	T
S_22975295 S_61468109	639793	A	G
S_22975303 S_61468139	639881	G	C
S_22975337 S_61468224	640165	G	T
S_22975362 S_61468262	640510	A	G
S_22975363 S_61468266	640530	G	A
S_22975364 S_61468271	640555	T	C
S_22975371 S_61468292	640662	A	G
S_22975374 S_61468301	640710	A	G
S_22975375 S_61468302	640711	G	C
S_22975379 S_61468316	640783	T	G
S_22975380 S_61468320	640804	A	G
S_22975381 S_61468323	640809	A	G
S_22975397 S_61468351	641032	G	C
S_22975399 S_61468358	641067	T	G
S_22975406 S_61468368	641118	G	A
S_22975413 S_61468375	641157	T	C
S_22975419 S_61468382	641207	A	T
S_22975420 S_61468388	641251	T	C
I_2443141	641332	T	TA
S_22975431 S_61468431	641479	C	T
S_22975583 S_61468747	643254	T	G
S_22975587 S_61468757	643332	A	G
S_22975669 S_61468904	643920	G	A
S_22975705 S_61468976	644252	G	T
S_22975719 S_61469012	644483	T	C
S_22975735 S_61469050	644680	G	T
S_22975746 S_61469063	644776	G	T
S_22975749 S_61469081	644836	G	A
S_22975750 S_61469093	644884	A	T
S_22975751 S_61469095	644892	G	C
S_22975759 S_61469118	644966	C	A
S_22975768 S_61469157	645136	C	A
S_22975773 S_61469162	645181	G	A
S_22975775 S_61469176	645271	C	A
S_22975785 S_61469206	645425	T	C
S_22975788 S_61469207	645437	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22975789 S_61469208	645440	T	A
S_22975794 S_61469214	645470	A	C
S_22975795 S_61469218	645490	T	C
S_22975797 S_61469219	645498	T	C
S_22975798 S_61469233	645548	T	C
S_22975800 S_61469235	645553	C	T
S_22975801 S_61469237	645562	C	T
S_22975804 S_61469243	645593	G	A
S_22975805 S_61469249	645610	T	C
S_22975807 S_61469273	645695	T	A
S_22975819 S_61469321	645961	G	C
S_22975826 S_61469338	646081	G	A
S_22975827 S_61469339	646084	C	A
S_22975828 S_61469341	646111	T	G
S_22975906 S_61469548	647062	A	C
S_22975956 S_61469720	647767	T	A
S_22975962 S_61469726	647830	T	G
S_22975963 S_61469736	647881	A	C
S_22975977 S_61469802	648038	C	T
S_22975989 S_61469829	648141	G	A
S_22975991 S_61469831	648146	C	A
S_22975994 S_61469840	648183	T	A
S_22976006 S_61469903	648462	T	G
S_22976029 S_61469966	648790	A	T
S_22976048 S_61470046	649061	G	T
S_22976049 S_61470048	649074	C	A
S_22976051 S_61470051	649079	G	T
S_22976053 S_61470063	649110	T	C
S_22976054 S_61470068	649131	T	C
S_22976079 S_61470158	649853	A	G
S_22976083 S_61470166	649918	A	T
S_22976084 S_61470167	649925	A	T
S_22976086 S_61470175	649969	C	T
S_22976087 S_61470176	649974	G	T
S_22976090 S_61470184	650033	G	C
S_22976105 S_61470220	650240	T	C
S_22976113 S_61470240	650306	T	A
S_22976114 S_61470241	650307	T	A
S_22976115 S_61470243	650311	A	G
S_22976117 S_61470245	650317	A	T
S_22976118 S_61470246	650318	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22976150 S_61470364	650947	A	T
S_22976158 S_61470413	651023	T	C
S_22976171 S_61470437	651113	C	T
S_22976175 S_61470460	651208	C	T
S_22976193 S_61470505	651362	C	T
S_22976211 S_61470544	651503	A	T
S_22976212 S_61470547	651518	G	A
S_22976215 S_61470559	651564	T	C
S_22976356 S_61470994	652942	C	G
S_22976358 S_61471000	652955	T	A
S_22976359 S_61471002	652962	A	G
S_22976362 S_61471013	653023	G	T
S_22976366 S_61471020	653071	T	C
S_22976392 S_61471091	653435	T	G
S_22976413 S_61471134	653667	A	C
S_22976428 S_61471172	653854	C	G
S_22976453 S_61471246	654149	A	T
S_22976474 S_61471298	654365	G	A
S_22976480 S_61471311	654439	T	C
S_22976481 S_61471316	654448	G	T
S_22976486 S_61471371	654584	C	A
S_22976502 S_61471426	654753	A	C
S_22976503 S_61471435	654767	G	A
S_22976524 S_61471494	655009	A	G
S_22976572 S_61471705	655630	C	T
S_22976590 S_61471782	655886	G	T
S_22976626 S_61471916	656239	C	G
S_22976640 S_61471942	656325	A	C
S_22976715 S_61472240	657161	G	A
S_22976719 S_61472243	657179	A	G
S_22976727 S_61472261	657333	T	C
S_22976731 S_61472267	657364	C	T
S_22976734 S_61472289	657498	T	G
S_22976765 S_61472392	658028	A	G
S_22976767 S_61472393	658033	T	G
S_22976784 S_61472450	658291	T	G
S_22976785 S_61472452	658302	A	T
S_22976872 S_61472570	659114	A	G
S_22976903 S_61472631	659319	T	A
S_22976908 S_61472638	659343	A	G
S_22976931 S_61472696	659546	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22976932 S_61472699	659556	A	G
S_22976945 S_61472767	659712	T	C
S_22977039 S_61473061	660682	C	T
S_22977063 S_61473178	661038	A	T
S_22977066 S_61473198	661112	C	A
S_22977100 S_61473339	661635	A	G
S_22977108 S_61473391	661755	A	T
S_22977141 S_61473430	661877	G	T
S_22977143 S_61473432	661880	T	A
S_22977166 S_61473466	661939	A	C
S_22977212 S_61473573	662403	T	G
S_22977302 S_61473844	663396	A	G
S_22977306 S_61473857	663467	A	T
S_22977307 S_61473858	663469	G	A
S_22977310 S_61473861	663484	C	T
S_22977417 S_61474165	665234	G	A
S_22977436 S_61474219	665605	G	T
S_22977447 S_61474288	666008	T	C
S_22977450 S_61474323	666102	A	T
S_22977509 S_61474476	666653	T	A
S_22977557 S_61474587	667310	C	T
S_22977559 S_61474591	667334	A	T
S_22977564 S_61474611	667518	A	T
S_22977565 S_61474612	667520	T	A
S_22977566 S_61474613	667526	G	C
S_22977567 S_61474618	667553	G	A
S_22977569 S_61474619	667557	T	C
S_22977574 S_61474647	667729	A	G
S_22977579 S_61474656	667786	G	A
I_1467474 I_2443383	668135	T	TA
S_22977629 S_61474732	668170	A	G
S_22977642 S_61474765	668334	T	A
S_22977649 S_61474790	668421	A	C
S_22977654 S_61474810	668546	A	C
S_22977655 S_61474813	668564	A	G
S_22977671 S_61474874	668864	G	C
S_22977675 S_61474885	668901	T	G
S_22977676 S_61474887	668909	C	A
S_22977677 S_61474899	668953	T	C
S_22977678 S_61474909	668974	C	A
S_22977680 S_61474913	668991	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22977683 S_61474926	669054	T	C
S_22977688 S_61474940	669126	G	A
S_22977691 S_61474946	669137	A	G
S_22977692 S_61474947	669143	A	C
S_22977693 S_61474948	669144	C	A
S_22977724 S_61475023	669650	T	A
S_22977772 S_61475097	669769	T	A
S_22977817 S_61475213	670401	T	C
S_22977824 S_61475234	670468	A	C
S_22977825 S_61475236	670470	T	C
S_22977830 S_61475242	670492	T	A
S_22977848 S_61475286	670672	G	A
S_22977850 S_61475290	670685	T	C
S_22977853 S_61475297	670769	A	G
S_22977854 S_61475300	670797	A	G
S_22977876 S_61475348	671014	C	A
S_22977880 S_61475359	671051	A	C
S_22977882 S_61475363	671072	A	G
S_22977884 S_61475369	671090	T	C
S_22977885 S_61475371	671114	C	T
S_22977889 S_61475396	671213	C	G
S_22977920 S_61475458	671421	G	A
S_22977930 S_61475491	671490	G	C
I_1467495 I_2443423	671927	T	TAA
S_22977951 S_61475648	671957	A	G
S_22977968 S_61475685	672267	G	T
S_22977972 S_61475692	672303	T	G
S_22977981 S_61475715	672445	C	A
S_22977991 S_61475739	672632	C	A
S_22978081 S_61476057	673893	C	A
S_22978083 S_61476059	673904	A	T
S_22978087 S_61476067	673921	T	C
S_22978090 S_61476077	673959	G	C
S_22978096 S_61476096	674025	C	G
S_22978102 S_61476137	674167	C	T
S_22978103 S_61476138	674170	A	T
S_22978106 S_61476149	674202	T	C
S_22978110 S_61476159	674243	T	C
S_22978125 S_61476250	674512	G	A
S_22978130 S_61476273	674613	T	C
S_22978132 S_61476281	674641	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22978137 S_61476325	674829	G	A
S_22978139 S_61476344	674888	G	A
S_22978155 S_61476388	675046	C	A
D_1467510 D_2443453	675047	TACA	T
S_22978161 S_61476414	675148	T	A
S_22978162 S_61476416	675149	A	T
S_22978179 S_61476455	675361	A	T
S_22978221 S_61476569	675926	A	T
S_22978223 S_61476573	675945	G	T
S_22978237 S_61476595	676047	A	G
S_22978290 S_61476731	676563	T	C
S_22978291 S_61476735	676578	A	C
S_22978293 S_61476744	676623	C	T
S_22978296 S_61476747	676635	C	G
S_22978301 S_61476761	676685	T	C
S_22978338 S_61476890	677104	G	T
S_22978361 S_61476942	677689	G	A
S_22978473 S_61477081	678478	T	C
S_22978475 S_61477085	678506	A	G
S_22978479 S_61477091	678547	A	G
S_22978486 S_61477109	678704	A	G
S_22978487 S_61477110	678710	G	A
S_22978491 S_61477116	678759	C	T
S_22978521 S_61477198	679056	C	G
S_22978536 S_61477217	679195	T	A
S_22978537 S_61477219	679197	C	A
S_22978538 S_61477228	679230	T	C
S_22978556 S_61477259	679410	C	T
S_22978558 S_61477268	679436	C	T
S_22978560 S_61477272	679448	T	G
S_22978567 S_61477287	679549	C	A
S_22978568 S_61477290	679568	G	A
S_22978570 S_61477309	679652	C	G
S_22978630 S_61477462	680425	T	G
S_22978723 S_61477789	682438	C	G
S_22978733 S_61477830	682510	A	C
S_22978752 S_61477897	682658	A	G
S_22978764 S_61477946	682766	G	A
S_22978782 S_61478008	682874	G	C
S_22978786 S_61478033	682927	G	T
S_22978834 S_61478177	683395	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22978844 S_61478205	683540	A	T
S_22978845 S_61478206	683543	C	T
S_22978855 S_61478267	683899	C	T
S_22978857 S_61478269	683908	A	C
S_22978858 S_61478275	683919	T	C
S_22978890 S_61478366	684227	C	T
S_22978895 S_61478371	684273	C	G
S_22979232 S_61478755	685072	C	G
S_22979233 S_61478757	685093	C	T
S_22979236 S_61478764	685115	C	G
S_22979237 S_61478767	685125	G	A
S_22979251 S_61478816	685341	G	C
S_22979255 S_61478834	685413	T	C
S_22979256 S_61478837	685419	A	G
S_22979257 S_61478838	685426	C	T
S_22979258 S_61478844	685450	G	A
S_22979259 S_61478846	685463	C	T
S_22979261 S_61478849	685477	A	G
S_22979262 S_61478853	685493	T	C
S_22979263 S_61478862	685526	A	G
S_22979273 S_61478910	685681	C	T
S_22979274 S_61478912	685687	A	G
S_22979282 S_61478945	685861	C	T
S_22979283 S_61478946	685868	T	C
S_22979284 S_61478947	685881	T	C
S_22979288 S_61478957	685933	C	T
S_22979289 S_61478959	685943	A	T
S_22979291 S_61478966	685991	G	A
S_22979298 S_61478981	686063	C	T
S_22979303 S_61478992	686100	G	A
S_22979309 S_61479006	686202	C	G
S_22979310 S_61479009	686218	G	A
S_22979313 S_61479013	686263	A	C
S_22979361 S_61479093	686592	A	T
S_22979388 S_61479172	687016	T	C
S_22979392 S_61479194	687132	T	G
S_22979400 S_61479220	687327	A	G
S_22979407 S_61479234	687401	C	A
S_22979456 S_61479375	687831	G	A
S_22979457 S_61479376	687832	C	A
S_22979502 S_61479474	688282	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22979518 S_61479503	688342	A	G
S_22979533 S_61479530	688507	C	T
S_22979549 S_61479592	688745	A	G
S_22979555 S_61479616	688870	G	A
S_22979557 S_61479625	688901	C	G
S_22979571 S_61479712	689060	C	A
S_22979581 S_61479737	689158	C	G
S_22979592 S_61479786	689348	G	A
S_22979608 S_61479853	689682	G	A
S_22979622 S_61479880	689851	T	A
S_22979623 S_61479881	689859	G	A
S_22979624 S_61479884	689863	A	T
S_22979632 S_61479919	690016	A	T
S_22979633 S_61479921	690021	A	T
S_22979660 S_61479967	690294	G	T
S_22979680 S_61480017	690578	C	G
S_22979681 S_61480027	690634	T	C
S_22979709 S_61480100	691009	G	T
S_22979720 S_61480135	691162	G	A
S_22979722 S_61480136	691169	T	G
S_22979724 S_61480146	691225	C	A
S_22979726 S_61480155	691246	A	T
S_22979810 S_61480374	692074	C	A
S_22979814 S_61480392	692127	A	G
S_22979818 S_61480400	692154	C	T
S_22979849 S_61480479	692433	C	T
S_22979850 S_61480480	692447	G	T
S_22979853 S_61480496	692506	A	G
I_1467640 I_2443689	692575	A	AT
S_22979917 S_61480561	692812	T	C
S_22979925 S_61480568	692852	C	T
S_22979930 S_61480580	692917	T	C
S_61480609	692999	G	A
S_22979949 S_61480617	693028	C	A
S_22979950 S_61480621	693051	G	A
S_22979951 S_61480628	693095	A	T
S_22979967 S_61480666	693310	T	C
S_22979969 S_61480669	693346	G	T
S_22979976 S_61480677	693440	G	A
S_22979978 S_61480685	693480	G	T
S_22979979 S_61480689	693509	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22979989 S_61480714	693670	T	C
S_22979991 S_61480739	693705	G	C
S_22979993 S_61480751	693722	T	C
S_22980020 S_61480795	694116	G	A
S_22980098 S_61480902	694988	A	C
S_22980106 S_61480914	695158	T	A
S_22980109 S_61480921	695198	G	A
S_22980110 S_61480923	695211	T	C
S_22980112 S_61480926	695222	A	T
S_22980125 S_61480949	695340	C	G
S_22980126 S_61480951	695348	A	G
S_22980141 S_61481000	695680	T	A
S_22980143 S_61481004	695704	G	T
S_22980156 S_61481028	695838	A	G
S_22980166 S_61481039	695981	T	G
S_22980169 S_61481068	696062	G	A
S_22980170 S_61481072	696070	A	G
S_22980197 S_61481114	696632	G	A
S_22980199 S_61481136	696662	T	A
S_22980204 S_61481159	696787	C	G
S_22980258 S_61481350	697519	T	A
S_22980298 S_61481444	698024	T	A
S_22980300 S_61481448	698035	C	T
S_22980301 S_61481450	698039	T	A
S_22980311 S_61481475	698138	G	A
S_22980320 S_61481497	698269	G	A
S_22980331 S_61481547	698417	A	G
S_22980341 S_61481567	698523	A	T
S_22980342 S_61481568	698525	T	G
S_22980343 S_61481576	698559	C	T
S_22980346 S_61481584	698594	C	G
S_22980350 S_61481631	698776	T	C
S_22980357 S_61481648	698881	A	T
S_22980365 S_61481672	699057	G	A
S_22980381 S_61481707	699198	C	T
S_22980382 S_61481708	699199	A	G
S_22980383 S_61481721	699243	T	C
S_22980402 S_61481793	699704	C	T
S_22980420 S_61481849	699963	A	G
S_22980421 S_61481851	699994	T	C
S_22980422 S_61481852	699995	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22980437 S_61481892	700301	C	T
S_22980444 S_61481910	700410	C	T
S_22980446 S_61481911	700417	T	A
S_22980448 S_61481916	700457	C	T
S_22980449 S_61481921	700489	T	G
S_22980450 S_61481923	700502	T	G
S_22980457 S_61481940	700628	A	G
S_22980460 S_61481957	700726	C	T
S_22980462 S_61481961	700739	T	C
S_22980481 S_61482015	701027	T	A
S_22980492 S_61482044	701202	A	T
S_22980494 S_61482049	701226	C	T
S_22980495 S_61482051	701229	T	A
S_22980496 S_61482055	701255	A	T
S_22980497 S_61482057	701256	A	T
S_22980499 S_61482061	701290	T	C
S_22980504 S_61482108	701382	A	G
S_22980505 S_61482115	701390	C	T
S_22980508 S_61482142	701460	A	G
S_22980509 S_61482143	701461	T	C
S_22980510 S_61482147	701472	C	T
S_22980511 S_61482149	701480	A	T
I_2443786	701536	A	AT
S_22980521 S_61482164	701570	G	A
S_22980523 S_61482176	701602	A	T
S_22980530 S_61482194	701694	C	A
S_22980534 S_61482203	701725	G	A
S_22980541 S_61482211	701780	A	C
S_22980578 S_61482343	702432	C	T
S_22980583 S_61482386	702515	G	A
S_22980585 S_61482389	702533	A	G
S_22980616 S_61482504	703129	G	A
S_22980649 S_61482561	703463	A	G
S_22980650 S_61482566	703481	C	T
S_22980651 S_61482568	703491	C	T
S_22980652 S_61482570	703498	T	G
S_22980653 S_61482572	703503	C	T
S_22980654 S_61482582	703556	G	T
S_22980679 S_61482707	704044	G	A
S_22980680 S_61482708	704046	C	T
S_22980686 S_61482732	704160	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22980693 S_61482764	704318	A	G
S_22980704 S_61482806	704568	T	C
S_22980736 S_61483009	705206	T	A
S_22980783 S_61483067	705435	T	A
S_22980789 S_61483088	705526	T	G
S_22980793 S_61483104	705627	C	A
S_22980822 S_61483213	706042	G	T
S_22980833 S_61483260	706202	C	T
S_22980932 S_61483493	706606	A	G
S_22980963 S_61483603	707016	T	G
S_22980968 S_61483638	707096	T	G
S_22980984 S_61483709	707377	A	G
S_22980991 S_61483731	707453	A	G
S_22980998 S_61483744	707571	A	C
S_22981033 S_61483782	708002	G	A
S_22981034 S_61483793	708113	A	G
S_22981035 S_61483796	708129	G	T
S_22981036 S_61483799	708164	C	T
I_2443865	708193	A	AG
S_22981053 S_61483853	708506	C	T
S_22981067 S_61483890	708693	A	C
S_22981193 S_61484313	709988	A	T
S_22981204 S_61484352	710190	G	C
S_22981229 S_61484431	710533	C	T
S_22981231 S_61484432	710535	T	G
S_22981263 S_61484513	710714	C	T
S_22981299 S_61484578	710927	A	C
S_22981346 S_61484641	711208	C	T
S_22981367 S_61484688	711349	A	G
S_22981368 S_61484691	711376	G	A
S_22981369 S_61484694	711407	A	G
S_22981520 S_61485221	712852	C	G
S_22981632 S_61485549	714453	T	C
S_22981652 S_61485578	714631	A	T
S_22981654 S_61485582	714651	T	C
S_22981655 S_61485585	714658	A	G
S_22981675 S_61485617	714727	T	C
S_61485618	714729	C	T
S_22981678 S_61485620	714741	A	G
S_22981681 S_61485630	714781	C	T
S_22981684 S_61485636	714811	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_61485654	714849	A	T
S_22981747 S_61485739	714966	G	A
S_22981754 S_61485755	714989	T	C
S_22981801 S_61485949	715777	T	C
S_22981896 S_61486262	717025	T	A
S_22981990 S_61486504	717804	A	G
S_22981996 S_61486514	717859	A	T
S_22982000 S_61486521	717892	C	A
I_2443948	718032	C	CA
S_22982011 S_61486549	718072	C	T
S_22982057 S_61486611	718703	T	C
S_22982064 S_61486628	718848	C	T
S_22982136 S_61486803	719608	T	A
S_22982185 S_61486945	720326	T	C
S_22982191 S_61486966	720394	T	C
S_22982222 S_61487041	720554	A	C
S_22982359 S_61487296	721134	C	T
S_22982365 S_61487300	721157	A	G
S_22982375 S_61487320	721258	C	T
S_22982536 S_61487856	722863	A	C
S_22982539 S_61487862	722915	C	A
S_22982544 S_61487890	723020	T	C
S_22982594 S_61488070	723788	A	C
S_22982733 S_61488282	724773	T	G
S_22982734 S_61488285	724792	T	A
S_22982766 S_61488373	725203	A	C
S_22982774 S_61488395	725282	T	A
S_22982780 S_61488405	725313	A	G
S_22982824 S_61488514	725742	C	G
S_22982839 S_61488546	725878	A	T
S_22982868 S_61488634	726197	G	T
S_22982885 S_61488722	726793	T	A
S_22982886 S_61488723	726795	T	A
S_22982888 S_61488726	726834	G	A
S_22982890 S_61488735	726928	A	G
S_22982944 S_61488916	728704	T	C
S_22983080 S_61489250	730044	A	G
S_22983083 S_61489255	730096	C	T
S_22983119 S_61489365	730370	A	G
S_22983138 S_61489431	730661	G	T
S_22983226 S_61489575	731421	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22983281 S_61489616	731539	T	C
S_22983282 S_61489617	731541	A	C
S_22983283 S_61489618	731546	A	G
S_22983287 S_61489627	731635	T	C
S_22983288 S_61489632	731653	A	G
S_22983289 S_61489634	731663	C	T
S_22983314 S_61489671	731842	A	C
S_22983327 S_61489716	732027	G	C
S_22983329 S_61489721	732046	A	G
S_22983354 S_61489786	732499	A	G
S_22983360 S_61489796	732560	A	T
S_22983362 S_61489807	732592	A	G
S_22983441 S_61489965	732882	A	C
S_22983449 S_61489987	733017	A	T
S_22983451 S_61489992	733038	T	C
S_22983452 S_61490000	733082	A	T
S_22983453 S_61490003	733095	A	G
S_22983471 S_61490046	733362	A	G
S_22983473 S_61490055	733405	A	G
S_22983476 S_61490062	733431	C	A
S_22983479 S_61490080	733535	T	C
S_22983486 S_61490109	733664	T	C
S_22983487 S_61490114	733685	T	A
S_22983488 S_61490116	733690	G	T
S_22983489 S_61490118	733695	G	A
S_22983491 S_61490120	733699	G	T
S_22983492 S_61490131	733731	T	C
S_22983501 S_61490165	733911	C	A
S_22983525 S_61490238	734127	T	G
S_22983532 S_61490257	734199	C	G
S_22983551 S_61490295	734366	G	A
S_22983553 S_61490309	734421	A	C
S_22983581 S_61490381	734646	A	G
S_22983588 S_61490417	734749	T	G
S_22983591 S_61490427	734783	T	A
S_22983646 S_61490640	735486	T	C
S_22983696 S_61490823	736376	A	G
S_22983699 S_61490829	736417	C	A
S_22983735 S_61490910	736639	G	A
S_22983738 S_61490914	736658	A	G
S_22983750 S_61491001	736867	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22983771 S_61491046	737036	A	G
S_22983778 S_61491054	737099	T	C
S_22983781 S_61491060	737142	T	C
S_22983854 S_61491251	737759	G	A
S_22983881 S_61491319	738001	A	T
S_22983896 S_61491408	738161	A	G
S_22983897 S_61491420	738183	G	A
S_22983898 S_61491422	738189	G	A
S_22983922 S_61491459	738422	A	G
S_22983925 S_61491472	738461	C	T
S_22983933 S_61491504	738596	C	T
S_22983934 S_61491505	738598	C	T
S_22983935 S_61491506	738600	T	C
S_22983939 S_61491523	738657	C	A
S_22983947 S_61491565	738774	T	C
S_22983951 S_61491588	738889	G	A
S_22983952 S_61491590	738903	C	T
S_22983959 S_61491615	739002	G	C
S_22983960 S_61491623	739023	A	G
S_22983963 S_61491629	739048	C	A
S_22983967 S_61491638	739094	T	C
S_22983971 S_61491647	739141	A	G
S_22983973 S_61491650	739147	A	C
S_22983986 S_61491746	739295	A	G
S_22984020 S_61491872	739756	A	G
S_22984040 S_61491947	739969	C	T
S_22984048 S_61491999	740082	A	G
S_22984052 S_61492027	740189	C	T
S_22984053 S_61492037	740210	C	T
S_22984058 S_61492044	740251	G	A
S_22984065 S_61492067	740322	C	T
S_22984082 S_61492110	740506	C	T
S_22984090 S_61492124	740536	G	A
S_22984096 S_61492166	740590	A	G
S_22984097 S_61492168	740591	T	G
S_22984131 S_61492291	740893	C	T
S_22984132 S_61492296	740905	G	A
S_22984138 S_61492320	740945	C	A
S_22984150 S_61492337	740989	T	C
S_22984151 S_61492342	741022	A	C
S_22984156 S_61492370	741158	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22984158 S_61492375	741167	A	G
S_22984163 S_61492405	741317	G	A
S_22984191 S_61492519	741725	A	T
S_22984194 S_61492524	741752	A	T
S_22984195 S_61492525	741762	C	G
S_22984201 S_61492535	741813	G	A
S_22984228 S_61492588	741983	G	T
S_22984229 S_61492591	742007	C	A
S_22984230 S_61492593	742045	T	A
S_22984232 S_61492596	742051	A	T
S_22984240 S_61492613	742185	T	C
S_22984245 S_61492623	742252	G	T
S_22984256 S_61492678	742460	T	G
S_22984257 S_61492680	742465	A	G
S_22984261 S_61492704	742558	G	C
S_22984266 S_61492721	742657	A	G
S_22984278 S_61492756	742833	T	G
S_22984279 S_61492757	742836	G	C
S_22984282 S_61492766	742874	T	C
S_22984291 S_61492819	743098	G	A
S_22984316 S_61492879	743432	G	T
S_22984318 S_61492886	743468	T	G
S_22984321 S_61492899	743518	G	T
S_22984322 S_61492901	743523	C	T
S_22984340 S_61492941	743687	T	A
S_22984342 S_61492951	743725	T	C
S_22984343 S_61492955	743778	A	T
S_22984345 S_61492963	743801	A	T
S_22984348 S_61492974	743841	T	A
S_22984349 S_61492976	743848	C	T
S_22984352 S_61492988	743927	A	T
S_22984353 S_61492989	743929	C	T
S_22984354 S_61492998	743974	G	C
S_22984355 S_61492999	743977	G	T
S_22984425 S_61493131	744245	A	G
S_22984430 S_61493153	744339	G	C
S_22984454 S_61493237	744495	C	T
S_22984496 S_61493368	744936	G	A
S_22984498 S_61493373	744944	T	G
S_22984506 S_61493394	745068	C	G
S_22984507 S_61493398	745083	C	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22984527 S_61493468	745458	T	C
S_22984530 S_61493497	745619	G	A
S_22984643 S_61493721	746268	A	C
S_22984644 S_61493724	746278	C	A
S_22984688 S_61493804	746589	C	A
S_22984689 S_61493812	746613	T	C
S_22984692 S_61493827	746684	G	C
S_22984718 S_61493942	747115	C	T
S_22984726 S_61493989	747341	A	G
S_22984731 S_61494008	747422	A	G
S_22984735 S_61494012	747450	T	G
S_22984768 S_61494060	747812	A	G
S_22984784 S_61494098	747958	A	C
S_22984785 S_61494099	747965	T	C
S_22984786 S_61494102	747971	A	G
S_22984803 S_61494146	748124	G	A
S_22984804 S_61494149	748137	G	A
S_22984808 S_61494153	748192	T	C
S_22984810 S_61494158	748228	T	A
S_22984811 S_61494164	748267	A	T
S_22984838 S_61494207	748714	C	T
S_22984840 S_61494211	748750	A	G
S_22984841 S_61494213	748759	A	C
S_22984845 S_61494220	748780	A	G
S_22984864 S_61494303	749042	A	G
S_22984872 S_61494328	749116	T	G
S_22984873 S_61494329	749124	A	T
S_22984876 S_61494347	749203	C	T
S_22984880 S_61494353	749237	G	T
S_22984881 S_61494355	749240	T	C
S_22984925 S_61494439	749560	A	G
S_22984930 S_61494446	749604	G	A
S_22984943 S_61494468	749779	T	A
S_22984945 S_61494470	749782	C	T
S_22984946 S_61494471	749785	T	G
S_22984947 S_61494472	749792	T	A
S_22984969 S_61494500	749963	T	G
S_22984974 S_61494507	749994	T	C
S_22984977 S_61494515	750034	A	T
S_22984978 S_61494540	750148	A	T
S_22984999 S_61494603	750433	C	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22985001 S_61494609	750446	G	A
S_22985011 S_61494647	750601	G	T
S_22985019 S_61494653	750674	C	G
S_22985029 S_61494693	750916	T	A
S_22985032 S_61494700	750968	G	T
S_22985034 S_61494705	750982	A	G
S_22985040 S_61494714	751075	A	T
S_22985041 S_61494733	751143	G	A
S_22985042 S_61494734	751144	G	T
S_22985067 S_61494787	751326	T	C
S_22985068 S_61494796	751349	G	C
S_22985078 S_61494834	751586	G	A
S_22985085 S_61494856	751671	T	C
S_22985088 S_61494860	751705	A	G
S_22985093 S_61494869	751786	A	T
S_22985094 S_61494871	751799	G	A
S_22985100 S_61494895	751897	T	G
S_22985101 S_61494897	751908	A	C
S_22985104 S_61494900	751926	T	C
S_22985111 S_61494917	751998	G	T
S_22985112 S_61494919	752011	G	T
S_22985113 S_61494923	752039	G	C
S_22985121 S_61494945	752125	C	T
S_22985130 S_61494962	752223	A	G
S_22985131 S_61494968	752243	C	G
S_22985142 S_61495003	752388	A	G
S_22985145 S_61495016	752426	G	A
S_22985155 S_61495029	752586	T	A
S_22985164 S_61495048	752647	T	C
S_22985180 S_61495092	752845	A	T
S_22985190 S_61495131	752992	G	T
S_22985208 S_61495184	753275	A	G
S_22985209 S_61495187	753289	C	A
S_22985308 S_61495395	753707	T	C
S_22985310 S_61495396	753708	T	C
S_22985312 S_61495397	753735	C	A
S_22985314 S_61495399	753736	C	T
S_22985315 S_61495403	753754	G	T
S_22985320 S_61495422	753840	C	T
S_22985321 S_61495423	753843	C	A
S_22985343 S_61495483	754215	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22985344 S_61495484	754217	A	G
S_22985371 S_61495595	754710	T	A
S_22985377 S_61495624	754777	G	T
S_22985386 S_61495656	754889	A	G
S_22985388 S_61495675	754940	A	C
S_22985399 S_61495705	755045	A	G
S_22985407 S_61495756	755210	T	C
S_22985408 S_61495757	755211	A	T
S_22985422 S_61495782	755287	A	T
S_22985516 S_61495940	755728	A	T
S_22985545 S_61495994	755942	T	G
S_22985568 S_61496037	756107	T	C
S_22985595 S_61496106	756328	A	C
S_22985596 S_61496109	756329	A	T
S_22985679 S_61496269	757393	A	G
S_22985682 S_61496280	757448	G	A
S_22985687 S_61496287	757497	A	G
S_22985689 S_61496292	757528	C	T
S_22985701 S_61496327	757703	G	A
S_22985723 S_61496392	757891	G	A
S_22985767 S_61496509	758294	G	A
S_22985783 S_61496559	758583	G	A
S_22985784 S_61496564	758601	T	C
S_22985785 S_61496570	758637	T	G
S_22985786 S_61496574	758656	T	A
S_22985789 S_61496584	758705	A	T
S_22985793 S_61496588	758739	G	T
S_22985821 S_61496723	759172	A	G
S_22985822 S_61496732	759185	C	T
S_22985837 S_61496816	759514	C	G
S_22985856 S_61496880	759753	T	C
S_22985878 S_61496908	759826	C	T
S_22985908 S_61496996	760063	A	T
S_22985929 S_61497056	760247	T	A
S_22985954 S_61497161	760503	T	C
S_22985957 S_61497167	760532	C	G
S_22985958 S_61497169	760540	C	A
S_22985970 S_61497210	760751	A	C
S_22985978 S_61497223	760826	G	C
S_22985981 S_61497233	760859	T	A
S_22985989 S_61497268	761058	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22985990 S_61497270	761061	C	T
S_22986010 S_61497330	761232	G	A
S_22986030 S_61497393	761461	T	C
S_22986071 S_61497532	761891	T	C
S_22986073 S_61497563	762007	C	T
S_22986198 S_61497896	763279	C	A
S_22986207 S_61497963	763490	G	T
S_22986235 S_61498031	763800	G	A
S_22986241 S_61498055	763892	C	T
S_22986269 S_61498151	764191	G	C
S_22986309 S_61498259	764538	A	C
S_22986324 S_61498323	764800	G	T
S_22986346 S_61498415	765164	G	T
S_22986353 S_61498437	765263	A	G
S_22986356 S_61498445	765307	G	T
S_22986365 S_61498465	765414	A	C
S_22986371 S_61498489	765484	T	C
S_22986379 S_61498510	765544	A	G
S_22986381 S_61498528	765605	C	T
S_22986382 S_61498531	765615	C	T
S_22986403 S_61498575	765762	T	A
S_22986422 S_61498585	765786	T	C
S_22986470 S_61498601	765934	G	A
S_22986473 S_61498611	765975	C	T
S_22986478 S_61498625	766035	A	G
S_22986491 S_61498691	766249	G	A
S_22986535 S_61498813	766708	A	G
S_22986537 S_61498842	766749	G	A
S_22986560 S_61498967	767035	G	A
S_22986561 S_61498969	767040	C	T
S_22986563 S_61498974	767066	G	C
S_22986565 S_61498981	767087	A	G
S_22986567 S_61498986	767124	T	C
S_22986599 S_61499067	767483	A	T
S_22986601 S_61499071	767517	G	A
S_22986605 S_61499080	767599	C	T
S_22986648 S_61499185	767978	T	G
S_22986653 S_61499202	768043	C	T
S_22986654 S_61499203	768045	A	G
S_22986658 S_61499215	768085	A	G
S_22986659 S_61499219	768113	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22986693 S_61499280	768520	T	C
S_22986694 S_61499281	768523	A	T
S_22986697 S_61499284	768579	G	A
S_22986698 S_61499286	768594	T	C
S_22986709 S_61499300	768614	C	T
S_22986715 S_61499306	768621	T	C
S_22986770 S_61499385	768854	C	G
S_22986786 S_61499416	768998	T	C
S_22986810 S_61499534	769299	G	A
S_22986812 S_61499552	769337	C	T
S_22986816 S_61499579	769411	G	T
S_22986831 S_61499625	769552	A	G
S_22986851 S_61499678	769709	T	A
S_22986856 S_61499698	769809	C	G
S_22986857 S_61499702	769817	G	C
S_22986858 S_61499708	769838	T	C
S_22986864 S_61499731	769925	G	A
S_22986870 S_61499753	770011	C	T
S_22986880 S_61499803	770175	A	G
S_22986886 S_61499824	770253	G	A
S_22986887 S_61499831	770264	A	G
S_22986888 S_61499845	770290	G	C
S_22986889 S_61499852	770300	A	G
S_22986891 S_61499865	770330	T	C
S_22986894 S_61499870	770387	A	C
S_22986895 S_61499879	770442	T	A
I_1468143 I_2444551	770485	T	TG
S_22986915 S_61499951	770784	T	C
S_22986941 S_61500058	771317	A	G
S_22986944 S_61500070	771380	G	A
S_22986945 S_61500078	771397	G	C
S_22986961 S_61500106	771472	T	C
S_22986976 S_61500127	771498	C	T
S_22987023 S_61500251	771849	A	C
S_22987027 S_61500265	771907	T	G
S_22987028 S_61500272	771943	A	T
S_22987035 S_61500297	772093	A	G
S_22987037 S_61500299	772111	C	T
S_22987038 S_61500303	772134	C	T
S_22987050 S_61500364	772467	T	C
S_22987078 S_61500456	772712	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22987087 S_61500488	772868	C	A
S_22987088 S_61500489	772869	T	C
S_22987089 S_61500490	772871	T	G
S_22987127 S_61500647	773234	C	T
S_22987128 S_61500648	773237	G	A
S_22987144 S_61500723	773435	A	G
S_22987151 S_61500771	773542	G	C
S_22987153 S_61500782	773587	A	C
S_22987196 S_61500892	774039	T	C
S_22987198 S_61500898	774061	G	T
S_22987227 S_61500990	774420	C	T
S_22987230 S_61500994	774442	A	G
S_22987251 S_61501046	774844	C	T
S_22987268 S_61501093	774987	T	C
S_22987318 S_61501216	775455	T	A
S_22987319 S_61501217	775456	C	G
S_22987378 S_61501406	776052	G	A
S_22987379 S_61501413	776071	T	A
S_22987411 S_61501520	776313	A	T
S_22987412 S_61501521	776316	A	C
S_22987418 S_61501552	776378	T	A
S_22987424 S_61501566	776427	G	A
S_22987433 S_61501604	776575	A	G
S_22987441 S_61501630	776656	A	T
S_22987445 S_61501641	776700	A	G
S_22987460 S_61501681	776862	G	A
S_22987485 S_61501737	777137	G	T
S_22987501 S_61501769	777331	C	T
S_22987521 S_61501829	777672	C	G
S_22987553 S_61501936	778135	C	T
S_22987556 S_61501944	778173	C	T
S_22987557 S_61501946	778178	G	A
S_22987558 S_61501950	778193	T	C
S_22987565 S_61501965	778325	C	G
S_22987601 S_61502049	778721	A	G
S_22987602 S_61502053	778732	T	A
S_22987630 S_61502189	779040	C	T
S_22987631 S_61502190	779041	A	G
S_22987636 S_61502232	779151	C	T
S_22987638 S_61502236	779176	G	T
S_22987697 S_61502303	779342	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22987729 S_61502358	779511	C	T
S_22987797 S_61502622	780417	A	T
S_22987805 S_61502666	780627	T	C
S_22987806 S_61502667	780632	C	G
S_22987812 S_61502684	780700	G	A
S_22987816 S_61502690	780720	C	T
S_22987825 S_61502714	780805	C	T
S_22987844 S_61502730	780891	A	T
S_22987856 S_61502804	781067	C	T
S_22987857 S_61502805	781068	A	G
S_22987895 S_61502929	781660	T	A
S_22987896 S_61502932	781686	A	G
S_22987913 S_61502946	781806	T	A
S_22987970 S_61503029	782174	C	T
S_22987971 S_61503030	782177	T	G
S_22987974 S_61503042	782251	T	A
S_22987994 S_61503086	782766	A	T
S_22987995 S_61503088	782778	C	T
S_22987997 S_61503093	782806	C	G
S_22988001 S_61503110	782882	T	G
S_22988002 S_61503113	782903	C	T
S_22988004 S_61503116	782929	G	T
S_22988005 S_61503117	782932	C	A
S_22988006 S_61503119	782940	C	T
S_22988020 S_61503143	783042	T	C
S_22988021 S_61503144	783049	A	G
S_22988036 S_61503178	783218	G	T
S_22988058 S_61503211	783472	G	A
S_22988061 S_61503219	783510	T	G
S_22988062 S_61503220	783514	C	A
S_22988064 S_61503238	783589	G	C
S_22988084 S_61503300	783782	T	C
S_22988086 S_61503302	783787	A	G
S_22988091 S_61503314	783849	T	C
S_22988092 S_61503320	783865	T	C
S_22988093 S_61503322	783885	G	A
S_22988094 S_61503325	783900	T	C
S_22988095 S_61503327	783906	A	G
S_22988115 S_61503361	784015	G	T
S_22988118 S_61503378	784087	G	T
S_22988122 S_61503386	784141	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22988128 S_61503398	784237	A	T
S_22988131 S_61503402	784262	T	C
S_22988136 S_61503417	784338	T	C
S_22988139 S_61503422	784360	T	G
S_22988140 S_61503425	784368	C	T
S_61503642	784719	A	G
S_22988293 S_61503674	784770	T	A
S_22988353 S_61503771	785234	G	A
S_22988360 S_61503797	785535	G	A
S_22988374 S_61503832	785776	A	C
S_22988376 S_61503834	785788	A	G
S_22988389 S_61503861	785889	C	T
S_22988390 S_61503867	785906	G	C
S_22988415 S_61503922	786028	T	G
S_22988457 S_61503996	786077	G	A
S_22988472 S_61504035	786152	A	C
S_22988480 S_61504058	786233	T	C
S_22988485 S_61504065	786289	A	G
S_22988487 S_61504070	786310	C	G
S_22988488 S_61504078	786345	C	G
S_22988493 S_61504107	786446	T	G
S_22988497 S_61504119	786507	A	T
S_22988501 S_61504139	786577	G	T
S_22988522 S_61504220	786898	A	G
S_22988525 S_61504238	786986	T	C
S_22988529 S_61504256	787043	G	A
S_22988578 S_61504313	787118	C	T
S_22988644 S_61504394	787209	G	A
S_22988646 S_61504395	787215	G	T
S_22988657 S_61504419	787290	A	T
S_22988662 S_61504431	787323	T	C
S_22988672 S_61504450	787355	T	G
S_22988719 S_61504506	787511	G	A
S_22988720 S_61504515	787536	A	T
S_22988722 S_61504517	787539	C	T
S_22988746 S_61504570	787784	C	T
S_22988775 S_61504667	788277	C	A
S_22988777 S_61504671	788305	A	C
S_22988779 S_61504685	788377	A	T
S_22988780 S_61504686	788380	T	A
S_22988789 S_61504709	788466	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22988800 S_61504769	788537	G	T
S_22988803 S_61504809	788587	T	C
S_22988804 S_61504816	788617	C	T
S_22988805 S_61504819	788622	G	A
S_22988806 S_61504820	788627	A	T
S_22988809 S_61504838	788729	C	A
S_22988811 S_61504847	788768	T	C
S_22988812 S_61504851	788774	T	C
S_22988813 S_61504854	788799	A	T
S_22988819 S_61504887	788919	G	A
S_22988838 S_61504947	789220	A	G
S_22988889 S_61505138	789808	T	A
S_22988898 S_61505148	789865	T	C
S_22988914 S_61505203	790090	A	C
S_22988915 S_61505205	790094	G	T
S_22988918 S_61505211	790123	A	C
S_22988949 S_61505367	790371	G	A
S_22988992 S_61505583	791177	T	C
S_22989000 S_61505633	791360	T	C
S_22989002 S_61505639	791406	T	C
S_22989003 S_61505640	791410	G	T
S_22989004 S_61505646	791436	G	T
I_1468269 I_2444750	791444	G	GT
S_22989014 S_61505677	791575	T	G
S_22989024 S_61505709	791727	C	G
S_22989050 S_61505783	791952	G	T
S_22989097 S_61505869	792383	T	C
S_22989099 S_61505870	792390	A	G
S_22989103 S_61505881	792451	C	T
S_22989114 S_61505939	792636	C	A
S_22989123 S_61505983	792741	C	T
S_22989151 S_61506060	792975	C	A
S_22989157 S_61506076	793065	A	C
S_22989168 S_61506106	793178	C	T
S_22989170 S_61506108	793203	A	G
S_22989171 S_61506109	793204	T	C
S_22989172 S_61506110	793210	G	T
S_22989174 S_61506111	793211	G	T
S_22989178 S_61506129	793269	A	T
S_22989179 S_61506135	793290	C	T
S_22989187 S_61506153	793411	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22989189 S_61506170	793430	G	A
S_22989190 S_61506179	793438	A	G
S_22989198 S_61506249	793667	A	G
I_1468288 I_2444774	793954	A	AG
S_22989217 S_61506314	793959	T	C
S_22989220 S_61506327	794017	A	G
S_22989229 S_61506367	794194	A	G
S_22989259 S_61506422	794470	A	T
S_22989262 S_61506429	794535	A	T
S_22989270 S_61506460	794626	C	T
S_22989271 S_61506462	794628	A	G
S_22989298 S_61506628	795023	A	T
S_22989300 S_61506634	795035	T	C
S_22989307 S_61506679	795183	G	A
S_22989309 S_61506695	795219	G	A
S_22989310 S_61506699	795233	C	T
S_22989312 S_61506707	795248	C	G
S_22989314 S_61506726	795311	T	A
S_22989323 S_61506746	795354	T	C
S_22989327 S_61506753	795381	A	C
S_22989329 S_61506764	795400	A	G
S_22989338 S_61506860	795534	A	G
S_22989339 S_61506879	795552	G	C
S_22989347 S_61506936	795707	A	C
S_22989348 S_61506939	795716	C	T
S_22989350 S_61506945	795759	G	A
S_22989354 S_61506961	795828	C	A
S_22989356 S_61506970	795859	G	A
S_22989359 S_61506987	795929	G	A
S_22989361 S_61506994	795945	A	G
S_22989367 S_61507019	796039	G	T
S_22989369 S_61507025	796095	C	A
S_22989371 S_61507027	796110	A	C
S_22989372 S_61507028	796116	T	C
S_22989389 S_61507056	796289	G	C
S_22989396 S_61507066	796358	A	T
S_22989397 S_61507067	796359	T	C
S_22989403 S_61507086	796459	C	T
S_22989426 S_61507141	796722	T	C
S_22989428 S_61507150	796787	A	G
S_22989435 S_61507157	796826	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22989441 S_61507181	796953	A	C
S_22989447 S_61507202	797062	G	T
S_22989448 S_61507203	797064	A	G
S_22989453 S_61507223	797129	G	A
S_22989463 S_61507272	797367	C	A
I_1468302 I_2444802	797479	C	CTTGTGA
S_22989472 S_61507306	797482	A	C
S_22989519 S_61507462	797985	C	T
S_22989525 S_61507522	798151	A	T
S_22989528 S_61507526	798178	G	A
S_22989531 S_61507532	798212	G	A
S_22989593 S_61507701	798787	C	G
S_22989644 S_61507782	798933	A	T
S_22989651 S_61507799	798979	C	T
S_22989727 S_61507988	799441	C	T
S_22989771 S_61508118	799690	G	C
S_22989772 S_61508121	799696	T	A
S_22989796 S_61508235	800006	C	A
S_22989806 S_61508297	800213	A	T
S_22989818 S_61508349	800543	G	C
S_22989819 S_61508351	800548	C	T
S_22989820 S_61508352	800549	A	G
S_22989821 S_61508354	800559	C	T
S_22989920 S_61508524	800989	G	A
S_22989997 S_61508652	801431	T	C
S_22989998 S_61508656	801448	C	G
S_22990000 S_61508660	801488	C	T
S_22990005 S_61508666	801546	T	A
S_22990010 S_61508682	801597	G	A
S_22990011 S_61508684	801607	T	G
S_22990014 S_61508704	801712	A	G
S_22990015 S_61508711	801737	C	T
S_22990020 S_61508730	801813	A	T
S_22990022 S_61508734	801836	T	A
S_22990026 S_61508745	801906	A	C
S_22990028 S_61508753	801959	G	A
S_22990031 S_61508761	801985	T	C
S_22990032 S_61508762	801993	A	G
S_22990033 S_61508763	801997	A	G
S_22990034 S_61508764	802004	G	A
S_22990039 S_61508774	802078	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
I_1468339 I_2444870	802081	T	TA
S_22990072 S_61508808	802170	T	C
S_22990079 S_61508826	802284	C	T
S_22990085 S_61508862	802400	T	A
S_22990091 S_61508880	802493	A	T
S_22990125 S_61508973	802942	A	C
S_22990126 S_61508974	802962	G	C
S_22990128 S_61508978	803006	T	C
S_22990130 S_61508981	803023	G	A
S_22990132 S_61508983	803044	C	T
S_22990136 S_61509001	803154	G	A
S_22990137 S_61509002	803156	T	G
S_22990215 S_61509265	804433	G	A
S_22990315 S_61509411	805282	C	A
S_22990320 S_61509436	805407	A	C
S_22990324 S_61509456	805559	G	C
S_22990325 S_61509457	805561	T	A
S_22990326 S_61509458	805562	T	A
S_22990385 S_61509670	806382	A	G
S_22990388 S_61509678	806418	G	C
S_22990390 S_61509680	806449	C	T
S_22990393 S_61509687	806500	T	C
S_22990394 S_61509689	806502	A	G
S_22990395 S_61509692	806505	C	T
S_22990399 S_61509702	806587	C	T
S_22990402 S_61509704	806595	C	T
S_22990407 S_61509717	806654	A	T
S_22990410 S_61509724	806678	A	G
S_22990444 S_61509803	807208	G	A
S_22990445 S_61509807	807218	C	T
S_22990463 S_61509907	807689	C	T
S_22990470 S_61509914	807761	A	G
S_22990481 S_61509952	807892	T	C
S_22990505 S_61510057	808375	G	A
S_22990509 S_61510069	808452	T	C
S_22990541 S_61510142	808942	C	T
S_22990569 S_61510227	809623	T	C
S_22990572 S_61510235	809679	C	T
S_22990594 S_61510285	809903	A	T
S_22990597 S_61510299	809978	T	C
S_22990608 S_61510361	810242	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22990623 S_61510431	810548	C	T
S_22990653 S_61510518	811001	A	G
S_22990669 S_61510587	811352	G	A
S_22990800 S_61511015	812538	A	G
S_22990811 S_61511068	812790	C	A
S_22990840 S_61511151	813076	G	A
S_22990845 S_61511172	813153	C	T
S_22990888 S_61511368	813700	G	A
S_22990890 S_61511374	813730	T	C
S_22990891 S_61511380	813748	G	A
S_22990892 S_61511381	813754	A	G
S_22990895 S_61511389	813787	A	T
S_22990899 S_61511418	813912	T	G
S_22990900 S_61511419	813914	T	A
S_22990902 S_61511434	814019	T	A
S_22990904 S_61511447	814092	A	G
D_1468412 D_2444999	814688	CAG	C
S_22991019 S_61511661	814918	A	G
S_22991048 S_61511735	815356	A	T
S_22991051 S_61511742	815428	C	T
S_22991052 S_61511744	815436	T	A
S_22991055 S_61511750	815467	A	C
S_22991056 S_61511754	815488	G	A
S_22991061 S_61511781	815723	G	C
S_22991082 S_61511853	816003	T	C
S_22991093 S_61511923	816201	C	G
S_22991126 S_61512006	816697	G	A
S_22991142 S_61512032	816828	C	T
S_22991148 S_61512046	816902	G	T
S_22991150 S_61512049	816910	A	C
S_22991154 S_61512051	816930	C	A
S_22991160 S_61512073	817033	G	T
S_22991163 S_61512082	817068	G	A
S_22991164 S_61512083	817071	G	A
S_22991165 S_61512085	817072	A	G
S_22991168 S_61512090	817096	G	A
S_22991172 S_61512107	817152	G	A
S_22991173 S_61512110	817158	A	C
S_22991174 S_61512124	817201	T	C
S_22991175 S_61512125	817210	C	T
S_22991179 S_61512143	817286	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22991184 S_61512159	817326	G	A
S_22991185 S_61512166	817335	C	A
S_22991193 S_61512188	817422	T	A
S_22991194 S_61512191	817445	A	G
S_22991200 S_61512201	817488	T	C
S_22991202 S_61512202	817492	T	C
S_22991234 S_61512265	817689	A	C
S_22991238 S_61512279	817731	G	T
S_22991239 S_61512291	817763	A	G
S_22991242 S_61512302	817823	T	G
S_22991243 S_61512304	817833	G	T
S_22991414 S_61512584	818489	C	A
S_22991422 S_61512600	818612	A	C
S_22991423 S_61512602	818616	C	A
S_22991424 S_61512606	818641	G	A
S_22991435 S_61512645	818789	G	A
S_22991438 S_61512654	818817	T	A
S_22991440 S_61512662	818861	T	C
I_1468440 I_2445052	818881	G	GA
S_22991444 S_61512670	818882	C	G
S_22991445 S_61512675	818903	G	A
S_22991448 S_61512686	818953	G	C
S_22991463 S_61512719	819144	T	G
S_22991495 S_61512863	819674	A	C
S_22991513 S_61512910	819900	T	G
S_22991526 S_61512966	820177	T	G
S_22991527 S_61512973	820206	G	C
S_22991528 S_61512976	820209	G	A
S_22991547 S_61513059	820547	G	T
S_22991555 S_61513070	820625	G	C
S_22991556 S_61513071	820626	G	A
S_22991737 S_61513384	822355	G	A
S_22991804 S_61513594	822753	C	G
S_22991846 S_61513733	823104	T	C
S_22991848 S_61513737	823131	T	C
S_22991849 S_61513740	823136	C	G
S_22991865 S_61513801	823441	C	T
S_22991866 S_61513806	823464	A	G
S_22991867 S_61513808	823472	T	A
S_22991900 S_61513905	823728	A	G
S_22991901 S_61513908	823737	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22991924 S_61513991	823976	C	T
S_22991925 S_61513992	823979	T	G
S_22991926 S_61513993	823980	C	G
S_22991959 S_61514068	824176	T	G
S_22991960 S_61514069	824177	C	G
S_22991967 S_61514127	824243	C	T
S_22991975 S_61514227	824517	T	G
S_22992203 S_61514972	830195	A	C
S_22992206 S_61514978	830249	G	A
S_22992208 S_61514982	830266	T	C
S_22992210 S_61514983	830280	T	G
S_22992211 S_61514984	830284	A	G
S_22992212 S_61514988	830305	T	C
S_22992214 S_61514990	830327	C	G
S_61515420	831397	G	A
S_22992607 S_61516030	833624	T	C
S_22992773 S_61516396	835733	G	A
S_22992776 S_61516408	835804	G	C
S_22992785 S_61516432	835932	C	G
S_22992839 S_61516556	837064	A	G
S_22992841 S_61516567	837099	G	A
S_22992842 S_61516573	837126	C	G
S_22993131 S_61517041	839562	A	G
S_61517419	841310	A	G
S_22993362 S_61517702	842354	C	T
S_22993364 S_61517715	842410	A	G
S_22993370 S_61517736	842498	G	A
S_22993372 S_61517755	842539	T	C
S_22993387 S_61517819	842794	C	T
S_22993388 S_61517831	842834	T	G
S_22993396 S_61517874	842968	C	T
S_22993414 S_61517943	843280	T	C
S_22993419 S_61517957	843323	C	A
S_22993423 S_61517983	843430	C	G
S_22993425 S_61517991	843446	C	G
S_22993441 S_61518099	843753	T	C
S_22993459 S_61518142	843939	G	C
S_22993493 S_61518197	844191	T	A
S_22993505 S_61518240	844396	A	T
S_22993547 S_61518389	844997	G	A
S_22993635 S_61518571	845509	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22993645 S_61518600	845650	T	C
S_22993739 S_61518765	846223	C	T
S_22993740 S_61518769	846244	T	G
S_22993744 S_61518776	846285	T	A
S_22993768 S_61518859	846753	T	G
S_22993772 S_61518878	846837	C	T
S_22993773 S_61518880	846840	G	A
S_22993791 S_61518929	847191	T	C
S_22993814 S_61518975	847561	G	T
S_22993835 S_61519009	847779	A	T
S_22993858 S_61519066	848099	A	C
S_22993864 S_61519073	848136	G	A
S_22993868 S_61519078	848165	T	C
S_22993869 S_61519080	848166	A	G
S_22993893 S_61519142	848359	A	C
S_22993895 S_61519152	848377	A	G
S_22993915 S_61519270	848643	A	G
S_22993916 S_61519274	848655	A	G
S_61519385	849045	C	T
S_22993960 S_61519395	849092	C	T
S_22994004 S_61519472	849580	A	T
S_22994048 S_61519679	850506	T	A
S_22994067 S_61519711	850746	T	C
S_22994107 S_61519829	851642	A	G
S_22994117 S_61519858	851742	A	T
S_22994123 S_61519897	851896	A	G
S_22994518 S_61520770	855557	C	G
S_22994519 S_61520772	855562	G	C
S_22994675 S_61521071	856828	T	C
S_22994841 S_61521550	858784	G	T
S_22994849 S_61521560	858839	T	C
S_22994918 S_61521696	859391	G	A
S_22994968 S_61521778	859561	A	G
S_22995074 S_61522061	860328	G	T
S_22995081 S_61522095	860430	C	T
S_22995140 S_61522294	861027	A	T
S_22995168 S_61522426	861436	A	G
S_22995952 S_61523810	865178	T	C
S_22995954 S_61523814	865190	G	T
S_22995958 S_61523830	865259	A	T
S_22996015 S_61523955	865767	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22996034 S_61524008	866009	G	A
S_22996058 S_61524102	866381	G	A
D_1468787 D_2445631	866682	GTT	G
S_22996137 S_61524268	867005	T	C
S_22996185 S_61524386	867390	T	G
S_22996189 S_61524394	867447	G	A
S_22996196 S_61524415	867549	A	G
S_22996199 S_61524419	867567	A	G
S_22996203 S_61524427	867615	A	T
S_22996208 S_61524446	867725	A	T
S_22996278 S_61524579	868188	G	A
S_22996397 S_61524756	868578	A	T
S_22996425 S_61524944	868965	G	A
S_22996479 S_61525137	869729	G	C
S_22996480 S_61525142	869746	T	C
S_22996493 S_61525186	869934	C	T
S_22996503 S_61525211	870006	C	T
S_22996512 S_61525259	870209	T	C
S_22996565 S_61525399	870883	G	A
S_22996570 S_61525411	870926	G	T
S_22996599 S_61525491	871290	G	A
S_22997569 S_61527658	876337	G	T
S_22997575 S_61527680	876403	C	T
S_22997618 S_61527822	876853	A	T
S_22997620 S_61527824	876860	A	G
S_22997666 S_61527926	877313	A	C
S_22997763 S_61528104	877759	C	T
S_22997781 S_61528163	877995	A	C
S_22997793 S_61528194	878094	T	C
S_22997803 S_61528212	878198	G	A
S_22997805 S_61528225	878235	A	T
S_22997810 S_61528232	878281	A	C
S_22997811 S_61528234	878283	G	A
S_22997828 S_61528273	878421	T	A
S_22997864 S_61528399	878965	G	C
S_22997869 S_61528428	879082	T	C
S_22997870 S_61528437	879122	A	G
S_22997871 S_61528442	879132	A	G
S_22997876 S_61528468	879216	A	T
S_22997892 S_61528499	879323	C	A
S_22997912 S_61528524	879349	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22997928 S_61528540	879448	G	T
S_22997931 S_61528553	879512	T	A
S_22997933 S_61528557	879536	C	A
S_22997936 S_61528561	879552	C	A
S_22997938 S_61528565	879578	C	G
S_22997989 S_61528669	880020	A	T
S_22998085 S_61528832	880465	A	G
S_22998106 S_61528859	880599	A	C
I_2445748	880616	A	AC
S_22998119 S_61528877	880729	G	A
S_22998131 S_61528886	880846	T	C
S_22998138 S_61528899	880948	C	A
S_22998141 S_61528901	880955	T	C
S_22998168 S_61528955	881321	T	C
S_22998169 S_61528956	881322	G	A
S_22998173 S_61528967	881384	C	T
S_22998175 S_61528973	881403	A	G
S_22998178 S_61528981	881479	T	A
S_22998179 S_61528982	881482	T	A
S_22998180 S_61528983	881483	T	A
S_22998181 S_61528984	881484	T	A
S_22998182 S_61528992	881543	C	T
S_22998183 S_61528993	881554	G	T
S_22998184 S_61528995	881576	A	G
S_22998186 S_61529000	881606	A	C
S_22998195 S_61529049	881889	A	G
S_22998196 S_61529050	881890	C	T
S_22998211 S_61529090	882087	G	T
S_22998216 S_61529099	882145	C	T
S_22998220 S_61529123	882230	C	T
S_22998221 S_61529127	882237	T	G
S_22998222 S_61529130	882240	C	T
S_22998240 S_61529252	882452	T	C
S_22998256 S_61529311	882566	G	A
S_22998259 S_61529314	882573	C	A
S_22998269 S_61529344	882653	C	G
S_22998272 S_61529349	882660	C	A
S_22998278 S_61529370	882747	A	G
S_22998285 S_61529398	882852	T	A
S_22998287 S_61529400	882867	G	A
S_22998291 S_61529407	882898	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22998340 S_61529512	883306	A	T
S_22998384 S_61529621	883547	G	T
S_22998385 S_61529624	883561	T	C
S_22998472 S_61529891	884519	G	T
S_22998481 S_61529912	884578	G	T
S_22998521 S_61530060	885075	C	T
S_22998564 S_61530237	885778	T	C
S_22998595 S_61530297	886039	G	T
S_22998596 S_61530309	886074	A	G
S_22998597 S_61530314	886109	C	T
S_22998599 S_61530328	886155	G	T
S_22998611 S_61530380	886385	C	T
S_22998615 S_61530390	886418	A	G
S_22998653 S_61530522	886937	C	G
S_22998671 S_61530584	887173	A	G
I_2445799	887374	T	TA
S_22998703 S_61530640	887376	T	A
S_22998704 S_61530642	887377	G	T
S_22998707 S_61530657	887442	G	C
S_22998708 S_61530663	887481	A	C
S_22998711 S_61530665	887499	C	T
S_22998718 S_61530689	887662	C	T
S_22998719 S_61530692	887695	A	C
S_22998721 S_61530693	887703	C	G
S_22998722 S_61530695	887708	A	T
S_22998723 S_61530696	887729	G	A
S_22998725 S_61530704	887746	T	C
S_22998752 S_61530809	888142	T	A
S_22998790 S_61530967	888763	C	T
S_22998791 S_61530968	888765	T	C
S_22998797 S_61530993	888874	T	C
S_22998801 S_61531001	888895	A	G
S_22998813 S_61531023	888968	C	T
S_22998817 S_61531025	888987	A	G
S_22998838 S_61531091	889317	A	G
S_22998839 S_61531107	889365	G	A
S_22998851 S_61531178	889630	T	C
S_22998857 S_61531193	889677	C	A
S_22998869 S_61531276	889806	G	A
S_22998876 S_61531288	889893	G	A
S_22998884 S_61531307	889973	C	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22998892 S_61531316	890021	T	G
S_22998899 S_61531338	890115	T	C
S_22998902 S_61531346	890168	A	T
S_22998905 S_61531351	890198	T	G
S_22999038 S_61531526	891022	G	T
S_22999050 S_61531547	891159	G	A
S_22999064 S_61531567	891414	C	T
S_22999065 S_61531568	891418	A	G
S_22999119 S_61531681	892251	G	C
S_22999160 S_61531767	892510	T	G
S_22999161 S_61531768	892511	G	A
S_22999262 S_61532130	894232	C	T
S_22999276 S_61532151	894408	G	A
S_22999277 S_61532152	894410	G	A
S_22999278 S_61532153	894412	G	A
S_22999293 S_61532224	894610	G	A
S_22999304 S_61532300	894849	T	G
S_22999330 S_61532407	895174	A	C
I_1468938 I_2445874	895547	G	GC
S_22999351 S_61532510	895548	A	T
S_22999354 S_61532521	895626	G	A
S_22999356 S_61532529	895661	G	T
S_22999361 S_61532541	895744	T	A
S_22999364 S_61532557	895860	T	C
S_22999366 S_61532561	895896	G	A
S_22999370 S_61532574	895946	C	T
I_2445883	896032	C	CT
S_22999380 S_61532597	896108	T	C
S_22999382 S_61532603	896165	T	G
S_22999391 S_61532612	896233	T	C
S_22999412 S_61532681	896594	T	A
S_22999413 S_61532682	896595	G	A
S_22999414 S_61532683	896597	A	G
S_22999418 S_61532690	896631	G	A
S_22999425 S_61532735	896745	C	G
S_22999494 S_61532874	897260	T	A
S_22999495 S_61532875	897261	G	T
S_22999496 S_61532876	897262	T	C
S_22999535 S_61533014	897695	A	C
S_22999546 S_61533051	897819	G	A
S_22999595 S_61533183	898379	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_22999604 S_61533202	898448	A	C
S_22999622 S_61533258	898667	A	G
S_22999627 S_61533268	898707	T	C
S_22999628 S_61533270	898724	T	A
S_22999629 S_61533275	898735	C	A
S_22999652 S_61533374	899057	C	T
S_22999656 S_61533403	899182	T	G
S_22999671 S_61533455	899347	A	G
S_22999677 S_61533467	899399	G	A
S_22999680 S_61533492	899499	A	G
S_22999690 S_61533521	899671	A	T
S_22999694 S_61533536	899752	C	A
S_22999695 S_61533538	899760	G	A
S_22999698 S_61533551	899816	G	A
S_22999701 S_61533562	899865	G	A
S_22999751 S_61533714	900410	G	A
S_22999754 S_61533723	900461	G	A
S_22999781 S_61533831	900911	G	A
S_22999784 S_61533835	900928	T	C
S_22999790 S_61533847	900986	A	G
S_22999791 S_61533859	901024	A	C
S_22999797 S_61533873	901064	T	A
S_22999826 S_61533960	901406	C	T
S_22999851 S_61534021	901621	C	A
S_22999862 S_61534034	901637	A	T
S_22999910 S_61534160	902115	C	T
S_22999946 S_61534224	902513	C	A
S_22999967 S_61534274	902744	A	C
S_22999979 S_61534307	902865	A	T
S_22999981 S_61534309	902878	G	A
S_22999997 S_61534443	903144	G	A
S_23000019 S_61534484	903280	T	A
S_23000028 S_61534505	903362	T	A
S_23000031 S_61534517	903419	T	C
S_23000033 S_61534531	903452	C	A
S_23000057 S_61534692	903850	A	G
S_23000068 S_61534749	904086	T	C
I_1468983 I_2445949	904229	T	TC
S_23000089 S_61534799	904249	T	A
S_23000090 S_61534819	904294	C	T
S_23000095 S_61534842	904369	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23000105 S_61534878	904504	A	C
S_23000106 S_61534881	904533	T	A
S_23000108 S_61534885	904553	C	G
S_23000175 S_61535079	905201	A	G
S_23000184 S_61535132	905360	C	T
S_23000188 S_61535139	905419	A	T
S_23000190 S_61535143	905461	T	G
S_23000197 S_61535169	905586	A	T
S_23000200 S_61535174	905620	G	T
S_23000289 S_61535332	906750	T	C
S_23000299 S_61535350	906956	A	G
S_23000300 S_61535355	906986	A	T
S_23000301 S_61535356	907005	T	A
S_23000307 S_61535367	907112	T	C
S_23000344 S_61535584	907954	A	C
S_23000371 S_61535645	908265	T	G
S_23000378 S_61535659	908334	C	T
S_23000387 S_61535676	908399	G	C
S_23000394 S_61535689	908479	G	A
S_23000432 S_61535777	908948	A	G
S_23000455 S_61535841	909193	C	T
S_23000485 S_61535939	909646	T	C
S_23000489 S_61535945	909670	C	A
S_23000491 S_61535952	909716	T	A
S_23000492 S_61535954	909720	A	G
S_23000497 S_61535966	909789	T	A
S_23000511 S_61536002	910072	A	G
S_23000517 S_61536023	910195	A	T
S_23000518 S_61536025	910210	A	T
S_23000633 S_61536325	911548	A	G
S_23000638 S_61536332	911600	C	A
S_23000643 S_61536350	911660	G	A
S_23000644 S_61536353	911664	A	G
S_23000647 S_61536363	911730	C	A
S_23000656 S_61536389	911858	G	T
S_23000657 S_61536399	911900	T	C
S_23000658 S_61536403	911913	A	G
S_23000711 S_61536506	912422	T	C
S_23000717 S_61536531	912537	T	C
S_23000722 S_61536536	912577	A	T
I_2446049	912806	G	GGT

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23000745 S_61536613	912865	T	C
S_23000747 S_61536616	912879	C	T
S_23000748 S_61536617	912895	G	A
S_23000749 S_61536626	912919	T	A
S_23000778 S_61536722	913344	T	A
S_23000785 S_61536730	913382	G	A
S_23000835 S_61536855	913800	T	C
S_23000836 S_61536856	913801	C	T
S_23000839 S_61536859	913822	C	A
S_23000860 S_61536990	914178	T	C
S_23000868 S_61537055	914337	A	C
S_23000871 S_61537066	914396	A	T
S_23000891 S_61537128	914668	A	G
S_23000914 S_61537245	915020	C	A
S_61537341	915307	A	T
S_23000942 S_61537345	915328	T	G
S_23000943 S_61537346	915333	G	A
S_23001076 S_61537677	916604	G	A
S_23001086 S_61537731	916712	A	C
S_23001105 S_61537760	916837	A	G
S_23001112 S_61537786	916946	T	C
S_23001114 S_61537790	916962	G	A
S_23001123 S_61537804	917043	G	C
S_23001131 S_61537818	917123	A	G
S_23001132 S_61537819	917130	T	C
S_23001138 S_61537824	917176	A	T
S_23001224 S_61538212	918415	T	C
S_23001232 S_61538231	918512	T	A
S_23001234 S_61538237	918540	G	T
S_23001242 S_61538284	918716	A	T
S_23001245 S_61538289	918740	C	T
S_23001246 S_61538290	918741	C	A
S_23001281 S_61538360	919015	T	G
S_23001287 S_61538383	919154	G	C
S_23001288 S_61538393	919213	T	G
S_23001289 S_61538396	919228	G	C
S_23001293 S_61538401	919264	C	G
S_23001345 S_61538458	919450	G	A
S_23001366 S_61538525	919554	A	G
S_23001367 S_61538528	919564	T	G
S_23001405 S_61538600	920010	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23001407 S_61538616	920055	A	G
S_23001452 S_61538696	920244	A	G
S_23001457 S_61538706	920270	C	T
S_23001472 S_61538747	920402	A	G
S_23001516 S_61538850	920861	G	T
S_23001685 S_61539222	922848	A	T
S_23001710 S_61539303	923124	C	T
S_23001712 S_61539307	923159	T	A
S_23001726 S_61539364	923316	A	G
S_23001783 S_61539446	923544	A	G
S_23001784 S_61539447	923545	T	C
S_23001843 S_61539532	923772	T	A
S_23001854 S_61539567	923907	T	C
S_23001855 S_61539569	923913	G	A
S_23001867 S_61539596	924028	A	T
S_23001876 S_61539633	924218	T	A
S_23001915 S_61539706	924400	T	C
S_23001936 S_61539770	924776	A	G
S_23001978 S_61539949	925716	A	G
S_23002074 S_61540053	926733	T	C
S_23002081 S_61540061	926815	G	C
S_23002082 S_61540064	926820	C	T
S_23002084 S_61540066	926846	A	C
S_23002085 S_61540078	926891	G	A
S_23002087 S_61540085	926946	A	G
S_23002095 S_61540133	927098	G	A
S_23002108 S_61540180	927225	G	C
S_23002125 S_61540239	927378	C	T
S_23002142 S_61540271	927472	C	T
S_23002145 S_61540282	927511	C	A
S_23002149 S_61540286	927529	T	C
S_23002194 S_61540448	928070	A	C
S_23002228 S_61540589	928295	C	T
S_23002232 S_61540604	928342	C	G
S_23002233 S_61540606	928346	C	T
S_23002256 S_61540655	928470	G	A
S_23002257 S_61540661	928479	C	T
S_23002289 S_61540808	928796	C	A
S_23002290 S_61540819	928814	G	A
S_23002311 S_61540940	929137	G	A
S_23002318 S_61540965	929330	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23002335 S_61541014	929531	T	G
S_23002339 S_61541016	929549	T	C
S_23002347 S_61541034	929598	T	C
S_23002351 S_61541065	929711	T	G
S_23002354 S_61541075	929765	A	T
S_23002356 S_61541079	929785	G	T
S_23002364 S_61541093	929876	A	T
S_23002376 S_61541115	930024	C	T
S_23002570 S_61541408	931780	C	A
S_23002588 S_61541453	931918	C	T
S_23002589 S_61541454	931921	T	C
S_23002590 S_61541455	931923	T	A
S_23002591 S_61541459	931934	A	T
S_23002612 S_61541492	932095	T	C
S_23002620 S_61541533	932259	G	T
S_23002622 S_61541537	932279	A	G
S_23002719 S_61541715	933221	T	G
I_1469185 I_2446275	933305	A	AT
S_23002724 S_61541737	933306	A	T
S_23002725 S_61541739	933311	T	A
S_23002728 S_61541741	933329	A	G
S_23002733 S_61541763	933487	A	C
S_23002753 S_61541795	933587	C	T
S_23002757 S_61541818	933704	G	T
S_23002768 S_61541844	933825	T	A
S_23002774 S_61541863	933877	T	A
S_23002805 S_61541985	934225	C	T
S_23002828 S_61542046	934503	T	G
S_23002871 S_61542175	935302	C	A
S_23003186 S_61542750	936767	C	T
I_2446380	936776	A	AAC
S_23003203 S_61542782	937022	T	A
S_23003204 S_61542784	937041	G	A
S_23003205 S_61542785	937053	A	T
S_23003208 S_61542794	937103	A	C
S_23003211 S_61542804	937148	G	T
S_23003222 S_61542825	937221	C	T
S_23003223 S_61542826	937223	T	G
S_23003283 S_61542938	937324	G	C
S_23003292 S_61543003	937507	T	G
S_23003302 S_61543030	937862	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23003303 S_61543031	937864	A	T
S_23003314 S_61543046	937948	T	C
S_23003320 S_61543054	937993	T	C
S_23003323 S_61543064	938043	T	C
S_23003324 S_61543068	938052	C	T
S_23003403 S_61543183	938420	T	A
S_23003408 S_61543196	938512	G	A
S_23003415 S_61543209	938578	T	A
S_23003429 S_61543253	938792	A	C
S_23003431 S_61543256	938814	A	C
S_23003451 S_61543297	939017	G	T
S_23003452 S_61543298	939024	T	A
S_23003453 S_61543301	939046	G	C
S_23003454 S_61543302	939048	A	C
S_23003463 S_61543319	939172	G	A
S_23003473 S_61543340	939307	T	A
S_23003475 S_61543341	939336	A	T
S_23003479 S_61543357	939411	T	A
S_23003484 S_61543376	939513	A	C
S_23003495 S_61543394	939585	T	G
S_23003497 S_61543400	939610	A	T
S_23003503 S_61543417	939692	G	T
S_23003506 S_61543424	939704	T	C
S_23003520 S_61543443	939809	A	C
S_23003524 S_61543446	939832	T	A
S_23003555 S_61543521	940467	C	T
S_23003560 S_61543530	940516	C	G
S_23003569 S_61543574	940651	C	T
S_23003597 S_61543615	940864	T	A
S_23003598 S_61543616	940865	A	T
S_23003600 S_61543617	940873	A	C
S_23003606 S_61543632	940988	G	C
S_23003613 S_61543664	941124	A	C
S_23003622 S_61543700	941229	G	C
S_23003639 S_61543793	941304	T	G
S_23003679 S_61543936	941593	C	T
S_23003683 S_61543950	941619	T	A
S_23003714 S_61544099	941976	C	A
I_2446454	942262	G	GA
S_23003736 S_61544177	942298	A	G
S_23003745 S_61544198	942390	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23003753 S_61544228	942539	T	A
S_23003756 S_61544237	942581	G	C
S_23003758 S_61544242	942599	G	T
S_23003759 S_61544251	942666	A	T
S_23003822 S_61544447	943504	C	T
S_23003825 S_61544454	943539	T	C
S_23003827 S_61544479	943604	G	C
S_23003831 S_61544513	943707	T	C
S_23003832 S_61544518	943720	G	A
S_23003841 S_61544533	943828	T	C
S_23003844 S_61544538	943865	A	G
S_23003845 S_61544542	943882	C	T
S_23003846 S_61544543	943886	A	G
S_23003847 S_61544546	943894	T	C
S_23003849 S_61544550	943924	A	T
S_23003850 S_61544552	943927	G	T
S_23003852 S_61544563	943966	C	T
S_23003854 S_61544569	943983	G	A
S_23003857 S_61544585	944022	T	C
S_23003858 S_61544586	944024	T	G
S_23003870 S_61544617	944166	T	A
S_23003873 S_61544639	944189	C	G
S_23003877 S_61544656	944207	T	C
S_23003878 S_61544657	944208	C	A
S_23003884 S_61544695	944277	T	G
S_23003893 S_61544726	944420	T	C
S_23003894 S_61544727	944426	A	G
S_23003895 S_61544730	944433	T	C
S_23003906 S_61544752	944540	T	C
S_23003907 S_61544759	944587	A	C
S_23003908 S_61544763	944601	T	C
S_23003909 S_61544764	944602	T	C
S_23003910 S_61544766	944606	C	A
S_23003913 S_61544786	944698	A	G
S_23003917 S_61544851	944825	G	A
S_23003981 S_61544971	945497	A	C
S_23003987 S_61544980	945554	C	T
S_23004754 S_61546142	947545	T	C
S_23004755 S_61546148	947584	G	A
S_23004756 S_61546150	947594	A	G
S_23004757 S_61546152	947605	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23004758 S_61546153	947612	T	C
S_23004763 S_61546168	947716	G	T
S_23004764 S_61546172	947731	A	C
S_23004793 S_61546227	948181	G	A
S_23004795 S_61546239	948218	A	G
S_23004796 S_61546246	948249	A	G
S_23004801 S_61546249	948281	A	G
S_23004826 S_61546287	948375	T	C
S_23004841 S_61546326	948495	C	T
S_61546332	948522	A	T
S_23004857 S_61546341	948568	T	A
S_23004863 S_61546351	948613	T	G
S_23004866 S_61546361	948678	G	C
S_23004867 S_61546362	948680	C	T
S_23004872 S_61546381	948763	A	G
S_23004885 S_61546405	948924	T	C
S_23004886 S_61546409	948935	C	T
S_23004892 S_61546421	948985	G	A
S_23004893 S_61546426	949018	G	A
S_23004902 S_61546439	949060	C	T
S_23004904 S_61546444	949076	A	C
S_23004924 S_61546501	949523	A	C
S_23004926 S_61546505	949540	A	T
S_23004931 S_61546517	949600	C	G
S_23004932 S_61546519	949608	C	G
S_23004949 S_61546565	949758	C	A
S_23004951 S_61546568	949768	A	G
S_23004952 S_61546574	949794	T	C
S_23004954 S_61546584	949829	C	A
S_23004956 S_61546589	949851	G	A
S_23004970 S_61546635	950040	G	C
S_23004972 S_61546643	950056	A	G
S_23004973 S_61546644	950061	A	T
S_23004975 S_61546649	950081	T	C
S_23004977 S_61546654	950095	C	A
S_23004981 S_61546662	950127	T	C
S_23004986 S_61546674	950197	C	A
S_23004989 S_61546677	950211	C	A
S_23004991 S_61546680	950228	G	A
S_23005003 S_61546714	950366	T	A
S_23005021 S_61546735	950493	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23005049 S_61546741	950543	C	T
S_61546743	950550	C	T
S_23005104 S_61546802	950749	C	T
S_23005106 S_61546804	950759	C	A
S_23005118 S_61546831	950851	C	A
S_23005138 S_61546880	951002	A	C
S_61546895	951047	G	T
S_61546899	951054	G	T
S_23005158 S_61546929	951233	T	A
S_23005163 S_61546960	951291	A	G
S_23005167 S_61546977	951364	G	A
S_23005172 S_61546990	951417	A	C
S_23005191 S_61547017	951500	G	T
S_23005194 S_61547039	951565	T	C
S_23005196 S_61547041	951580	C	A
S_23005199 S_61547049	951611	A	G
S_23005203 S_61547060	951641	A	T
S_23005207 S_61547070	951673	A	G
S_23005247 S_61547224	952220	A	C
S_23005249 S_61547229	952240	G	C
S_23005251 S_61547233	952267	T	C
S_23005262 S_61547251	952359	A	C
S_23005264 S_61547254	952365	T	C
S_23005272 S_61547285	952503	C	T
S_23005273 S_61547289	952518	A	G
S_23005274 S_61547296	952546	A	G
S_23005275 S_61547306	952577	G	T
S_23005283 S_61547341	952706	G	C
S_23005288 S_61547355	952787	T	C
S_23005289 S_61547356	952789	T	C
S_23005298 S_61547380	952877	T	C
S_23005300 S_61547383	952889	G	C
S_23005309 S_61547417	953102	T	C
S_23005327 S_61547454	953358	A	G
S_23005328 S_61547461	953386	A	T
S_23005332 S_61547469	953451	A	T
S_23005344 S_61547499	953593	C	A
S_23005351 S_61547511	953644	T	A
S_23005356 S_61547528	953704	C	A
S_23005357 S_61547541	953720	G	A
S_23005371 S_61547619	953860	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23005372 S_61547622	953862	C	G
S_23005374 S_61547627	953877	A	T
S_23005380 S_61547647	953931	G	A
S_23005388 S_61547658	954003	C	T
S_23005402 S_61547692	954176	G	A
S_23005404 S_61547694	954194	A	C
S_23005406 S_61547701	954211	A	G
S_23005408 S_61547709	954238	A	G
S_23005509 S_61548088	955610	G	C
S_23005974 S_61549656	962242	G	C
S_23006002 S_61549744	962537	C	A
S_23006010 S_61549753	962554	A	C
S_23006158 S_61550342	964952	G	A
S_23006165 S_61550377	965180	C	T
S_23006231 S_61550618	966272	A	T
S_23006344 S_61551076	968453	G	A
S_23006843 S_61551986	970601	C	A
S_23006894 S_61552110	971448	A	C
S_23006969 S_61552395	973227	T	C
S_23007095 S_61552703	974153	G	A
S_23007568 S_61553693	977353	T	C
I_2446831	979310	A	AC
S_23007686 S_61553950	979354	G	A
S_23007702 S_61553994	979565	A	G
S_23007848 S_61554560	981768	A	T
S_23007990 S_61555013	983378	A	C
S_23008358 S_61556110	988224	A	G
S_23008436 S_61556297	988829	T	C
S_23008508 S_61556509	989501	T	C
S_23008510 S_61556516	989521	C	T
S_23008517 S_61556530	989562	C	T
S_23009130 S_61557613	992457	T	C
S_23009182 S_61557733	992993	A	G
S_61557819	993302	T	A
S_61558039	993885	G	A
S_23009421 S_61558346	994365	T	C
S_23009837 S_61559497	998797	T	C
S_61559610	999036	C	T
S_23009952 S_61559825	1000290	C	A
S_23010000 S_61559903	1000550	C	T
S_23010066 S_61560048	1001009	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23010112 S_61560123	1001243	T	C
S_23010114 S_61560135	1001271	T	C
S_23010135 S_61560235	1001568	G	A
S_23010145 S_61560259	1001621	C	T
S_23010149 S_61560267	1001654	A	C
S_23010183 S_61560334	1001870	T	C
S_23010199 S_61560382	1001977	C	T
S_23010200 S_61560390	1002008	A	C
S_23010202 S_61560394	1002027	T	C
S_23010209 S_61560430	1002191	T	C
S_23010469 S_61561034	1003296	C	T
S_23010714 S_61561765	1005334	T	C
S_23010733 S_61561816	1005435	C	T
S_23010764 S_61561893	1005607	T	A
S_23010797 S_61561950	1005837	C	T
S_23010830 S_61561991	1006059	G	A
S_23010855 S_61562051	1006372	G	A
S_23010932 S_61562201	1007088	T	A
S_23011321 S_61562967	1009629	G	C
S_23011359 S_61563083	1010145	C	A
S_23011374 S_61563138	1010333	C	G
S_23011406 S_61563274	1011238	A	G
S_23011452 S_61563405	1012090	C	T
S_23011551 S_61563703	1013695	A	C
S_23011694 S_61563892	1014727	G	A
S_23011865 S_61564331	1017044	A	G
S_23011872 S_61564431	1017239	G	A
S_23011925 S_61564550	1018077	G	A
S_23012078 S_61564902	1019972	C	G
S_23012079 S_61564905	1019982	C	G
S_23012092 S_61564929	1020051	C	T
S_23012101 S_61564939	1020068	C	T
S_23012916 S_61566800	1028047	T	G
S_23012940 S_61566885	1028371	G	C
S_23012942 S_61566889	1028384	G	A
S_23012943 S_61566890	1028391	A	G
S_23012945 S_61566895	1028402	G	A
S_23012963 S_61566936	1028529	A	G
S_23012983 S_61566982	1028779	C	T
S_23013255 S_61567375	1029631	C	T
S_23013257 S_61567377	1029637	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23016526 S_61571349	1033768	A	G
S_23016769 S_61572126	1036872	T	C
S_23017139 S_61573224	1040814	A	G
S_23017272 S_61573589	1042470	A	G
S_23017807 S_61574708	1047776	C	T
S_23017817 S_61574740	1047910	A	C
S_23017889 S_61575017	1049056	G	A
S_23017915 S_61575120	1049703	G	T
S_23017919 S_61575121	1049732	G	T
S_23018023 S_61575392	1051173	G	A
S_23018027 S_61575406	1051221	A	G
S_23018036 S_61575433	1051468	A	G
S_23018037 S_61575435	1051482	T	G
S_23018048 S_61575451	1051553	T	C
S_23018049 S_61575453	1051562	T	C
S_23018057 S_61575490	1051732	C	T
S_23018058 S_61575491	1051733	T	G
S_23018063 S_61575524	1051855	C	T
S_23018090 S_61575612	1052152	T	A
S_23018091 S_61575617	1052177	T	A
S_23018092 S_61575619	1052178	G	C
S_23018097 S_61575631	1052233	T	A
S_23018114 S_61575683	1052523	A	T
S_23018122 S_61575700	1052636	G	T
S_23018129 S_61575722	1052751	C	T
S_23018162 S_61575786	1053307	C	A
S_23018163 S_61575787	1053310	G	C
S_23018164 S_61575788	1053318	T	A
S_23018165 S_61575792	1053345	A	C
S_23018166 S_61575794	1053369	G	A
S_23018177 S_61575812	1053465	C	T
S_23018198 S_61575849	1053721	A	G
S_23018204 S_61575907	1053913	C	G
S_23018298 S_61576320	1055303	A	T
S_23018303 S_61576355	1055420	A	C
S_23018306 S_61576369	1055480	C	T
S_23018308 S_61576383	1055513	A	T
S_23018316 S_61576457	1055761	A	G
S_23018399 S_61576763	1056613	G	A
S_23018416 S_61576839	1056915	C	A
S_23018419 S_61576842	1056932	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23018464 S_61577065	1057741	T	C
S_23018530 S_61577203	1058293	G	C
S_23018541 S_61577240	1058417	T	C
S_23018552 S_61577260	1058507	T	C
S_23018615 S_61577398	1059309	G	A
S_23018620 S_61577416	1059403	T	A
S_23018636 S_61577468	1059667	T	C
S_23018642 S_61577484	1059765	G	A
S_23018694 S_61577642	1060402	A	G
S_23018743 S_61577765	1060895	C	G
S_23018748 S_61577781	1060948	T	A
S_23018826 S_61577957	1061590	T	A
S_23018868 S_61578100	1062098	T	G
S_23018963 S_61578359	1062940	T	C
S_23018993 S_61578452	1063237	T	A
S_23018995 S_61578454	1063248	A	C
S_23019033 S_61578480	1063369	A	C
S_23019048 S_61578536	1063620	A	G
S_23019119 S_61578711	1063979	A	G
S_23019131 S_61578825	1064230	G	A
S_23019148 S_61578904	1064503	C	G
S_23019184 S_61579022	1064905	C	T
S_23019196 S_61579047	1065020	A	T
S_23019198 S_61579048	1065025	T	G
S_23019199 S_61579051	1065032	T	C
S_61579053	1065039	A	C
S_61579594	1066590	T	G
S_61579621	1066648	A	G
S_23019636 S_61579648	1066725	A	G
S_23019645 S_61579692	1066914	A	T
S_23019646 S_61579693	1066919	A	G
S_23019654 S_61579745	1067174	A	C
S_23019655 S_61579746	1067175	G	A
S_23019695 S_61579796	1067292	A	G
S_23019735 S_61579868	1067603	A	G
S_23019771 S_61579962	1068046	C	T
S_23019782 S_61579999	1068198	C	T
S_23019800 S_61580085	1068407	T	C
S_23019801 S_61580091	1068437	A	G
S_23019814 S_61580125	1068533	A	G
S_23019833 S_61580152	1068636	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
I_1470467 I_2448277	1068795	C	CCT
S_23019848 S_61580229	1069003	C	T
S_23019914 S_61580481	1070006	T	G
S_23019918 S_61580493	1070050	C	T
S_23019963 S_61580567	1070340	G	T
S_23020106 S_61580835	1071028	A	T
S_23020109 S_61580876	1071077	A	C
S_23020136 S_61580978	1071514	A	G
S_23020155 S_61581012	1071684	G	A
S_23020161 S_61581037	1071783	C	T
S_23020181 S_61581120	1072128	A	C
S_23020220 S_61581346	1072902	T	A
S_23020260 S_61581512	1073524	A	G
S_23020274 S_61581550	1073738	G	A
S_23020275 S_61581562	1073773	C	T
S_23020281 S_61581610	1073926	A	G
S_23020333 S_61581812	1074664	C	T
S_23020365 S_61581908	1075225	A	G
S_23020366 S_61581911	1075238	A	G
S_23020367 S_61581912	1075257	C	T
S_23020371 S_61581934	1075327	T	C
S_23020372 S_61581935	1075332	T	C
S_23020373 S_61581938	1075344	G	T
S_23020374 S_61581939	1075349	G	A
S_23020377 S_61581952	1075396	G	T
S_23020383 S_61581971	1075450	A	T
S_23020395 S_61582019	1075614	T	C
S_23020448 S_61582106	1076643	T	C
S_23020467 S_61582113	1076668	G	T
S_23020496 S_61582199	1077183	T	G
I_1470525 I_2448369	1077194	C	CT
S_23020501 S_61582203	1077208	C	G
S_23020507 S_61582224	1077305	C	A
I_2448384	1077392	T	TG
S_23020519 S_61582260	1077458	T	C
S_23020522 S_61582279	1077588	T	C
S_23020523 S_61582280	1077593	T	A
S_23020532 S_61582302	1077717	T	C
S_23020583 S_61582489	1078541	T	C
S_23020590 S_61582507	1078659	G	T
S_23020610 S_61582547	1078891	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23020619 S_61582571	1079019	T	C
S_23020630 S_61582609	1079204	G	A
S_23020707 S_61582799	1080529	A	G
S_23020708 S_61582801	1080539	G	A
S_23020709 S_61582802	1080540	T	G
S_23020746 S_61582894	1080953	T	C
S_23020747 S_61582897	1080957	T	C
S_23020751 S_61582909	1081028	C	G
S_61582920	1081059	G	A
S_23020759 S_61582924	1081101	C	T
S_23020760 S_61582925	1081115	T	G
S_23020761 S_61582927	1081124	G	A
S_23020762 S_61582934	1081152	G	A
S_23020774 S_61582968	1081274	A	G
S_23020783 S_61583001	1081370	C	T
S_23020786 S_61583018	1081476	A	C
S_23020806 S_61583074	1081754	T	C
S_23020807 S_61583075	1081761	A	G
S_23020810 S_61583083	1081777	A	C
S_23020817 S_61583118	1081893	G	T
S_23020825 S_61583141	1082008	T	C
S_23020838 S_61583165	1082147	C	T
S_23020839 S_61583168	1082160	A	C
S_23020842 S_61583179	1082219	A	T
S_23020844 S_61583180	1082228	T	G
S_23020864 S_61583398	1082963	C	T
S_23020892 S_61583439	1083015	T	G
S_23020899 S_61583474	1083187	C	T
S_23020913 S_61583503	1083364	T	A
S_23020914 S_61583504	1083365	G	C
I_1470580 I_2448482	1083424	G	GA
S_23020929 S_61583564	1083662	A	G
S_23020951 S_61583641	1083919	C	A
S_23020984 S_61583715	1084238	G	T
S_23020990 S_61583734	1084305	A	T
S_23021024 S_61583851	1084800	A	C
S_23021050 S_61583934	1085071	T	C
S_23021088 S_61584047	1085369	A	G
S_23021090 S_61584071	1085420	A	G
S_23021120 S_61584180	1085732	G	T
S_23021164 S_61584383	1086399	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23021181 S_61584452	1086716	G	A
S_61584466	1086764	C	G
S_23021296 S_61584796	1087828	G	C
S_23021318 S_61584876	1088061	A	G
S_23021319 S_61584877	1088065	A	T
S_23021417 S_61585261	1089228	G	A
S_23021420 S_61585270	1089244	T	C
S_23021425 S_61585294	1089310	T	C
S_23021443 S_61585383	1089587	T	C
S_23021466 S_61585497	1089953	G	T
S_23021470 S_61585519	1090018	T	C
S_23021471 S_61585520	1090025	T	G
S_23021476 S_61585531	1090106	T	A
S_23021480 S_61585538	1090147	A	G
I_1470603 I_2448540	1090397	T	TA
S_23021508 S_61585616	1090483	A	G
S_23021509 S_61585617	1090486	G	A
S_23021511 S_61585624	1090505	C	A
S_23021514 S_61585636	1090541	T	C
S_23021521 S_61585672	1090694	A	T
S_23021524 S_61585686	1090724	T	A
S_23021592 S_61586067	1091687	C	T
S_23021593 S_61586069	1091694	A	G
S_23021632 S_61586114	1091796	A	T
S_23021637 S_61586135	1091866	C	T
S_23021641 S_61586162	1091972	T	G
S_23021664 S_61586213	1092421	C	T
S_23021680 S_61586248	1092584	T	C
S_23021681 S_61586251	1092596	A	C
S_23021687 S_61586264	1092681	T	C
S_23021689 S_61586269	1092705	C	A
S_23021691 S_61586273	1092738	T	G
S_23021692 S_61586274	1092742	G	A
S_23021724 S_61586382	1093253	A	G
S_23021727 S_61586398	1093305	G	A
S_23021765 S_61586557	1093810	G	T
S_23021768 S_61586565	1093846	A	G
S_23021769 S_61586591	1093926	A	G
S_23021827 S_61586721	1094384	A	C
S_23021835 S_61586732	1094440	C	T
S_23021892 S_61586878	1094958	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23021895 S_61586887	1094976	G	T
S_23021897 S_61586892	1095002	G	A
S_23021904 S_61586905	1095084	T	C
S_23021979 S_61587087	1095897	G	A
S_23021985 S_61587100	1095948	T	C
S_23022007 S_61587163	1096207	C	T
S_23022027 S_61587213	1096338	C	T
I_2448608	1096627	C	CT
S_23022048 S_61587288	1096696	A	T
S_23022066 S_61587355	1096903	G	A
S_23022084 S_61587401	1097050	T	C
S_23022100 S_61587447	1097211	T	C
S_23022127 S_61587527	1097557	A	G
S_23022165 S_61587645	1098320	G	A
S_23022167 S_61587650	1098363	T	C
S_23022168 S_61587652	1098391	A	T
S_23022169 S_61587654	1098414	T	C
S_23022170 S_61587656	1098425	A	T
S_61587694	1098604	T	C
S_23022183 S_61587697	1098625	T	A
S_23022233 S_61587761	1098771	A	G
S_23022235 S_61587764	1098778	A	C
S_23022239 S_61587784	1098884	G	A
S_23022252 S_61587813	1099062	C	A
S_23022282 S_61587859	1099231	C	A
S_23022303 S_61587885	1099262	A	T
S_23022306 S_61587893	1099306	A	G
S_23022312 S_61587913	1099382	T	A
S_23022315 S_61587915	1099387	G	C
S_23022329 S_61587939	1099496	T	C
S_23022330 S_61587940	1099497	G	A
S_23022339 S_61587952	1099558	A	T
S_23022357 S_61588007	1099734	A	T
S_23022374 S_61588045	1099924	C	T
S_23022384 S_61588064	1100017	A	G
S_23022395 S_61588110	1100175	T	G
S_23022413 S_61588151	1100342	T	A
S_23022443 S_61588266	1100708	G	T
S_23022452 S_61588331	1100898	T	G
S_23022453 S_61588335	1100923	C	A
S_23022454 S_61588340	1100944	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23022458 S_61588347	1100988	A	G
S_23022459 S_61588353	1101013	G	A
S_23022493 S_61588480	1101356	T	A
I_2448643	1101867	A	AATCC
S_23022537 S_61588717	1102038	A	G
S_23022539 S_61588727	1102088	T	G
S_23022540 S_61588730	1102141	T	A
S_23022541 S_61588731	1102144	A	G
S_23022580 S_61588836	1102565	C	T
S_23022597 S_61588885	1102823	C	A
S_23022598 S_61588887	1102825	A	C
S_23022605 S_61588902	1102903	A	G
S_23022646 S_61589046	1103281	A	G
S_23022749 S_61589276	1103778	C	T
S_61589292	1103826	G	A
S_23022802 S_61589368	1104034	T	C
S_23022803 S_61589372	1104050	A	T
S_23022818 S_61589406	1104164	T	A
S_23022825 S_61589417	1104204	A	C
S_23022826 S_61589418	1104205	T	C
S_23022830 S_61589419	1104216	C	A
S_23022835 S_61589450	1104315	A	C
S_23022837 S_61589485	1104359	C	T
S_23022864 S_61589521	1104515	C	T
S_23022877 S_61589539	1104535	A	G
S_23022885 S_61589559	1104600	G	T
S_23022888 S_61589561	1104614	A	T
S_23022892 S_61589567	1104646	C	G
S_23022901 S_61589589	1104755	A	G
S_23022958 S_61589621	1104997	G	C
S_23022959 S_61589627	1105040	A	T
S_23022972 S_61589649	1105193	G	A
S_23023027 S_61589719	1105504	C	A
S_23023033 S_61589740	1105550	A	G
S_23023038 S_61589752	1105597	C	A
S_23023049 S_61589792	1105805	T	C
S_23023060 S_61589818	1106035	C	G
S_23023066 S_61589850	1106172	T	C
S_23023076 S_61589896	1106419	T	G
S_23023119 S_61589981	1106834	C	T
S_23023120 S_61589983	1106837	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23023123 S_61589988	1106873	T	C
S_23023481 S_61590560	1108982	A	G
S_23023522 S_61590660	1109348	G	A
S_23023528 S_61590678	1109429	G	C
S_23023548 S_61590732	1109656	A	T
S_23023549 S_61590742	1109687	T	G
S_23023557 S_61590757	1109774	G	A
S_23023606 S_61590838	1109906	T	C
S_23023609 S_61590846	1109935	G	A
S_23023620 S_61590888	1110056	A	G
S_23023633 S_61590922	1110185	C	T
S_23023644 S_61590973	1110391	G	A
S_23023672 S_61591043	1110651	A	G
S_23023675 S_61591054	1110702	C	T
S_23023676 S_61591055	1110711	T	G
S_23023738 S_61591195	1111326	T	C
S_23023752 S_61591252	1111508	A	C
S_23023760 S_61591280	1111627	G	A
S_23023773 S_61591358	1111876	T	C
S_23023774 S_61591363	1111906	T	G
S_23023775 S_61591366	1111944	G	A
S_23023844 S_61591492	1112529	T	C
S_23023845 S_61591493	1112538	A	G
S_23023846 S_61591497	1112562	T	A
S_23023856 S_61591527	1112688	C	T
S_23023858 S_61591529	1112696	T	G
S_23023860 S_61591545	1112790	C	T
S_23023863 S_61591557	1112833	G	C
S_23023916 S_61591670	1113351	G	A
S_23023917 S_61591676	1113380	T	A
S_23023960 S_61591807	1113852	C	T
S_23023961 S_61591808	1113854	C	T
S_23023969 S_61591842	1114007	G	A
S_23023970 S_61591844	1114014	G	A
S_23023972 S_61591856	1114044	A	G
S_23024002 S_61591935	1114322	G	A
S_23024004 S_61591937	1114336	C	G
S_23024034 S_61592023	1114593	G	A
S_23024045 S_61592037	1114632	T	G
S_23024137 S_61592302	1115343	A	T
S_23024268 S_61592563	1115977	C	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23024274 S_61592595	1116142	T	A
S_23024276 S_61592603	1116180	A	G
S_23024278 S_61592617	1116289	A	T
S_23024314 S_61592667	1116619	A	T
S_23024324 S_61592683	1116724	A	C
S_23024343 S_61592768	1116985	T	C
S_23024344 S_61592773	1117003	A	C
S_23024347 S_61592785	1117062	A	C
S_23024359 S_61592847	1117252	T	C
S_23024366 S_61592883	1117350	C	T
S_23024367 S_61592886	1117354	T	C
S_23024387 S_61592961	1117603	C	T
S_23024400 S_61593001	1117778	G	T
S_23024405 S_61593021	1117851	T	G
S_23024440 S_61593150	1118254	T	C
S_23024441 S_61593151	1118255	G	A
S_23024488 S_61593258	1118591	C	G
S_23024490 S_61593262	1118600	C	G
S_23024497 S_61593275	1118645	G	A
S_23024571 S_61593402	1119109	C	T
S_23024578 S_61593425	1119231	A	G
S_23024586 S_61593464	1119355	T	A
S_23024611 S_61593577	1119882	A	G
S_23024613 S_61593586	1119929	C	T
S_23024628 S_61593608	1120089	C	A
S_23024631 S_61593612	1120109	T	A
S_23024703 S_61593884	1122464	C	T
S_23024705 S_61593891	1122488	C	G
S_23024724 S_61593924	1122586	A	G
S_23024726 S_61593927	1122631	A	G
S_23024728 S_61593932	1122653	A	C
S_23024729 S_61593944	1122697	C	A
S_23024730 S_61593946	1122699	T	C
S_23024731 S_61593947	1122707	A	G
S_23024771 S_61594000	1122876	G	T
S_23024772 S_61594001	1122877	T	A
S_23024773 S_61594002	1122882	T	A
S_23024775 S_61594005	1122898	A	C
S_23024781 S_61594014	1122958	G	C
S_23024785 S_61594025	1123001	T	A
S_23024786 S_61594030	1123017	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23024788 S_61594041	1123075	A	G
S_23024793 S_61594062	1123175	A	T
S_23024813 S_61594123	1123546	T	A
S_23024814 S_61594126	1123553	C	T
S_23024824 S_61594134	1123628	C	A
S_23024842 S_61594136	1123652	G	T
S_23024876 S_61594153	1123707	T	A
S_23024893 S_61594203	1123871	T	C
S_23024894 S_61594205	1123876	T	C
S_23024895 S_61594211	1123919	T	C
S_23024896 S_61594212	1123920	G	A
S_23024899 S_61594221	1123962	C	A
S_23024900 S_61594222	1123971	G	T
S_23024901 S_61594225	1123974	C	G
S_23024903 S_61594231	1124011	T	G
I_1470818 I_2448913	1124102	C	CTA
S_23024909 S_61594247	1124103	C	T
S_23024913 S_61594260	1124161	T	C
S_23024915 S_61594269	1124190	C	T
S_23024928 S_61594330	1124336	C	T
S_23024929 S_61594332	1124337	A	G
S_23024946 S_61594401	1124546	G	C
S_23024947 S_61594412	1124588	A	T
I_1470819 I_2448917	1124613	G	GT
S_23024948 S_61594423	1124625	A	G
S_23024949 S_61594424	1124627	A	G
S_23024959 S_61594432	1124694	A	G
S_23024962 S_61594446	1124785	C	T
S_23024963 S_61594452	1124807	A	T
S_23024964 S_61594459	1124838	G	A
S_23024965 S_61594460	1124839	T	A
S_23024972 S_61594483	1124936	G	A
S_23024973 S_61594493	1124951	A	G
S_23024974 S_61594496	1124960	A	G
S_23024975 S_61594501	1124987	A	C
S_23024977 S_61594513	1125057	C	T
S_23024990 S_61594552	1125224	G	A
S_23024992 S_61594554	1125226	A	C
S_23025002 S_61594574	1125323	G	A
S_23025003 S_61594575	1125325	A	T
S_23025054 S_61594656	1125536	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23025055 S_61594657	1125538	A	T
S_23025056 S_61594658	1125541	T	A
S_23025057 S_61594659	1125544	G	A
S_23025082 S_61594702	1125801	G	A
S_23025083 S_61594705	1125825	C	T
S_23025084 S_61594710	1125842	A	T
S_23025085 S_61594714	1125862	C	T
S_23025086 S_61594715	1125863	C	G
S_23025087 S_61594716	1125871	G	T
S_23025088 S_61594721	1125908	T	A
S_23025111 S_61594762	1126171	G	A
S_23025113 S_61594783	1126229	A	T
S_23025136 S_61594868	1126577	C	A
S_23025139 S_61594871	1126584	A	C
S_23025144 S_61594898	1126656	T	A
S_23025157 S_61594918	1126748	T	G
S_23025167 S_61594925	1126795	G	A
S_23025204 S_61595005	1126960	T	C
S_23025207 S_61595081	1127052	G	A
S_23025208 S_61595097	1127082	A	T
S_23025209 S_61595100	1127089	T	C
S_23025210 S_61595104	1127111	C	T
S_23025212 S_61595116	1127186	A	T
S_23025213 S_61595123	1127213	G	A
S_23025215 S_61595124	1127222	A	T
S_23025219 S_61595129	1127253	T	G
S_23025221 S_61595138	1127285	G	A
S_23025222 S_61595141	1127317	C	T
S_23025223 S_61595143	1127322	T	C
S_23025234 S_61595196	1127617	G	A
S_23025235 S_61595197	1127624	A	G
S_23025236 S_61595200	1127632	G	A
S_23025258 S_61595294	1127982	A	G
S_23025265 S_61595313	1128029	G	C
D_1470837 D_2448939	1128207	AT	A
S_23025271 S_61595358	1128230	A	G
S_23025289 S_61595400	1128391	A	T
S_23025319 S_61595448	1128610	T	C
S_23025325 S_61595459	1128654	T	C
S_23025327 S_61595462	1128670	A	C
S_23025341 S_61595492	1128815	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23025362 S_61595610	1129017	T	A
S_23025371 S_61595658	1129228	C	T
S_23025388 S_61595704	1129371	C	T
S_23025389 S_61595711	1129396	G	A
S_23025394 S_61595718	1129423	G	T
S_23025417 S_61595800	1129683	T	G
S_23025457 S_61595923	1130206	G	A
S_23025463 S_61595949	1130267	A	C
S_23025464 S_61595952	1130274	T	A
S_23025466 S_61595957	1130293	A	G
S_23025471 S_61595974	1130413	T	G
S_23025473 S_61595982	1130491	A	T
S_23025474 S_61595988	1130507	G	A
S_23025477 S_61595999	1130612	A	G
S_23025479 S_61596000	1130617	G	T
S_23025481 S_61596003	1130622	C	T
S_23025486 S_61596013	1130703	A	C
S_23025488 S_61596017	1130715	T	G
S_23025494 S_61596025	1130793	C	T
S_23025497 S_61596027	1130808	C	T
S_23025500 S_61596032	1130868	C	T
S_23025517 S_61596066	1131062	T	A
I_1470857 I_2448994	1131129	C	CT
S_23025524 S_61596086	1131169	G	A
S_23025550 S_61596160	1131417	A	G
S_23025561 S_61596187	1131482	C	G
S_23025562 S_61596190	1131487	T	A
S_23025576 S_61596220	1131596	G	T
S_23025577 S_61596221	1131600	T	C
S_23025578 S_61596222	1131607	A	G
S_23025579 S_61596229	1131647	T	G
S_23025581 S_61596232	1131659	C	G
S_23025593 S_61596261	1131738	T	A
S_23025612 S_61596324	1131956	A	T
S_23025613 S_61596326	1131966	T	C
S_23025626 S_61596343	1132094	C	T
S_23025629 S_61596354	1132144	A	C
S_23025816 S_61596710	1132886	C	A
S_23025929 S_61596903	1133250	T	G
S_23025973 S_61596998	1133468	C	A
S_23025974 S_61596999	1133470	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23025975 S_61597000	1133471	T	C
S_61597146	1133813	A	C
S_23026034 S_61597153	1133838	T	C
S_23026193 S_61597412	1134372	A	G
S_23026194 S_61597413	1134380	T	C
S_23026195 S_61597419	1134394	A	T
S_23026197 S_61597425	1134409	T	C
S_23026205 S_61597480	1134534	G	T
S_23026206 S_61597482	1134552	T	C
S_23026207 S_61597483	1134555	A	T
S_23026226 S_61597529	1134768	C	T
S_23026228 S_61597532	1134783	C	A
S_23026298 S_61597738	1135380	G	T
S_23026300 S_61597740	1135401	T	C
S_23026326 S_61597804	1135501	T	C
S_23026345 S_61597871	1135718	C	T
S_23026347 S_61597887	1135764	T	A
S_23026352 S_61597909	1135833	G	A
S_23026355 S_61597916	1135870	G	A
S_23026357 S_61597918	1135882	A	T
S_23026364 S_61597932	1135951	A	T
S_23026368 S_61597948	1136004	T	A
S_23026395 S_61598014	1136307	A	G
S_23026405 S_61598046	1136466	C	G
S_23026406 S_61598047	1136467	C	G
S_23026407 S_61598049	1136482	T	C
S_23026408 S_61598052	1136491	G	A
S_23026450 S_61598152	1136723	C	T
S_23026454 S_61598161	1136764	G	C
S_23026498 S_61598269	1137630	A	C
S_23026502 S_61598273	1137650	G	C
S_23026510 S_61598312	1137870	C	T
S_23026511 S_61598318	1137914	A	G
S_23026623 S_61598559	1138948	T	C
S_23026638 S_61598593	1139042	C	G
S_23026649 S_61598618	1139151	T	C
S_23026670 S_61598693	1139403	T	G
S_23026675 S_61598706	1139463	A	T
S_23026694 S_61598757	1139654	C	T
S_23026698 S_61598762	1139691	T	A
S_23026736 S_61598901	1140213	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23026743 S_61598942	1140340	A	C
S_23026758 S_61598974	1140546	T	G
S_23026765 S_61598997	1140669	C	T
S_23026766 S_61598999	1140675	G	A
S_23026767 S_61599001	1140682	G	A
S_23026785 S_61599041	1140867	A	G
S_23026789 S_61599057	1140927	T	C
S_23026818 S_61599179	1141339	G	A
S_23026819 S_61599181	1141349	T	A
S_23026822 S_61599196	1141383	G	C
S_23026843 S_61599256	1141723	A	G
S_23026855 S_61599306	1141915	C	T
S_23026861 S_61599331	1142055	A	G
S_23026862 S_61599334	1142070	A	G
S_23026863 S_61599337	1142077	G	C
S_23026864 S_61599343	1142089	G	C
S_23026888 S_61599430	1142299	T	C
S_23026889 S_61599431	1142300	G	A
S_23026931 S_61599565	1142716	T	C
S_61599589	1142809	T	A
S_23026970 S_61599642	1142963	C	T
S_23026972 S_61599651	1143007	T	C
S_23026986 S_61599676	1143128	G	A
S_23026987 S_61599683	1143173	T	A
S_23026996 S_61599723	1143410	G	C
S_23027004 S_61599730	1143459	A	T
S_23027008 S_61599746	1143509	A	G
S_23027023 S_61599810	1143750	T	C
S_23027037 S_61599844	1143953	G	T
S_23027040 S_61599886	1144062	G	A
S_23027110 S_61600083	1144941	G	A
S_23027120 S_61600121	1145074	T	G
S_23027123 S_61600133	1145115	T	A
S_23027127 S_61600152	1145183	C	A
S_23027131 S_61600163	1145230	A	G
S_23027143 S_61600185	1145299	A	G
S_23027155 S_61600245	1145380	A	C
S_23027185 S_61600350	1145721	A	T
S_23027188 S_61600353	1145740	T	G
S_23027190 S_61600368	1145789	T	C
S_23027218 S_61600444	1146196	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23027219 S_61600446	1146201	T	C
S_23027225 S_61600457	1146270	A	T
S_23027229 S_61600463	1146319	A	G
I_1470971 I_2449163	1146342	C	CCTGG
S_23027230 S_61600466	1146343	A	G
S_23027280 S_61600570	1146863	C	T
S_23027281 S_61600572	1146883	T	C
S_23027322 S_61600635	1147111	G	T
S_23027379 S_61600732	1147407	T	G
S_23027383 S_61600737	1147433	G	C
S_23027394 S_61600776	1147630	G	T
S_23027397 S_61600791	1147678	A	T
S_23027407 S_61600859	1148054	T	G
S_23027410 S_61600861	1148083	A	G
S_23027427 S_61600895	1148293	A	T
S_23027432 S_61600899	1148327	T	A
I_1470979 I_2449179	1148501	T	TA
S_23027451 S_61600961	1148511	A	G
S_23027456 S_61600968	1148574	G	T
S_23027533 S_61601062	1148728	G	A
S_61601064	1148730	G	A
S_23027540 S_61601086	1148839	A	T
S_23027541 S_61601089	1148856	G	C
S_23027549 S_61601126	1149004	A	G
S_23027556 S_61601149	1149122	C	T
S_23027647 S_61601358	1149828	A	C
S_23027659 S_61601392	1149991	G	A
S_23027661 S_61601396	1150006	C	A
S_23027663 S_61601399	1150020	T	G
S_23027665 S_61601412	1150071	A	G
S_23027676 S_61601436	1150211	G	T
S_23027677 S_61601437	1150213	T	C
S_23027689 S_61601473	1150475	T	G
S_23027695 S_61601497	1150590	G	T
S_23027697 S_61601503	1150607	A	T
S_23027711 S_61601524	1150756	G	A
S_23027721 S_61601536	1150809	A	G
S_23027757 S_61601580	1151033	T	G
S_23027773 S_61601615	1151278	T	C
S_23027775 S_61601619	1151300	T	G
S_23027776 S_61601627	1151318	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23027777 S_61601630	1151323	A	T
S_23027779 S_61601640	1151364	T	A
S_23027781 S_61601643	1151380	G	A
S_23027790 S_61601667	1151479	C	T
S_23027795 S_61601678	1151522	T	C
S_23027831 S_61601733	1151692	G	A
S_23027840 S_61601752	1151750	T	G
S_61601756	1151763	C	A
S_23027848 S_61601764	1151774	G	C
S_23027859 S_61601793	1151859	C	T
S_23027872 S_61601809	1151885	C	T
S_23027879 S_61601825	1151909	A	C
S_23027881 S_61601830	1151913	C	T
S_23027897 S_61601880	1152020	G	A
S_23027902 S_61601888	1152065	A	G
S_23027914 S_61601924	1152178	A	G
S_23027924 S_61601937	1152227	T	A
S_23027932 S_61601970	1152369	G	C
S_23027933 S_61601971	1152371	T	C
S_23027934 S_61601973	1152391	G	A
S_23027948 S_61602001	1152515	A	G
S_23027949 S_61602006	1152540	A	G
S_23027961 S_61602028	1152719	C	A
S_23027964 S_61602036	1152762	C	T
S_23027982 S_61602090	1153066	G	A
S_23027988 S_61602116	1153249	G	A
S_23027996 S_61602137	1153325	A	G
S_23027997 S_61602144	1153354	T	C
S_23028006 S_61602155	1153402	G	A
S_23028014 S_61602163	1153410	T	C
S_23028053 S_61602211	1153502	A	T
S_23028054 S_61602213	1153515	C	G
S_23028075 S_61602263	1153778	G	A
S_23028083 S_61602278	1153866	T	C
S_23028088 S_61602283	1153921	C	G
S_23028089 S_61602285	1153923	G	C
S_23028090 S_61602288	1153938	T	G
S_23028183 S_61602475	1154874	A	T
S_23028184 S_61602477	1154885	A	G
S_23028224 S_61602550	1155168	G	T
S_23028284 S_61602829	1155900	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23028323 S_61602946	1156360	G	T
S_23028324 S_61602947	1156361	G	T
S_23028328 S_61602973	1156437	C	A
S_23028334 S_61603002	1156529	C	G
S_23028341 S_61603030	1156677	T	A
S_23028347 S_61603049	1156743	G	A
S_23028359 S_61603081	1156871	C	T
S_23028367 S_61603089	1156911	G	A
S_23028376 S_61603118	1156999	T	C
S_23028388 S_61603238	1157262	T	G
S_23028413 S_61603303	1157681	C	G
S_23028416 S_61603356	1157746	T	G
S_23028419 S_61603363	1157779	T	C
S_23028468 S_61603439	1157913	C	T
S_23028497 S_61603477	1158016	A	T
S_23028550 S_61603575	1158419	C	T
S_23028579 S_61603669	1158843	G	C
S_23028590 S_61603688	1158983	C	T
S_23028591 S_61603697	1159034	T	A
S_23028594 S_61603699	1159058	T	C
S_23028632 S_61603784	1159494	A	G
S_23028633 S_61603787	1159506	T	C
S_23028634 S_61603789	1159519	A	C
S_23028638 S_61603802	1159565	A	T
S_23028643 S_61603814	1159654	G	A
S_23028660 S_61603881	1159821	T	C
S_23028676 S_61603911	1159994	C	T
S_23028678 S_61603914	1160002	T	G
S_23028681 S_61603926	1160055	C	A
S_23028688 S_61603946	1160150	G	T
S_23028691 S_61603960	1160190	T	C
S_23028695 S_61603963	1160204	A	G
S_23028705 S_61603995	1160379	T	A
S_23028709 S_61604010	1160443	C	G
S_23028747 S_61604104	1161096	A	G
S_23028748 S_61604105	1161107	G	A
S_23028749 S_61604108	1161131	C	T
S_23028750 S_61604109	1161135	G	A
S_23028768 S_61604174	1161666	T	A
S_23028770 S_61604178	1161680	T	G
S_23028771 S_61604179	1161681	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23028774 S_61604186	1161760	G	A
S_23028775 S_61604187	1161764	C	G
S_23028784 S_61604207	1161885	T	G
S_23028785 S_61604208	1161886	A	G
S_23028786 S_61604209	1161889	A	T
S_23028789 S_61604227	1161919	A	G
S_23028790 S_61604234	1161925	A	G
S_23028791 S_61604248	1161944	C	T
S_23028792 S_61604258	1161956	T	C
S_23028794 S_61604297	1162018	C	A
S_23028796 S_61604299	1162028	A	G
S_23028797 S_61604301	1162040	A	G
S_23028805 S_61604325	1162136	T	C
S_23028809 S_61604343	1162242	T	A
S_23028810 S_61604345	1162254	G	A
S_23028812 S_61604354	1162298	G	A
S_23028855 S_61604467	1162803	A	G
S_23028857 S_61604471	1162826	T	A
S_23028869 S_61604529	1163103	A	T
S_23028882 S_61604594	1163311	T	A
S_23028883 S_61604595	1163312	T	C
S_23028885 S_61604597	1163323	A	C
S_23028891 S_61604620	1163430	A	G
S_23028906 S_61604673	1163554	C	T
S_23028916 S_61604741	1163690	G	C
S_23028949 S_61604843	1164330	C	A
S_23028951 S_61604847	1164351	T	G
S_23028962 S_61604893	1164643	C	T
S_23028963 S_61604898	1164663	C	T
S_23028978 S_61604962	1164871	A	G
S_23028980 S_61604966	1164879	A	C
S_23028981 S_61604971	1164887	G	A
S_23028984 S_61604975	1164921	A	T
S_23029069 S_61605123	1165448	A	G
S_23029158 S_61605392	1166423	G	T
S_23029166 S_61605467	1166585	A	G
S_23029169 S_61605477	1166634	T	C
S_23029175 S_61605492	1166704	T	A
S_23029179 S_61605499	1166720	A	T
S_23029213 S_61605613	1167126	G	T
S_23029254 S_61605732	1167563	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23029368 S_61606074	1168825	G	C
S_23029399 S_61606225	1169249	C	G
S_23029412 S_61606266	1169389	G	T
S_23029414 S_61606274	1169402	C	T
S_23029480 S_61606519	1170316	C	T
S_23029490 S_61606569	1170389	C	A
S_23029497 S_61606582	1170448	A	G
S_23029501 S_61606587	1170489	A	C
S_23029506 S_61606605	1170532	T	G
S_23029545 S_61606733	1170907	G	A
S_23029553 S_61606762	1171002	A	T
S_23029554 S_61606767	1171016	T	G
S_23029585 S_61606813	1171150	T	C
S_23029588 S_61606827	1171220	A	G
I_1471128 I_2449420	1171338	A	ATATAT
S_23029603 S_61606854	1171480	T	C
S_23029617 S_61606864	1171635	C	T
S_23029662 S_61606928	1172079	A	C
S_23029664 S_61606931	1172116	G	T
S_23029679 S_61606957	1172333	T	C
S_23029681 S_61606966	1172355	A	G
S_23029705 S_61607059	1172779	G	A
S_23029727 S_61607103	1173006	T	C
S_23029741 S_61607128	1173170	C	A
S_23029742 S_61607129	1173172	T	G
S_23029825 S_61607371	1174071	C	G
S_23029832 S_61607389	1174155	T	C
S_23029837 S_61607395	1174197	A	C
S_23029839 S_61607396	1174210	A	G
S_23029841 S_61607402	1174251	C	T
S_23029843 S_61607407	1174261	A	G
S_23029892 S_61607538	1174887	T	A
S_23029896 S_61607553	1174932	C	T
S_23029906 S_61607562	1174980	C	T
S_23029915 S_61607576	1175043	T	G
S_23029919 S_61607582	1175081	A	T
S_23029923 S_61607589	1175111	G	T
S_23029925 S_61607606	1175186	C	T
S_23029939 S_61607642	1175352	C	G
S_23029949 S_61607670	1175484	G	T
S_23029951 S_61607677	1175522	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23029955 S_61607681	1175540	A	G
S_23030024 S_61607760	1175660	T	G
S_23030043 S_61607822	1175915	C	A
S_23030050 S_61607838	1175982	A	T
I_1471154 I_2449451	1175997	C	CTA
S_23030055 S_61607845	1176029	T	C
S_23030063 S_61607871	1176165	A	C
S_23030195 S_61608063	1177210	C	T
S_23030384 S_61608445	1178547	T	G
S_23030523 S_61608796	1179449	A	G
S_23030525 S_61608799	1179472	C	T
S_23030603 S_61609122	1180451	T	C
S_23030608 S_61609130	1180480	T	A
S_23030625 S_61609170	1180719	G	T
I_2449487	1180723	A	AT
S_23030626 S_61609171	1180737	A	C
S_23030722 S_61609442	1181506	A	G
S_23030740 S_61609543	1181820	A	T
S_23030741 S_61609545	1181828	C	T
S_23030764 S_61609652	1182482	A	C
S_23030765 S_61609654	1182484	T	C
S_23030790 S_61609687	1182861	G	A
S_23030791 S_61609689	1182887	C	A
S_23030792 S_61609691	1182906	C	T
S_23030793 S_61609701	1182957	T	C
S_23030794 S_61609702	1182963	G	T
S_23030795 S_61609705	1182981	T	C
S_23030796 S_61609706	1182985	T	A
S_23030797 S_61609707	1182986	T	C
S_23030813 S_61609742	1183140	T	A
S_23030814 S_61609743	1183141	C	G
S_23030817 S_61609755	1183187	A	G
S_23030821 S_61609784	1183295	G	A
S_23030824 S_61609796	1183390	C	A
S_23030837 S_61609809	1183413	A	T
S_23030852 S_61609827	1183429	A	T
S_23030902 S_61609893	1183600	T	G
S_23030910 S_61609927	1183785	G	A
S_23030919 S_61609951	1183990	A	G
S_23030920 S_61609952	1184003	A	T
S_23030921 S_61609953	1184009	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23030962 S_61610039	1184359	T	G
S_23030966 S_61610053	1184435	C	G
I_2449552	1184475	G	GA
S_23030967 S_61610073	1184517	C	T
S_23030968 S_61610076	1184531	G	A
S_23030974 S_61610103	1184707	A	G
S_23030981 S_61610134	1184829	C	A
S_23030987 S_61610148	1184900	C	A
S_23030994 S_61610181	1184992	T	A
S_23030995 S_61610207	1185024	A	G
S_23030998 S_61610218	1185056	C	A
S_23030999 S_61610222	1185079	G	A
S_23031026 S_61610328	1185532	G	C
S_23031029 S_61610346	1185599	G	A
S_23031035 S_61610359	1185659	A	T
S_23031037 S_61610363	1185702	C	T
S_23031042 S_61610377	1185768	A	G
S_23031043 S_61610378	1185769	A	G
S_23031098 S_61610558	1186172	G	A
S_23031116 S_61610717	1186637	A	C
S_23031147 S_61610792	1186722	T	G
S_23031156 S_61610844	1186904	T	C
S_23031157 S_61610866	1186931	T	C
S_23031163 S_61610930	1187086	G	T
S_23031170 S_61610978	1187216	T	C
S_23031207 S_61611055	1187536	A	G
S_23031239 S_61611169	1187882	T	G
S_23031245 S_61611207	1187969	C	G
S_23031246 S_61611210	1187976	T	C
S_23031248 S_61611221	1188016	A	G
S_23031267 S_61611298	1188178	A	G
S_23031268 S_61611309	1188220	G	T
S_23031315 S_61611468	1188801	T	A
S_23031349 S_61611561	1189183	C	T
S_23031374 S_61611587	1189351	C	A
S_23031407 S_61611657	1189632	A	C
S_23031431 S_61611725	1189894	C	G
S_23031432 S_61611727	1189898	C	G
S_23031499 S_61611814	1190623	A	T
S_23031502 S_61611815	1190626	C	T
S_23031557 S_61611948	1191211	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23031581 S_61612052	1191616	T	C
S_23031582 S_61612054	1191618	C	T
S_23031588 S_61612068	1191668	T	G
S_23031646 S_61612213	1192395	C	A
S_23031660 S_61612252	1192627	C	A
S_23031664 S_61612257	1192678	A	G
S_23031670 S_61612267	1192747	T	C
S_23031687 S_61612294	1192895	T	C
S_23031688 S_61612295	1192905	A	T
S_23031708 S_61612352	1193080	G	T
S_23031714 S_61612371	1193108	G	T
S_23031740 S_61612423	1193395	G	A
S_23031746 S_61612445	1193530	T	A
S_23031747 S_61612446	1193534	A	T
S_23031748 S_61612447	1193535	A	G
S_23031751 S_61612451	1193551	A	G
S_23031756 S_61612490	1193767	C	T
S_23031774 S_61612606	1194088	T	C
S_23031805 S_61612684	1194446	G	C
S_23031807 S_61612700	1194486	C	A
S_23031809 S_61612701	1194488	T	A
S_23031826 S_61612735	1194655	G	A
I_2449677	1194660	A	AT
S_23031828 S_61612743	1194685	C	A
S_23031829 S_61612749	1194703	G	T
S_23031831 S_61612754	1194727	T	C
S_23031834 S_61612760	1194764	T	C
S_23031838 S_61612764	1194787	A	G
S_23031884 S_61612901	1195211	T	C
S_23031885 S_61612902	1195213	G	A
S_23031889 S_61612925	1195272	T	C
S_23031904 S_61612944	1195386	G	A
S_23031990 S_61613151	1196102	A	T
S_23031991 S_61613152	1196103	T	G
S_23032013 S_61613196	1196370	G	T
S_23032075 S_61613441	1197475	A	T
S_23032131 S_61613595	1198367	T	C
S_23032134 S_61613612	1198418	C	G
S_23032155 S_61613652	1198708	A	G
S_23032156 S_61613655	1198740	C	T
S_23032157 S_61613658	1198746	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23032161 S_61613661	1198769	T	C
S_23032170 S_61613673	1198828	A	G
S_23032181 S_61613694	1198985	G	T
S_23032182 S_61613695	1198989	T	G
S_23032183 S_61613696	1198990	C	A
S_23032186 S_61613704	1199005	T	C
S_23032219 S_61613772	1199177	C	G
S_23032300 S_61613968	1199756	A	G
S_23032336 S_61614068	1200101	G	C
S_23032365 S_61614104	1200244	G	C
S_23032366 S_61614120	1200346	G	T
S_23032403 S_61614235	1200809	T	A
S_23032484 S_61614532	1201997	C	G
S_23032513 S_61614641	1202286	C	T
S_23032519 S_61614694	1202467	C	T
S_23032523 S_61614704	1202507	T	C
S_23032549 S_61614749	1202693	A	G
S_23032558 S_61614769	1202766	C	A
S_23032561 S_61614773	1202772	T	C
S_23032566 S_61614795	1202826	T	A
S_23032572 S_61614806	1202883	G	C
S_23032574 S_61614809	1202892	C	G
S_23032582 S_61614828	1202984	A	G
S_23032587 S_61614847	1203053	A	G
S_23032598 S_61614872	1203178	T	C
S_23032600 S_61614891	1203253	T	A
S_23032613 S_61614909	1203395	G	T
S_23032615 S_61614916	1203427	T	G
S_23032616 S_61614919	1203441	G	T
S_23032630 S_61614954	1203619	C	T
S_23032637 S_61614969	1203714	T	A
S_23032651 S_61614992	1203845	G	T
S_23032743 S_61615189	1204988	A	G
S_23032744 S_61615190	1204996	T	C
S_23032761 S_61615252	1205474	A	T
S_23032769 S_61615310	1205620	G	A
S_23032822 S_61615404	1205952	T	G
S_23032835 S_61615441	1206141	G	A
S_23032837 S_61615447	1206172	C	A
S_23032844 S_61615460	1206239	G	T
S_23032868 S_61615494	1206461	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23032869 S_61615495	1206469	G	A
S_23032905 S_61615668	1207182	G	T
S_23032906 S_61615673	1207188	A	G
S_23032923 S_61615707	1207312	C	T
S_23032929 S_61615728	1207377	A	G
S_23032930 S_61615730	1207382	A	C
S_23033000 S_61615877	1207985	C	T
S_23033001 S_61615878	1207986	A	G
S_23033020 S_61615927	1208305	A	C
S_23033031 S_61615948	1208441	T	C
S_23033033 S_61615963	1208497	A	G
S_23033038 S_61615977	1208557	G	C
S_23033041 S_61615990	1208610	A	T
S_23033043 S_61615991	1208621	A	T
S_23033046 S_61615997	1208646	T	G
S_23033057 S_61616009	1208695	T	C
S_23033065 S_61616022	1208746	C	A
S_23033076 S_61616028	1208783	T	C
S_23033077 S_61616029	1208784	T	C
S_23033078 S_61616045	1208824	C	T
S_23033083 S_61616093	1208891	G	T
S_23033084 S_61616114	1208917	G	T
S_23033090 S_61616154	1209004	T	A
S_23033103 S_61616239	1209236	T	G
S_23033114 S_61616290	1209400	T	C
S_23033115 S_61616301	1209440	A	T
S_23033127 S_61616340	1209544	A	G
S_23033132 S_61616359	1209625	A	C
S_23033135 S_61616372	1209682	G	T
S_23033162 S_61616456	1210046	T	A
S_23033173 S_61616486	1210171	A	T
S_23033174 S_61616487	1210172	A	C
S_23033176 S_61616490	1210182	C	A
S_23033187 S_61616512	1210277	A	G
S_23033188 S_61616513	1210278	A	G
S_23033194 S_61616521	1210334	A	G
S_23033197 S_61616527	1210355	C	T
S_23033221 S_61616597	1210603	C	T
S_23033233 S_61616638	1210814	G	T
S_23033241 S_61616663	1210939	C	T
S_23033242 S_61616672	1210961	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23033273 S_61616799	1211425	T	A
S_23033274 S_61616800	1211428	A	G
S_23033284 S_61616849	1211676	G	A
S_23033285 S_61616850	1211684	G	A
S_23033287 S_61616852	1211697	A	C
S_23033288 S_61616854	1211716	C	G
S_23033289 S_61616857	1211728	C	T
S_23033304 S_61616888	1211938	C	T
S_23033305 S_61616896	1211973	A	G
S_23033306 S_61616897	1211983	T	A
S_23033307 S_61616898	1211984	A	T
S_23033318 S_61616926	1212144	C	T
S_23033336 S_61616959	1212327	T	A
S_23033339 S_61616970	1212363	T	A
S_23033351 S_61616987	1212435	C	T
S_23033377 S_61617050	1212702	T	C
S_23033378 S_61617052	1212711	C	A
S_23033382 S_61617072	1212769	C	A
S_23033386 S_61617081	1212816	C	G
S_23033387 S_61617085	1212840	A	C
S_23033388 S_61617086	1212841	A	T
S_23033389 S_61617088	1212845	A	T
S_23033396 S_61617116	1212982	T	C
S_23033397 S_61617117	1212983	A	G
S_23033402 S_61617126	1213027	T	C
S_23033404 S_61617145	1213070	C	A
S_23033434 S_61617286	1213520	A	G
S_23033466 S_61617469	1213987	G	A
S_23033467 S_61617473	1213994	G	A
S_23033468 S_61617475	1214006	G	A
S_23033498 S_61617596	1214309	A	G
S_23033507 S_61617643	1214459	G	A
S_23033513 S_61617673	1214516	G	T
S_23033514 S_61617677	1214525	G	A
S_23033548 S_61617837	1214971	C	T
S_23033549 S_61617840	1214974	C	A
S_23033558 S_61617892	1215228	C	G
S_23033559 S_61617895	1215239	G	A
S_23033560 S_61617897	1215242	T	G
S_23033561 S_61617898	1215254	A	G
S_23033563 S_61617904	1215269	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23033566 S_61617912	1215290	C	T
I_2449890	1215415	C	CA
S_23033592 S_61618032	1215649	A	T
S_23033593 S_61618043	1215667	A	G
S_23033599 S_61618071	1215765	T	A
I_1471401 I_2449898	1215809	A	AG
S_23033601 S_61618085	1215810	T	A
S_23033608 S_61618103	1215873	G	T
S_23033621 S_61618166	1216193	G	T
S_23033627 S_61618175	1216256	T	C
S_23033629 S_61618184	1216307	A	G
S_23033630 S_61618187	1216324	G	A
S_23033676 S_61618259	1216749	C	A
S_23033695 S_61618295	1216934	C	T
S_23033696 S_61618310	1217024	T	C
S_23033700 S_61618318	1217060	T	G
S_23033705 S_61618339	1217151	A	G
S_23033728 S_61618386	1217390	A	G
S_23033729 S_61618387	1217401	T	C
S_23033736 S_61618394	1217466	A	T
S_23033772 S_61618494	1218070	C	T
S_23033781 S_61618516	1218178	G	C
S_23033782 S_61618526	1218238	G	C
S_23033793 S_61618543	1218369	C	A
S_23033836 S_61618597	1218967	C	G
I_2449920	1219015	T	TA
S_23033838 S_61618605	1219041	G	A
S_23033839 S_61618606	1219043	A	C
S_23033903 S_61618755	1219741	G	A
S_23033904 S_61618758	1219745	A	G
S_23033907 S_61618767	1219772	G	A
S_23033911 S_61618812	1220042	C	T
S_23033912 S_61618815	1220049	T	C
S_23033939 S_61618952	1220274	C	T
S_23033969 S_61619031	1220641	C	T
S_23034004 S_61619116	1220909	T	G
S_23034032 S_61619166	1221239	T	C
S_23034033 S_61619167	1221244	A	G
S_23034036 S_61619174	1221277	A	T
S_23034073 S_61619239	1221613	G	T
S_23034074 S_61619244	1221635	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23034084 S_61619285	1221935	A	T
S_23034099 S_61619325	1222139	C	A
S_23034119 S_61619373	1222350	G	A
S_23034226 S_61619539	1222633	A	G
S_23034250 S_61619589	1222800	T	G
S_23034290 S_61619763	1223207	G	A
S_23034293 S_61619770	1223245	A	G
S_23034315 S_61619866	1223568	C	G
I_1471457 I_2449976	1224012	T	TA
S_23034344 S_61620007	1224068	T	C
S_23034366 S_61620077	1224581	C	G
S_23034483 S_61620266	1225501	A	C
S_23034485 S_61620273	1225527	C	T
S_23034531 S_61620353	1225736	G	A
S_23034551 S_61620394	1225920	G	A
S_23034553 S_61620397	1225931	A	G
S_23034591 S_61620542	1226489	C	G
S_23034619 S_61620656	1226829	A	T
S_23034767 S_61620866	1227374	C	T
S_23034772 S_61620891	1227465	G	A
S_23034797 S_61620955	1227891	T	G
S_23034838 S_61621114	1228514	C	A
S_23034897 S_61621416	1229547	C	T
S_23034930 S_61621520	1229917	A	T
S_23034971 S_61621748	1230676	G	A
S_23034972 S_61621751	1230724	T	A
S_23035006 S_61621947	1231400	G	C
S_23035017 S_61622001	1231650	A	C
S_23035030 S_61622039	1231766	T	G
S_23035047 S_61622118	1232131	C	G
S_23035134 S_61622291	1232812	G	A
S_23035135 S_61622292	1232813	G	A
S_23035174 S_61622436	1233298	T	A
S_23035181 S_61622456	1233381	A	G
S_23035236 S_61622651	1234298	A	G
S_23035431 S_61623257	1236516	A	G
S_23035473 S_61623421	1237083	T	C
S_23035536 S_61623641	1238023	A	T
S_23035543 S_61623661	1238129	C	A
S_23035545 S_61623671	1238171	G	A
S_23035561 S_61623739	1238480	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23035566 S_61623748	1238515	T	C
S_23035578 S_61623779	1238660	C	A
S_23035605 S_61623866	1238955	G	A
S_23035606 S_61623867	1238956	A	T
I_1471513 I_2450096	1239032	C	CAG
S_23035625 S_61623913	1239132	T	G
S_23035632 S_61623926	1239248	G	C
S_23035668 S_61623999	1239744	C	A
S_23035669 S_61624001	1239745	T	A
S_23035672 S_61624097	1239871	T	A
S_23035673 S_61624098	1239874	G	C
S_23035674 S_61624100	1239882	T	C
S_23035675 S_61624103	1239902	T	C
S_23035677 S_61624107	1239916	C	G
S_23035679 S_61624113	1239949	A	G
S_23035680 S_61624123	1240012	G	A
S_23035707 S_61624237	1240373	T	C
S_23035718 S_61624271	1240492	G	A
S_23035873 S_61624762	1244007	C	T
S_23035875 S_61624764	1244030	G	A
S_23035882 S_61624789	1244197	C	A
S_23035889 S_61624799	1244274	G	A
S_23035890 S_61624800	1244275	A	C
S_23035901 S_61624830	1244490	T	G
S_23035904 S_61624832	1244504	T	C
S_23035918 S_61624885	1244759	G	T
S_23035928 S_61624914	1244905	C	T
S_23036024 S_61625229	1246045	G	A
S_23036026 S_61625233	1246065	T	C
S_23036029 S_61625248	1246120	G	A
S_23036033 S_61625267	1246223	A	C
S_23036035 S_61625271	1246258	A	G
S_23036037 S_61625274	1246280	G	T
I_2450169	1246338	C	CAG
S_23036053 S_61625341	1246613	G	A
S_23036078 S_61625463	1247095	T	G
S_23036097 S_61625515	1247320	T	C
S_23036186 S_61625683	1247924	T	A
S_23036230 S_61625795	1248257	C	G
S_23036361 S_61626259	1250070	A	G
S_23036363 S_61626261	1250079	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23036401 S_61626406	1250626	C	T
S_23036466 S_61626608	1250981	G	T
S_23036467 S_61626609	1250988	T	A
S_23036493 S_61626721	1251389	G	C
S_23036499 S_61626761	1251485	T	G
S_23036503 S_61626774	1251499	A	G
S_23036520 S_61626863	1251702	T	C
S_23036529 S_61626921	1251922	A	C
S_23036534 S_61626951	1252014	T	C
S_23036567 S_61627007	1252155	A	T
S_23036573 S_61627021	1252196	T	A
S_23036575 S_61627025	1252199	T	G
S_23036583 S_61627044	1252268	A	T
S_23036588 S_61627054	1252313	A	G
S_23036594 S_61627075	1252377	T	A
S_23036601 S_61627107	1252492	G	T
S_23036605 S_61627135	1252607	T	C
S_23036649 S_61627267	1253196	G	T
S_23036650 S_61627269	1253197	A	G
S_23036655 S_61627283	1253272	A	G
S_23036663 S_61627305	1253387	T	A
S_23036665 S_61627306	1253395	A	C
S_23036681 S_61627376	1253674	T	G
S_23036698 S_61627432	1253895	T	G
S_23036705 S_61627446	1253945	G	T
S_23036709 S_61627453	1253972	A	T
S_23036784 S_61627630	1254528	A	G
S_23036882 S_61627973	1255988	C	A
S_23036883 S_61627979	1256029	G	A
S_23036886 S_61627992	1256066	A	G
S_23036898 S_61628029	1256186	A	G
S_23036915 S_61628090	1256393	C	A
S_23036988 S_61628296	1257182	T	C
S_23037004 S_61628372	1257335	G	A
S_23037006 S_61628379	1257350	G	A
S_23037007 S_61628382	1257353	A	C
S_23037034 S_61628462	1257633	T	G
S_23037089 S_61628554	1257991	C	T
S_23037119 S_61628619	1258387	G	T
S_23037129 S_61628631	1258473	G	T
S_23037141 S_61628680	1258798	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23037142 S_61628681	1258799	T	G
S_23037188 S_61628789	1259293	C	T
S_23037192 S_61628796	1259314	C	T
S_23037256 S_61628909	1259670	C	G
S_23037257 S_61628910	1259672	A	C
S_23037259 S_61628914	1259680	T	G
S_23037263 S_61628934	1259765	G	A
S_23037264 S_61628937	1259767	A	G
S_23037266 S_61628942	1259808	A	G
S_23037270 S_61628953	1259846	T	C
S_23037271 S_61628954	1259853	T	A
S_23037298 S_61629024	1260240	T	A
S_23037299 S_61629028	1260246	G	A
S_23037302 S_61629035	1260313	T	A
S_23037305 S_61629057	1260436	A	C
S_23037316 S_61629113	1260728	C	T
S_23037317 S_61629117	1260747	A	G
S_23037333 S_61629177	1261018	T	G
S_23037341 S_61629200	1261075	G	C
S_23037347 S_61629210	1261095	C	T
S_23037352 S_61629258	1261428	C	A
I_1471602 I_2450306	1261442	T	TA
S_23037353 S_61629259	1261468	C	A
S_23037354 S_61629260	1261488	C	A
S_23037355 S_61629261	1261489	G	A
S_23037356 S_61629267	1261526	G	A
S_23037357 S_61629270	1261536	T	A
S_23037363 S_61629288	1261622	A	G
S_23037365 S_61629292	1261652	T	C
S_23037374 S_61629326	1261836	G	C
S_23037375 S_61629333	1261850	A	G
S_23037377 S_61629352	1261929	G	A
S_23037378 S_61629353	1261932	G	T
S_23037379 S_61629356	1261940	C	A
S_23037380 S_61629358	1261968	C	G
S_23037384 S_61629364	1262002	T	C
S_23037385 S_61629370	1262026	G	A
S_23037392 S_61629393	1262133	T	A
S_23037393 S_61629396	1262157	G	A
S_23037405 S_61629435	1262414	C	T
S_23037406 S_61629448	1262455	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23037417 S_61629477	1262596	C	T
S_23037418 S_61629479	1262605	T	A
S_23037434 S_61629506	1262710	G	T
S_23037435 S_61629510	1262725	A	T
S_23037436 S_61629518	1262755	C	T
S_23037437 S_61629519	1262761	A	T
S_23037441 S_61629533	1262855	T	C
S_23037443 S_61629537	1262863	T	A
S_23037448 S_61629549	1262917	T	C
S_23037449 S_61629556	1262937	A	G
S_23037450 S_61629568	1262979	C	T
S_23037452 S_61629571	1262994	G	A
S_23037453 S_61629572	1262999	C	T
S_23037454 S_61629576	1263018	C	T
S_23037459 S_61629586	1263078	C	A
S_23037460 S_61629590	1263102	C	A
S_23037467 S_61629623	1263281	T	A
S_23037469 S_61629626	1263309	G	C
S_23037471 S_61629635	1263351	C	A
S_23037473 S_61629643	1263373	A	T
S_23037905 S_61630590	1266670	A	C
S_23037906 S_61630593	1266699	A	C
S_23037907 S_61630596	1266717	G	T
S_23037908 S_61630601	1266755	G	A
S_23037931 S_61630625	1266882	G	C
S_23037961 S_61630665	1267026	A	G
S_23037969 S_61630676	1267137	T	G
S_23037970 S_61630685	1267165	A	G
S_23038006 S_61630706	1267233	C	T
S_23038030 S_61630722	1267307	A	C
S_23038041 S_61630762	1267518	C	A
S_23038051 S_61630783	1267641	A	G
S_23038059 S_61630813	1267769	C	G
S_23038064 S_61630839	1267854	T	C
S_23038065 S_61630840	1267860	T	A
S_23038075 S_61630855	1267935	T	G
S_23038077 S_61630863	1267960	G	A
S_23038079 S_61630883	1268061	C	A
S_23038082 S_61630898	1268151	A	T
S_23038131 S_61630977	1268376	A	G
S_23038142 S_61630993	1268452	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23038155 S_61631054	1268601	C	T
S_23038161 S_61631091	1268744	A	C
S_23038239 S_61631262	1269120	C	T
S_23038240 S_61631264	1269121	C	G
S_23038243 S_61631272	1269151	G	C
S_23038246 S_61631288	1269254	A	T
S_23038249 S_61631294	1269302	T	C
S_23038260 S_61631321	1269471	T	G
S_23038267 S_61631329	1269529	A	C
I_2450423	1269677	G	GGAATC
S_23038276 S_61631393	1269699	G	T
S_23038281 S_61631403	1269763	T	C
S_23038284 S_61631405	1269770	C	A
S_23038294 S_61631419	1269874	A	G
S_23038298 S_61631439	1269940	T	C
S_23038317 S_61631497	1270251	A	G
S_23038327 S_61631511	1270374	C	A
S_23038328 S_61631512	1270381	A	C
S_23038329 S_61631513	1270385	G	C
S_23038343 S_61631551	1270593	A	G
S_23038403 S_61631637	1270744	A	G
S_23038412 S_61631647	1270755	A	C
S_23038428 S_61631674	1270871	A	G
S_23038434 S_61631687	1270940	G	A
S_23038438 S_61631693	1270982	A	G
S_23038441 S_61631696	1271015	A	C
S_23038442 S_61631700	1271052	G	C
S_23038443 S_61631701	1271063	T	A
S_23038445 S_61631704	1271081	G	C
S_23038446 S_61631713	1271128	A	C
D_1471689 D_2450437	1271317	GT	G
S_23038466 S_61631840	1271470	C	G
S_23038482 S_61631858	1271567	G	A
S_23038484 S_61631871	1271610	C	T
S_23038486 S_61631878	1271640	G	C
S_23038536 S_61631989	1272128	T	A
S_23038537 S_61631990	1272130	C	A
S_23038538 S_61631995	1272146	G	A
S_23038571 S_61632106	1272541	A	T
S_23038583 S_61632165	1272763	T	A
S_23038600 S_61632198	1272935	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23038604 S_61632202	1272991	A	T
S_23038615 S_61632237	1273159	G	T
S_23038617 S_61632244	1273187	T	C
S_23038618 S_61632249	1273205	A	C
S_23038635 S_61632292	1273398	T	A
S_23038643 S_61632299	1273412	C	T
S_23038645 S_61632301	1273416	T	C
S_23038683 S_61632317	1273484	T	C
S_23038707 S_61632369	1273658	T	C
S_23038727 S_61632417	1273907	A	G
S_23038728 S_61632424	1273972	A	T
S_23038761 S_61632535	1274407	C	A
S_23038775 S_61632563	1274575	G	A
S_23038794 S_61632619	1274854	T	G
S_23038795 S_61632620	1274860	A	T
S_23038796 S_61632621	1274862	A	C
S_23038812 S_61632659	1274990	G	A
S_23038817 S_61632689	1275110	A	T
S_23038835 S_61632754	1275378	C	A
S_23038840 S_61632769	1275431	C	G
S_23038849 S_61632810	1275561	G	A
S_23038873 S_61632880	1275883	C	T
S_23038920 S_61632920	1275957	C	T
S_23038928 S_61632983	1276061	T	C
S_23038929 S_61632989	1276084	C	A
S_23038931 S_61633005	1276126	A	T
S_23038932 S_61633006	1276130	G	T
S_23038934 S_61633017	1276167	C	T
S_23038940 S_61633028	1276261	A	G
S_23038941 S_61633030	1276262	C	T
S_23038942 S_61633032	1276277	G	T
S_23038943 S_61633035	1276291	G	C
S_23038944 S_61633038	1276314	A	T
S_23038961 S_61633136	1276665	T	C
S_23038962 S_61633143	1276684	T	G
S_23038963 S_61633145	1276687	A	T
S_23038973 S_61633188	1276856	T	C
S_23038980 S_61633209	1276931	A	C
S_23038988 S_61633227	1277021	C	T
S_23038989 S_61633230	1277037	A	G
S_23038995 S_61633247	1277101	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23039014 S_61633286	1277269	C	G
S_23039015 S_61633287	1277271	C	A
S_23039019 S_61633289	1277300	C	G
S_23039023 S_61633302	1277387	C	G
S_23039027 S_61633318	1277524	A	C
S_23039029 S_61633323	1277566	G	T
S_23039031 S_61633324	1277586	A	C
S_23039033 S_61633325	1277604	T	C
S_23039034 S_61633329	1277651	G	C
S_23039035 S_61633330	1277660	C	T
S_23039038 S_61633344	1277722	A	G
S_23039052 S_61633382	1278012	T	A
S_23039072 S_61633428	1278421	G	T
S_23039073 S_61633437	1278446	C	T
S_23039074 S_61633442	1278477	A	G
S_23039083 S_61633462	1278575	G	A
S_23039085 S_61633470	1278632	T	A
S_23039202 S_61633628	1279213	G	A
S_23039224 S_61633699	1279449	G	A
S_23039233 S_61633714	1279530	A	G
S_23039236 S_61633738	1279589	C	A
S_23039243 S_61633810	1279796	G	C
S_23039245 S_61633814	1279812	T	A
S_23039248 S_61633827	1279877	C	T
S_23039257 S_61633842	1279955	A	G
S_23039260 S_61633851	1279993	A	T
S_23039261 S_61633852	1279994	C	T
S_23039268 S_61633866	1280058	T	C
S_23039269 S_61633869	1280072	T	C
S_23039274 S_61633905	1280203	T	C
S_23039275 S_61633908	1280208	T	A
S_23039277 S_61633912	1280221	A	G
S_23039304 S_61633975	1280407	G	C
S_23039325 S_61634039	1280648	A	G
S_23039361 S_61634107	1280905	A	G
S_23039392 S_61634166	1281120	C	T
S_23039393 S_61634168	1281122	T	G
S_23039408 S_61634196	1281268	A	T
S_23039435 S_61634262	1281510	T	A
I_1471742 I_2450520	1282209	A	AT
S_23039615 S_61634603	1282738	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23039617 S_61634609	1282763	G	T
S_23039651 S_61634680	1282891	A	G
S_23039652 S_61634682	1282893	A	G
S_23039654 S_61634685	1282896	A	G
S_23039666 S_61634708	1282949	G	A
S_61634713	1282960	T	C
S_23039679 S_61634728	1283010	T	G
S_23039693 S_61634759	1283254	G	T
S_23039707 S_61634815	1283515	T	C
S_23039793 S_61635111	1284588	C	G
S_23039860 S_61635378	1285597	A	G
S_23039903 S_61635546	1286188	C	T
S_23039951 S_61635683	1286950	T	A
S_23039954 S_61635687	1286999	C	T
S_23039970 S_61635749	1287353	T	C
S_23039989 S_61635785	1287570	A	T
S_23039990 S_61635786	1287572	C	T
S_23040004 S_61635831	1287743	T	C
S_23040021 S_61635905	1287973	T	G
S_23040047 S_61636028	1288276	G	A
S_23040085 S_61636166	1288824	T	C
S_23040121 S_61636357	1289498	C	T
S_23040141 S_61636408	1289682	T	C
S_23040170 S_61636476	1289947	C	A
S_23040220 S_61636673	1290731	C	T
S_23040270 S_61636725	1290791	A	G
S_23040281 S_61636741	1290876	A	G
S_23040288 S_61636780	1290999	T	C
S_23040294 S_61636790	1291033	C	G
S_23040364 S_61636955	1291762	G	A
S_23040368 S_61636963	1291818	C	T
S_23040369 S_61636965	1291820	T	A
S_23040372 S_61636990	1291902	C	G
S_23040375 S_61636992	1291908	T	G
S_23040393 S_61637052	1292126	T	C
S_23040411 S_61637133	1292321	C	T
S_23040458 S_61637222	1293029	G	T
S_23040459 S_61637224	1293050	T	G
S_23040460 S_61637226	1293052	T	C
S_23040467 S_61637264	1293162	C	A
S_23040476 S_61637321	1293329	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23040484 S_61637336	1293397	G	A
S_23040485 S_61637337	1293399	G	A
S_23040488 S_61637350	1293484	G	C
S_23040504 S_61637386	1293781	T	A
S_23040507 S_61637395	1293838	A	G
S_23040508 S_61637400	1293856	G	A
S_23040518 S_61637414	1293974	T	C
S_23040522 S_61637417	1293999	G	A
S_23040526 S_61637422	1294047	G	A
S_23040535 S_61637440	1294184	G	C
S_23040552 S_61637476	1294335	A	G
S_23040555 S_61637494	1294414	A	G
S_23040603 S_61637658	1294759	A	G
S_23040608 S_61637671	1294798	A	G
S_23040625 S_61637749	1295107	A	C
S_23040644 S_61637789	1295353	A	G
S_23040651 S_61637810	1295509	T	G
S_23040659 S_61637819	1295568	G	A
S_23040661 S_61637833	1295638	A	C
S_23040704 S_61637927	1296033	T	C
S_23040711 S_61637945	1296112	C	G
S_23040712 S_61637946	1296116	A	G
S_23040713 S_61637948	1296124	C	T
S_23040727 S_61637990	1296288	T	C
S_23040737 S_61638024	1296417	T	C
S_23040739 S_61638030	1296436	C	T
S_23040742 S_61638045	1296476	A	G
S_23040748 S_61638074	1296561	A	G
S_23040766 S_61638123	1296714	T	C
S_23040769 S_61638132	1296749	A	G
S_23040772 S_61638146	1296786	G	T
S_23040773 S_61638149	1296799	G	T
S_23040774 S_61638159	1296851	G	T
S_23040881 S_61638425	1298744	T	C
S_23040913 S_61638453	1298785	T	A
S_23040915 S_61638456	1298788	T	C
S_23040917 S_61638458	1298790	T	A
S_23040946 S_61638507	1298944	A	G
S_23040962 S_61638536	1299083	T	C
S_61638554	1299165	C	G
S_61638555	1299167	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_61638557	1299168	T	C
S_23041026 S_61638751	1299857	A	T
S_23041032 S_61638766	1299929	G	A
S_23041033 S_61638767	1299931	C	G
S_23041038 S_61638793	1300046	C	T
S_23041051 S_61638859	1300260	T	A
S_23041082 S_61638932	1300560	A	G
S_23041083 S_61638934	1300573	G	A
S_23041090 S_61638976	1300664	A	G
S_23041091 S_61638978	1300669	A	G
S_23041136 S_61639073	1301031	A	G
S_23041141 S_61639086	1301075	T	C
S_23041166 S_61639185	1301347	G	A
S_23041266 S_61639441	1302201	G	A
S_23041267 S_61639443	1302209	C	A
S_23041268 S_61639444	1302221	A	C
S_23041287 S_61639467	1302331	G	T
S_23041288 S_61639469	1302338	A	C
S_23041289 S_61639470	1302357	A	C
S_23041290 S_61639471	1302360	T	C
S_23041292 S_61639482	1302487	A	C
S_23041293 S_61639483	1302494	A	G
S_23041297 S_61639493	1302534	C	A
S_23041343 S_61639560	1302785	A	T
S_23041348 S_61639566	1302816	G	A
S_23041354 S_61639579	1302882	C	G
S_23041376 S_61639644	1303243	T	A
S_23041383 S_61639657	1303341	G	T
S_23041420 S_61639739	1303855	T	C
S_23041421 S_61639740	1303859	A	C
S_23041424 S_61639747	1303888	G	A
S_23041425 S_61639752	1303902	A	G
S_23041428 S_61639766	1303983	G	T
S_23041445 S_61639822	1304276	T	C
S_23041446 S_61639824	1304280	G	A
S_23041491 S_61639917	1304537	C	A
S_23041492 S_61639918	1304539	C	T
S_23041584 S_61640123	1305091	A	T
S_23041585 S_61640124	1305092	T	G
S_23041754 S_61640558	1306425	A	C
S_23041755 S_61640559	1306429	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23041766 S_61640591	1306537	C	T
S_23041789 S_61640648	1306753	G	T
S_23041791 S_61640656	1306781	T	A
S_23041793 S_61640659	1306792	G	A
S_23041798 S_61640662	1306825	A	C
S_23041804 S_61640683	1306882	G	T
S_23041810 S_61640689	1306932	T	C
S_23041816 S_61640700	1306981	C	T
S_23041821 S_61640711	1307012	T	A
S_23041822 S_61640714	1307015	A	C
S_23041829 S_61640731	1307092	C	T
S_23041830 S_61640733	1307108	C	T
S_23041840 S_61640767	1307264	G	A
S_23041846 S_61640773	1307301	T	C
S_23041849 S_61640783	1307384	T	C
S_23041852 S_61640788	1307426	G	C
S_23041895 S_61640903	1308099	T	A
S_23041899 S_61640911	1308179	G	A
S_23041904 S_61640936	1308301	C	T
S_23041938 S_61641053	1308679	C	T
S_23041952 S_61641095	1308861	C	G
S_23041967 S_61641183	1309182	C	T
S_23041969 S_61641185	1309192	T	G
S_23041970 S_61641187	1309208	T	C
S_61641223	1309448	T	C
S_23041991 S_61641245	1309530	T	C
S_23041992 S_61641246	1309535	T	A
S_23042001 S_61641272	1309683	C	T
S_23042002 S_61641274	1309686	A	G
S_23042006 S_61641279	1309727	C	T
S_23042007 S_61641280	1309735	A	G
S_23042016 S_61641315	1309964	T	G
S_23042017 S_61641317	1309969	T	A
S_23042019 S_61641331	1310057	C	A
S_23042117 S_61641438	1310440	T	A
S_23042132 S_61641482	1310637	T	A
S_23042133 S_61641486	1310681	C	G
S_23042141 S_61641496	1310730	T	C
S_23042158 S_61641598	1310983	G	C
S_23042174 S_61641643	1311190	T	G
S_23042192 S_61641699	1311490	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23042328 S_61641918	1312406	A	G
S_23042368 S_61642043	1312916	G	T
S_23042370 S_61642054	1312944	T	A
S_23042453 S_61642191	1313650	A	G
S_23042460 S_61642205	1313767	C	T
S_23042462 S_61642206	1313775	G	C
S_23042465 S_61642212	1313834	T	A
S_23042469 S_61642232	1313939	T	G
S_23042470 S_61642236	1313952	A	G
S_23042471 S_61642241	1313973	T	C
S_23042473 S_61642257	1314032	T	A
S_23042475 S_61642264	1314059	A	T
S_23042480 S_61642279	1314142	A	G
S_23042484 S_61642293	1314189	T	C
S_23042485 S_61642295	1314198	C	G
S_23042488 S_61642302	1314242	A	G
S_23042490 S_61642316	1314328	A	G
S_23042512 S_61642349	1314430	T	C
S_23042531 S_61642381	1314537	A	G
S_23042577 S_61642411	1314664	C	T
S_23042631 S_61642610	1315217	T	G
S_23042632 S_61642616	1315230	T	C
S_23042633 S_61642617	1315236	C	G
S_23042649 S_61642649	1315365	A	G
S_23042655 S_61642675	1315500	G	A
S_23042658 S_61642683	1315536	A	C
S_23042659 S_61642685	1315546	A	T
S_23042661 S_61642697	1315608	A	G
S_61642782	1315800	T	C
S_23042712 S_61642829	1315917	C	A
S_23042714 S_61642836	1315953	G	T
S_23042725 S_61642885	1316126	G	A
S_23042744 S_61642961	1316469	T	C
S_23042767 S_61643024	1316727	T	A
S_23042959 S_61643636	1319484	A	G
S_23042973 S_61643694	1319636	T	G
S_23043003 S_61643774	1319999	C	G
S_23043007 S_61643799	1320087	C	A
S_23043008 S_61643800	1320092	A	T
S_23043009 S_61643802	1320099	T	A
S_23043015 S_61643827	1320235	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23043018 S_61643833	1320263	T	A
S_23043024 S_61643843	1320357	G	C
S_23043025 S_61643844	1320375	G	T
S_23043029 S_61643849	1320432	A	G
I_1471972 I_2450910	1320917	G	GT
S_23043061 S_61643938	1320942	A	C
S_23043066 S_61643980	1321120	T	G
S_23043067 S_61643981	1321121	A	G
S_23043069 S_61643990	1321186	G	C
S_23043088 S_61644034	1321367	A	G
S_23043091 S_61644036	1321378	T	C
S_23043098 S_61644054	1321465	G	C
S_23043107 S_61644094	1321636	G	A
S_23043120 S_61644115	1321756	A	C
S_23043215 S_61644380	1322575	T	C
S_23043243 S_61644433	1322829	G	A
S_23043287 S_61644643	1323459	A	C
S_23043309 S_61644744	1323870	C	G
S_23043312 S_61644771	1323970	C	T
S_23043444 S_61645270	1325049	T	A
S_23043447 S_61645295	1325152	T	G
S_23043458 S_61645315	1325329	C	T
S_23043463 S_61645323	1325389	T	A
S_23043523 S_61645457	1326246	C	A
S_23043540 S_61645488	1326349	A	T
S_23043564 S_61645574	1326723	G	A
S_23043583 S_61645611	1326917	C	G
S_23043584 S_61645616	1326934	G	T
S_23043585 S_61645619	1326949	T	G
S_23043637 S_61645694	1327147	A	G
S_23043651 S_61645738	1327302	T	G
S_23043656 S_61645742	1327332	C	T
S_23043661 S_61645750	1327375	A	G
S_23043665 S_61645752	1327390	G	A
S_23043669 S_61645772	1327469	T	G
S_23043674 S_61645807	1327637	T	A
S_23043680 S_61645819	1327754	T	A
S_23043689 S_61645883	1328091	A	G
S_23043940 S_61646346	1329673	T	A
S_23043968 S_61646411	1329894	A	G
S_23043970 S_61646419	1329923	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23043973 S_61646428	1329964	A	C
S_23043975 S_61646433	1330012	A	C
S_23043976 S_61646434	1330013	A	T
S_23043977 S_61646438	1330038	A	G
S_23043978 S_61646439	1330050	A	C
S_23043980 S_61646446	1330104	G	C
S_23043986 S_61646465	1330216	G	T
S_23043994 S_61646498	1330343	C	T
S_23043995 S_61646509	1330385	G	A
S_23044021 S_61646566	1330605	T	G
S_23044036 S_61646596	1330769	A	G
S_23044063 S_61646732	1331328	C	T
S_23044081 S_61646804	1331647	T	G
S_23044084 S_61646810	1331664	T	C
S_23044094 S_61646854	1331824	A	G
S_23044182 S_61647094	1332686	C	A
S_23044184 S_61647099	1332721	G	T
S_23044206 S_61647209	1333075	A	T
S_23044233 S_61647248	1333316	A	T
S_23044234 S_61647249	1333317	A	T
S_23044241 S_61647265	1333409	A	T
S_23044244 S_61647285	1333461	A	T
S_23044251 S_61647308	1333518	T	C
S_23044277 S_61647375	1333789	T	A
S_23044284 S_61647425	1333937	C	G
S_23044285 S_61647427	1333945	T	C
S_23044286 S_61647428	1333949	A	C
S_23044293 S_61647442	1333991	C	T
S_23044366 S_61647585	1334328	C	T
S_23044368 S_61647594	1334376	T	C
S_23044374 S_61647622	1334495	C	T
S_23044391 S_61647760	1334776	T	C
S_23044394 S_61647763	1334779	C	T
S_23044431 S_61647828	1335058	T	C
S_23044447 S_61647846	1335171	G	C
S_23044454 S_61647858	1335204	C	G
S_23044466 S_61647905	1335393	T	C
S_23044490 S_61647967	1335631	T	A
S_23044491 S_61647973	1335644	G	A
S_23044498 S_61647993	1335744	T	G
S_23044507 S_61648005	1335831	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23044509 S_61648007	1335854	A	G
S_23044523 S_61648037	1335983	T	A
S_23044527 S_61648047	1336045	T	C
S_23044528 S_61648050	1336054	A	G
S_23044529 S_61648054	1336071	A	G
S_23044532 S_61648059	1336098	A	G
S_23044534 S_61648070	1336124	G	A
S_23044547 S_61648141	1336291	T	G
S_23044548 S_61648168	1336377	T	A
S_23044564 S_61648232	1336600	A	G
S_23044571 S_61648245	1336692	T	A
S_23044581 S_61648272	1336817	C	A
S_23044586 S_61648313	1336943	T	C
S_23044600 S_61648340	1337067	C	T
S_23044601 S_61648344	1337096	G	A
S_23044602 S_61648345	1337103	A	G
S_23044605 S_61648351	1337141	G	A
S_23044607 S_61648357	1337169	T	C
S_23044612 S_61648379	1337239	T	C
S_23044615 S_61648387	1337269	C	T
S_23044617 S_61648391	1337299	G	C
S_23044618 S_61648395	1337325	T	A
S_23044637 S_61648445	1337683	T	C
S_23044643 S_61648474	1337784	A	G
S_23044660 S_61648516	1337980	A	G
S_23044662 S_61648527	1338026	G	A
S_23044680 S_61648585	1338289	C	T
S_23044699 S_61648640	1338434	T	G
S_23044711 S_61648669	1338544	A	C
S_23044725 S_61648708	1338691	A	G
S_23044727 S_61648709	1338695	T	C
S_23044764 S_61648861	1339182	A	T
S_23044859 S_61649113	1340136	T	G
S_23044878 S_61649188	1340459	A	C
S_23044886 S_61649198	1340515	A	T
S_23044895 S_61649229	1340613	A	T
S_23044934 S_61649314	1341037	T	C
S_23044941 S_61649321	1341095	C	A
S_23044947 S_61649325	1341123	T	C
S_23045025 S_61649461	1341621	C	A
S_23045031 S_61649481	1341723	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23045045 S_61649531	1342090	G	A
S_23045046 S_61649536	1342105	A	T
S_23045067 S_61649600	1342513	C	T
S_23045075 S_61649622	1342645	G	A
S_23045078 S_61649631	1342660	T	C
S_23045079 S_61649634	1342676	G	A
S_23045082 S_61649637	1342706	T	C
S_23045086 S_61649661	1342863	T	A
S_23045087 S_61649665	1342884	T	A
S_23045088 S_61649668	1342901	C	T
S_23045090 S_61649675	1342937	A	C
S_23045096 S_61649684	1342989	A	G
S_23045123 S_61649732	1343129	A	T
S_23045125 S_61649733	1343152	C	A
S_23045126 S_61649734	1343154	A	T
S_23045139 S_61649759	1343353	T	C
S_23045140 S_61649760	1343354	A	T
S_23045141 S_61649761	1343362	G	A
S_23045149 S_61649771	1343450	T	A
S_23045151 S_61649784	1343542	A	G
S_23045152 S_61649790	1343574	G	A
S_23045154 S_61649792	1343583	A	T
S_23045155 S_61649793	1343586	G	T
S_23045171 S_61649815	1343704	A	C
S_23045172 S_61649816	1343710	A	T
S_23045185 S_61649843	1343894	A	C
S_23045190 S_61649850	1343929	T	A
S_23045196 S_61649863	1343979	T	A
S_23045198 S_61649866	1343987	C	A
S_23045202 S_61649871	1344016	G	T
S_23045203 S_61649877	1344042	C	A
S_23045204 S_61649879	1344044	T	C
S_23045206 S_61649926	1344390	A	T
S_23045214 S_61649958	1344529	A	G
S_23045245 S_61650050	1344878	G	A
S_23045246 S_61650051	1344892	T	A
S_23045247 S_61650066	1344939	C	T
S_23045250 S_61650069	1344954	C	T
S_23045293 S_61650170	1345635	T	C
S_23045303 S_61650216	1345768	A	T
S_23045315 S_61650247	1345961	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23045343 S_61650331	1346265	G	T
S_23045344 S_61650333	1346273	C	T
S_23045350 S_61650357	1346337	G	A
S_23045352 S_61650363	1346395	A	C
S_23045354 S_61650368	1346409	T	G
S_23045355 S_61650371	1346425	T	C
S_23045359 S_61650398	1346498	C	T
S_23045360 S_61650399	1346504	G	A
S_23045361 S_61650402	1346513	A	G
S_23045383 S_61650441	1346710	G	A
S_23045384 S_61650443	1346716	T	G
S_23045385 S_61650444	1346717	G	A
S_23045386 S_61650455	1346757	A	G
S_23045398 S_61650482	1346866	C	T
S_23045402 S_61650497	1346906	T	G
S_23045433 S_61650601	1347175	A	G
S_23045440 S_61650620	1347253	C	G
S_23045495 S_61650803	1347761	A	G
S_23045500 S_61650840	1347865	G	T
S_23045504 S_61650847	1347895	T	C
S_23045507 S_61650852	1347928	G	T
S_23045515 S_61650884	1348011	T	G
S_23045517 S_61650893	1348051	C	A
S_23045518 S_61650897	1348070	C	G
S_23045519 S_61650899	1348080	T	G
S_23045521 S_61650903	1348097	A	G
S_23045522 S_61650904	1348100	G	A
S_23045532 S_61650960	1348282	T	C
S_23045533 S_61650973	1348322	G	A
S_23045535 S_61650982	1348343	G	A
S_23045590 S_61651114	1348949	T	C
S_23045641 S_61651186	1349388	A	G
S_23045642 S_61651188	1349391	G	T
S_23045644 S_61651194	1349481	C	T
S_23045645 S_61651195	1349482	A	G
S_23045646 S_61651197	1349488	C	T
S_23045647 S_61651202	1349498	A	C
S_23045649 S_61651206	1349522	A	G
S_23045650 S_61651208	1349523	A	G
S_23045652 S_61651219	1349563	G	A
S_23045654 S_61651235	1349642	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23045655 S_61651239	1349657	A	C
S_23045656 S_61651240	1349658	C	G
S_23045665 S_61651275	1349757	A	C
S_23045668 S_61651307	1349844	A	T
S_23045671 S_61651325	1349890	G	A
S_23045679 S_61651386	1350130	A	G
S_23045690 S_61651449	1350292	A	T
S_23045705 S_61651500	1350574	A	C
S_23045706 S_61651501	1350580	T	C
S_23045707 S_61651502	1350582	T	A
S_23045710 S_61651503	1350595	G	A
S_23045711 S_61651508	1350620	G	A
S_23045748 S_61651580	1350853	A	G
S_23045750 S_61651591	1350884	C	G
S_23045752 S_61651595	1350902	G	A
S_23045770 S_61651656	1351311	T	G
S_23045826 S_61651731	1351825	A	G
S_23045828 S_61651733	1351847	G	T
S_23045829 S_61651735	1351869	T	A
S_23045835 S_61651742	1351950	T	C
S_23045843 S_61651757	1352048	A	G
S_23045853 S_61651783	1352153	C	A
S_23045855 S_61651788	1352187	T	C
S_23045869 S_61651834	1352355	G	T
S_23045870 S_61651836	1352359	A	G
S_23045881 S_61651891	1352544	C	T
S_23045883 S_61651894	1352558	A	T
S_23045888 S_61651904	1352612	A	G
S_23045891 S_61651915	1352654	A	G
S_23045923 S_61652037	1353102	C	T
S_23045930 S_61652054	1353200	C	T
S_23045933 S_61652061	1353233	T	G
S_23045934 S_61652066	1353240	G	C
S_23045937 S_61652074	1353266	C	T
S_23045965 S_61652121	1353415	T	A
S_23045995 S_61652179	1353571	T	G
S_23045996 S_61652185	1353582	T	A
S_23046005 S_61652232	1353753	A	G
S_23046008 S_61652241	1353775	T	A
S_23046022 S_61652292	1353950	G	A
S_23046025 S_61652296	1353961	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23046033 S_61652307	1354043	G	T
S_23046034 S_61652308	1354044	T	G
S_23046093 S_61652544	1354871	T	G
S_23046108 S_61652560	1354927	T	C
S_23046116 S_61652581	1355026	A	C
S_23046135 S_61652618	1355205	A	T
S_23046140 S_61652652	1355349	T	C
S_23046172 S_61652759	1355745	T	A
S_23046174 S_61652765	1355789	C	A
S_23046178 S_61652772	1355842	G	T
I_2451257	1355908	G	GT
S_23046207 S_61652825	1356301	T	C
S_23046211 S_61652836	1356363	A	G
S_23046212 S_61652839	1356378	A	T
S_23046229 S_61652872	1356561	G	A
S_23046248 S_61652961	1356954	G	A
S_61652998	1357000	A	C
S_23046256 S_61653003	1357063	T	C
S_23046260 S_61653024	1357127	C	G
S_23046267 S_61653048	1357232	C	A
S_23046276 S_61653066	1357284	C	T
S_23046277 S_61653067	1357286	C	T
S_23046285 S_61653080	1357369	T	C
S_23046301 S_61653138	1357733	C	T
S_23046305 S_61653146	1357769	C	A
S_23046310 S_61653164	1357825	C	A
S_23046321 S_61653217	1358036	C	A
S_23046323 S_61653221	1358055	A	G
S_23046345 S_61653295	1358183	G	A
S_23046357 S_61653354	1358424	G	T
S_23046363 S_61653355	1358450	T	C
S_23046366 S_61653358	1358465	T	G
S_23046373 S_61653375	1358536	A	C
S_23046380 S_61653381	1358605	A	G
S_23046392 S_61653394	1358725	C	A
S_23046393 S_61653396	1358731	A	G
S_23046397 S_61653400	1358758	T	C
S_23046398 S_61653401	1358764	G	A
S_23046435 S_61653460	1359166	T	A
S_23046436 S_61653462	1359176	C	T
S_23046437 S_61653475	1359271	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23046438 S_61653482	1359311	G	C
S_23046439 S_61653484	1359312	T	C
S_23046440 S_61653485	1359315	G	A
S_23046441 S_61653490	1359349	A	T
S_23046450 S_61653523	1359575	G	A
S_23046463 S_61653548	1359768	T	A
S_23046464 S_61653550	1359774	G	C
S_23046467 S_61653564	1359846	G	T
S_23046497 S_61653667	1360632	T	C
S_23046508 S_61653695	1360864	C	T
S_23046517 S_61653716	1360987	A	T
S_23046520 S_61653736	1361045	A	G
S_23046548 S_61653849	1361585	G	T
S_23046551 S_61653857	1361637	T	G
S_23046626 S_61654111	1362404	A	T
S_23046630 S_61654126	1362442	G	C
S_23046668 S_61654317	1363184	T	C
S_23046672 S_61654324	1363223	A	G
S_23046674 S_61654326	1363228	C	T
S_23046683 S_61654354	1363358	C	A
S_23046684 S_61654355	1363361	A	G
S_23046686 S_61654361	1363403	A	G
S_23046692 S_61654379	1363460	C	T
S_23047303 S_61655265	1364977	A	G
S_23047304 S_61655267	1364982	A	C
S_23047310 S_61655277	1365052	C	G
S_23047311 S_61655285	1365103	G	A
S_23047366 S_61655372	1366038	C	A
S_23047367 S_61655373	1366046	A	C
S_23047368 S_61655377	1366057	A	T
S_23047396 S_61655497	1366424	T	C
S_23047409 S_61655538	1366580	G	A
S_23047448 S_61655623	1367019	G	T
S_23047449 S_61655624	1367020	C	G
S_23047463 S_61655665	1367216	C	T
S_23047465 S_61655668	1367256	G	A
S_23047466 S_61655669	1367259	A	G
S_23047471 S_61655680	1367332	G	T
S_23047473 S_61655685	1367351	C	T
S_23047474 S_61655688	1367372	G	T
S_23047475 S_61655690	1367400	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23047491 S_61655731	1367604	G	A
S_23047492 S_61655734	1367611	A	G
S_23047504 S_61655757	1367758	C	T
S_23047526 S_61655845	1368038	T	C
S_23047528 S_61655859	1368085	A	G
S_23047530 S_61655885	1368178	A	G
S_23047544 S_61655916	1368323	G	C
S_23047550 S_61655946	1368449	T	G
S_23047553 S_61655954	1368517	A	T
S_23047560 S_61655971	1368599	G	T
S_23047563 S_61655986	1368650	T	C
S_23047564 S_61655991	1368665	G	T
S_23047567 S_61656005	1368707	T	A
S_23047576 S_61656088	1368821	T	G
S_23047578 S_61656113	1368916	A	C
S_23047579 S_61656122	1368924	G	T
S_23047582 S_61656136	1368970	A	G
S_23047584 S_61656141	1368989	G	A
S_23047585 S_61656150	1369018	A	C
S_23047586 S_61656154	1369046	G	T
S_23047807 S_61656529	1370280	C	A
S_23047808 S_61656530	1370282	G	T
S_23047830 S_61656601	1370647	T	C
S_23047846 S_61656622	1370773	G	A
S_23047863 S_61656685	1370972	C	T
S_23047871 S_61656734	1371116	A	G
S_23047873 S_61656740	1371129	A	G
S_23047876 S_61656748	1371176	T	C
S_23047878 S_61656758	1371213	G	C
S_23047879 S_61656759	1371215	A	G
S_23047880 S_61656762	1371233	T	C
S_23047895 S_61656810	1371638	G	T
S_23047914 S_61656843	1371723	T	A
S_23047915 S_61656844	1371724	A	C
S_23047934 S_61656924	1371936	C	T
S_23047935 S_61656925	1371938	G	C
S_23047937 S_61656930	1371952	G	T
S_23047982 S_61657051	1372616	T	G
S_23047985 S_61657059	1372674	T	C
S_23047986 S_61657067	1372705	A	G
S_23047990 S_61657088	1372789	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23047998 S_61657092	1372818	G	T
S_23048005 S_61657166	1373629	G	A
S_23048006 S_61657168	1373636	C	G
S_23048007 S_61657172	1373649	G	A
S_23048047 S_61657207	1373946	T	C
S_23048057 S_61657243	1374114	T	C
S_23048059 S_61657250	1374135	T	G
S_23048061 S_61657255	1374157	C	T
S_23048065 S_61657274	1374225	A	G
S_23048069 S_61657287	1374279	C	G
S_23048070 S_61657289	1374282	A	T
S_23048099 S_61657358	1374646	T	C
S_23048100 S_61657359	1374651	C	A
S_23048101 S_61657364	1374680	G	A
S_23048120 S_61657425	1374928	A	G
S_23048159 S_61657542	1375835	C	G
S_23048165 S_61657570	1375964	G	T
S_23048168 S_61657582	1376066	G	A
S_23048170 S_61657584	1376075	G	A
S_23048175 S_61657595	1376162	G	T
S_23048205 S_61657687	1376641	G	A
S_23048206 S_61657689	1376646	T	C
S_23048207 S_61657691	1376658	T	C
S_23048208 S_61657692	1376659	T	C
S_23048215 S_61657709	1376717	C	G
S_23048218 S_61657711	1376752	A	T
S_23048220 S_61657717	1376777	A	T
S_23048229 S_61657748	1376890	T	C
S_23048348 S_61658104	1378203	G	A
S_23048411 S_61658253	1378703	T	A
S_23048412 S_61658255	1378713	A	T
S_23048445 S_61658350	1379068	T	C
S_23048447 S_61658355	1379079	G	A
S_23048459 S_61658370	1379121	T	G
S_23048487 S_61658454	1379446	A	C
S_23048495 S_61658480	1379689	A	C
S_23048496 S_61658484	1379704	T	G
S_23048497 S_61658486	1379719	T	C
I_1472342 I_2451589	1380033	G	GA
S_23048526 S_61658602	1380156	G	A
S_23048528 S_61658605	1380189	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23048529 S_61658607	1380193	G	A
S_23048555 S_61658694	1380564	G	A
S_23048560 S_61658738	1380774	G	T
S_23048561 S_61658742	1380794	T	A
S_23048568 S_61658782	1380983	G	A
S_23048624 S_61658953	1381680	G	A
S_23048625 S_61658954	1381682	G	C
S_23048626 S_61658957	1381693	C	A
S_23048627 S_61658959	1381710	A	C
S_23048631 S_61658963	1381720	G	A
S_23048679 S_61659074	1382201	A	T
S_23048695 S_61659155	1382447	C	T
S_23048696 S_61659162	1382475	A	G
S_23048705 S_61659193	1382640	G	A
S_23048727 S_61659275	1382928	T	A
S_23048739 S_61659313	1383110	C	T
S_23048740 S_61659314	1383126	A	G
S_23048746 S_61659321	1383208	G	A
S_23048747 S_61659327	1383228	A	C
S_23048760 S_61659349	1383387	G	C
S_23048768 S_61659370	1383486	C	G
S_23048769 S_61659371	1383494	A	C
S_23048770 S_61659373	1383501	T	G
S_23048771 S_61659381	1383536	G	T
S_23048777 S_61659427	1383608	G	T
S_23048805 S_61659488	1383708	A	G
S_23048808 S_61659495	1383751	A	C
S_23048811 S_61659507	1383797	T	G
S_23048862 S_61659636	1384301	C	G
S_23048879 S_61659709	1384548	C	G
S_23048882 S_61659718	1384589	T	C
S_23048902 S_61659769	1384702	C	A
S_23048931 S_61659829	1384907	G	C
S_23048987 S_61659985	1385684	T	C
S_23049001 S_61660113	1385946	C	T
S_23049003 S_61660114	1385952	A	G
S_23049019 S_61660263	1386319	T	C
S_23049029 S_61660309	1386500	T	G
S_23049040 S_61660331	1386593	T	C
S_23049105 S_61660579	1387337	T	G
S_23049204 S_61660881	1388451	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23049208 S_61660889	1388477	A	G
S_23049231 S_61660976	1388878	G	A
S_23049238 S_61661019	1389017	A	T
S_23049239 S_61661038	1389069	C	T
S_23049256 S_61661099	1389346	G	A
I_1472389 I_2451656	1389475	T	TA
S_23049322 S_61661321	1390126	G	C
S_23049325 S_61661337	1390189	G	A
S_23049328 S_61661347	1390237	T	G
S_23049334 S_61661385	1390403	C	T
S_23049339 S_61661393	1390453	T	C
S_23049343 S_61661410	1390531	T	G
S_23049364 S_61661476	1390845	C	T
S_23049366 S_61661479	1390863	C	G
S_23049418 S_61661572	1391669	T	A
S_23049421 S_61661576	1391695	C	T
S_23049422 S_61661578	1391699	T	C
S_23049432 S_61661593	1391802	G	T
S_23049435 S_61661598	1391860	G	A
S_23049436 S_61661599	1391867	T	C
S_23049437 S_61661600	1391879	G	A
S_23049439 S_61661603	1391905	G	T
S_23049452 S_61661621	1392051	C	G
S_23049456 S_61661628	1392090	T	C
S_23049457 S_61661630	1392098	G	A
S_23049462 S_61661640	1392180	T	C
S_23049463 S_61661641	1392185	G	C
S_23049464 S_61661645	1392196	T	G
S_23049571 S_61661915	1393435	T	A
S_23049584 S_61661951	1393613	A	G
S_23049648 S_61662127	1394581	T	G
S_23049652 S_61662133	1394636	C	T
S_23049680 S_61662229	1395213	T	C
S_23049682 S_61662238	1395254	A	C
S_23049683 S_61662240	1395266	C	T
S_23049696 S_61662271	1395462	A	C
S_23049697 S_61662276	1395506	G	T
S_23049700 S_61662283	1395561	C	T
S_23049701 S_61662286	1395582	T	A
S_23049714 S_61662312	1395899	G	A
S_23049717 S_61662319	1395948	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23049719 S_61662321	1395954	A	G
S_23049732 S_61662343	1396052	A	C
S_23049736 S_61662354	1396100	T	G
S_23049741 S_61662363	1396122	A	T
S_23049742 S_61662365	1396124	T	C
S_23049763 S_61662409	1396299	T	C
S_23049775 S_61662441	1396383	T	A
S_23049784 S_61662454	1396427	A	C
S_23049790 S_61662481	1396517	G	T
S_23049791 S_61662482	1396519	T	C
S_61662484	1396532	A	T
S_61662485	1396533	T	A
S_61662487	1396534	A	T
S_23049798 S_61662491	1396558	A	C
S_23049830 S_61662558	1396893	A	G
S_23049831 S_61662559	1396898	A	G
S_23049863 S_61662635	1397288	G	C
S_23049867 S_61662648	1397331	T	C
S_23049868 S_61662652	1397350	A	G
S_23049870 S_61662655	1397364	T	A
S_23049871 S_61662656	1397396	G	A
S_23049872 S_61662665	1397444	A	C
S_23049873 S_61662672	1397477	C	G
S_23049880 S_61662694	1397616	T	A
S_23049882 S_61662699	1397641	T	C
S_23050129 S_61663192	1399204	G	T
S_23050130 S_61663194	1399224	T	A
S_23050228 S_61663386	1400378	G	C
S_23050230 S_61663389	1400411	T	A
S_23050240 S_61663415	1400545	G	A
S_23050242 S_61663420	1400577	C	T
S_23050243 S_61663421	1400582	T	A
S_23050244 S_61663422	1400583	C	T
S_23050245 S_61663424	1400590	C	T
S_23050250 S_61663447	1400704	A	G
S_23050266 S_61663593	1401068	G	A
S_23050268 S_61663600	1401083	T	C
S_23050269 S_61663611	1401123	T	C
S_23050270 S_61663612	1401129	T	C
S_23050272 S_61663617	1401171	C	T
S_23050300 S_61663702	1401425	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23050304 S_61663708	1401456	C	T
S_23050306 S_61663711	1401471	A	G
S_23050310 S_61663717	1401493	G	A
S_23050316 S_61663730	1401576	T	A
S_23050351 S_61663813	1401831	A	T
S_61663818	1401859	A	C
S_23050360 S_61663829	1401888	T	C
S_23050410 S_61663915	1402213	G	T
S_23050460 S_61663969	1402737	C	A
S_23050465 S_61663979	1402815	T	C
S_23050479 S_61664001	1402950	A	T
S_23050490 S_61664014	1403019	G	A
S_23050512 S_61664102	1403274	G	A
S_23050517 S_61664115	1403334	T	C
S_23050519 S_61664116	1403337	A	G
S_23050520 S_61664117	1403339	A	G
S_23050521 S_61664121	1403355	A	C
S_23050530 S_61664133	1403445	C	T
S_23050532 S_61664136	1403457	T	C
S_23050536 S_61664199	1403558	C	T
S_23050537 S_61664210	1403575	T	A
S_23050538 S_61664215	1403592	T	C
S_23050546 S_61664227	1403695	C	T
S_23050547 S_61664236	1403752	T	G
S_23050549 S_61664253	1403800	T	G
S_23050550 S_61664255	1403801	T	C
S_23050551 S_61664257	1403810	C	G
S_23050561 S_61664296	1404030	C	T
S_23050596 S_61664409	1404588	A	C
S_23050627 S_61664477	1404886	T	C
S_23050629 S_61664480	1404899	C	T
S_23050674 S_61664560	1405128	A	C
S_23050685 S_61664572	1405150	T	G
S_23050688 S_61664582	1405233	T	A
S_23050690 S_61664591	1405367	C	T
S_23050691 S_61664593	1405390	A	G
S_23050692 S_61664596	1405417	T	A
S_23050768 S_61664605	1405555	G	T
S_23050817 S_61664772	1406240	A	C
S_23050818 S_61664773	1406241	A	G
S_23050836 S_61664816	1406548	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23050838 S_61664819	1406559	A	G
S_23050861 S_61664873	1406859	A	C
S_23050864 S_61664883	1406890	A	G
S_23050866 S_61664890	1406911	C	G
S_23050871 S_61664893	1406927	C	T
S_23050896 S_61664945	1407190	A	G
S_23050907 S_61665005	1407406	A	G
S_23050931 S_61665074	1407651	T	G
S_23050957 S_61665223	1408062	A	G
S_23050968 S_61665281	1408377	T	C
S_23050989 S_61665306	1408399	T	C
S_23050990 S_61665308	1408400	G	A
S_23050997 S_61665329	1408472	A	C
S_23051006 S_61665387	1408764	A	G
S_23051008 S_61665397	1408808	T	C
S_23051030 S_61665463	1409105	G	A
S_23051038 S_61665502	1409186	A	G
S_23051050 S_61665557	1409416	T	C
S_23051057 S_61665596	1409591	T	A
S_23051058 S_61665603	1409611	T	A
S_23051069 S_61665616	1409635	G	A
S_23051079 S_61665627	1409646	T	A
S_23051110 S_61665672	1409740	T	C
S_23051111 S_61665674	1409746	C	T
S_23051216 S_61665898	1410757	T	C
S_23051231 S_61665915	1410867	A	G
S_23051234 S_61665923	1410885	C	T
S_23051271 S_61665983	1411310	G	A
I_2451939	1413827	A	AT
S_23051541 S_61666409	1413865	A	T
S_23051562 S_61666452	1414076	T	C
S_23051575 S_61666501	1414237	G	T
S_23051583 S_61666517	1414318	A	G
S_23051622 S_61666640	1414758	A	G
S_23051623 S_61666645	1414780	T	G
S_23051630 S_61666664	1414827	A	G
S_23051648 S_61666694	1414947	T	C
S_23051686 S_61666777	1415253	G	A
S_23051691 S_61666787	1415280	C	A
S_23051699 S_61666809	1415361	C	G
S_23051700 S_61666810	1415363	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23051710 S_61666828	1415462	A	C
S_23051720 S_61666874	1415596	T	C
S_23051749 S_61666939	1415866	G	A
S_23051750 S_61666941	1415869	T	G
S_23051759 S_61666960	1415969	A	C
S_23051787 S_61667053	1416136	T	C
S_23051794 S_61667107	1416242	C	T
S_23051796 S_61667113	1416251	A	G
S_23051799 S_61667131	1416322	A	T
S_23051824 S_61667212	1416565	A	T
S_23051827 S_61667223	1416581	C	T
S_23051831 S_61667235	1416617	G	C
S_23051868 S_61667379	1417248	C	A
S_23051869 S_61667380	1417257	G	A
S_23051872 S_61667384	1417289	A	G
S_23051873 S_61667385	1417292	C	T
S_23051878 S_61667405	1417376	G	T
S_23051879 S_61667410	1417390	A	G
S_23051881 S_61667424	1417438	A	T
S_23051889 S_61667460	1417528	A	G
S_23051897 S_61667498	1417685	T	G
S_23051907 S_61667523	1417854	C	T
S_23051912 S_61667539	1417913	A	G
S_23051958 S_61667678	1418690	A	G
S_23051961 S_61667684	1418722	A	G
S_23051966 S_61667706	1418849	A	T
S_23051968 S_61667713	1418881	G	A
S_23051972 S_61667722	1418973	A	G
S_23051974 S_61667727	1419012	T	A
S_23051975 S_61667728	1419019	A	G
S_23051979 S_61667736	1419093	T	C
S_23051981 S_61667741	1419150	T	C
S_23051982 S_61667742	1419186	T	C
S_23051984 S_61667743	1419240	C	G
S_23051985 S_61667744	1419242	A	C
S_23051986 S_61667745	1419244	C	T
S_23052001 S_61667789	1419600	C	T
S_23052010 S_61667829	1419757	T	A
S_23052018 S_61667848	1419826	A	G
S_23052036 S_61667899	1420075	C	A
S_23052116 S_61668014	1420855	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23052167 S_61668124	1421445	T	G
S_23052186 S_61668160	1421691	C	T
S_23052187 S_61668161	1421714	A	G
S_23052188 S_61668164	1421727	G	A
S_23052483 S_61669073	1429095	C	T
S_23052484 S_61669075	1429112	A	C
S_23052488 S_61669084	1429170	C	T
S_23052489 S_61669086	1429190	G	T
S_23052491 S_61669095	1429238	A	T
S_23052499 S_61669125	1429370	T	C
S_23052502 S_61669131	1429405	C	G
S_23052504 S_61669142	1429443	T	C
S_23052526 S_61669229	1429652	T	C
S_23052537 S_61669251	1429762	G	A
S_23052543 S_61669266	1429857	G	C
S_61669278	1429962	G	T
S_23052602 S_61669279	1429963	G	A
S_61669284	1429992	T	C
S_23052617 S_61669308	1430113	T	A
I_1472630 I_2452074	1430268	A	AT
S_23052625 S_61669354	1430322	C	T
S_23052669 S_61669506	1430939	T	A
S_23052670 S_61669515	1431006	A	G
S_23052674 S_61669527	1431074	T	C
S_23052704 S_61669680	1431435	T	C
S_23052737 S_61669766	1431709	C	T
S_23052764 S_61669874	1432116	T	A
S_23052768 S_61669886	1432166	A	G
S_23052867 S_61670177	1433180	C	T
S_23052882 S_61670228	1433369	G	C
S_23052894 S_61670267	1433520	T	G
I_1472651 I_2452118	1434186	A	AC
S_23052951 S_61670467	1434253	G	A
S_23052955 S_61670478	1434322	A	C
S_23052959 S_61670493	1434415	T	C
S_23052974 S_61670561	1434705	C	T
S_23052994 S_61670698	1435130	C	T
S_23053004 S_61670706	1435182	G	A
S_23053026 S_61670776	1435473	C	T
I_1472661 I_2452136	1435698	G	GA
S_23053043 S_61670853	1435771	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23053058 S_61670898	1435917	A	C
S_23053089 S_61671007	1436133	T	C
S_23053110 S_61671112	1436375	C	T
S_23053118 S_61671128	1436451	G	T
S_23053119 S_61671129	1436452	T	A
S_23053180 S_61671304	1437064	C	A
I_2452152	1437068	C	CA
S_23053181 S_61671307	1437073	G	T
S_23053189 S_61671324	1437139	G	A
S_23053191 S_61671327	1437158	T	A
D_1472673 D_2452155	1437462	TG	T
S_23053216 S_61671401	1437527	T	C
S_23053217 S_61671404	1437542	T	C
S_23053219 S_61671409	1437569	A	T
S_23053221 S_61671410	1437583	C	T
S_23053224 S_61671414	1437613	T	C
S_23053226 S_61671417	1437620	T	C
S_23053227 S_61671418	1437624	T	C
S_23053228 S_61671419	1437625	C	T
S_23053241 S_61671445	1437748	G	C
S_23053242 S_61671446	1437760	A	C
S_23053247 S_61671469	1437837	A	C
S_23053253 S_61671475	1437860	G	T
S_23053263 S_61671494	1437948	A	G
S_23053273 S_61671531	1438036	C	T
S_23053275 S_61671532	1438044	A	G
S_23053283 S_61671572	1438179	C	T
S_23053317 S_61671684	1438685	T	C
S_23053318 S_61671687	1438697	T	C
S_23053336 S_61671742	1438972	G	A
S_23053337 S_61671745	1438977	T	A
S_23053338 S_61671746	1438980	G	A
S_23053383 S_61671945	1439458	G	T
S_23053403 S_61672036	1439771	A	G
S_23053454 S_61672189	1440407	A	G
I_1472687 I_2452180	1440641	T	TC
S_23053481 S_61672252	1440662	C	A
S_23053496 S_61672288	1440771	C	T
D_1472689 D_2452182	1440868	AAG	A
S_23053510 S_61672342	1440947	G	T
S_23053538 S_61672469	1441498	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23053588 S_61672740	1442515	C	A
S_23053590 S_61672747	1442529	T	C
S_23053602 S_61672787	1442698	T	A
S_23053626 S_61672852	1443177	A	G
S_23053662 S_61672949	1443590	T	A
S_23053667 S_61672973	1443717	A	G
S_23053668 S_61672980	1443759	G	T
I_1472696 I_2452192	1443784	T	TA
S_23053669 S_61672986	1443794	A	G
S_23053671 S_61672987	1443823	T	C
S_23053672 S_61672994	1443853	G	A
S_23053673 S_61672998	1443891	A	G
S_23053675 S_61673000	1443920	A	G
S_23053686 S_61673025	1444159	T	C
S_23053687 S_61673026	1444161	C	T
S_23053688 S_61673027	1444170	C	A
S_23053719 S_61673093	1444571	T	C
S_23053720 S_61673098	1444582	T	A
S_23053721 S_61673104	1444610	A	T
S_23053730 S_61673158	1444797	G	A
S_23053735 S_61673180	1444882	C	G
S_23053738 S_61673182	1444902	G	A
S_23053760 S_61673260	1445233	A	G
S_23053761 S_61673264	1445250	G	T
S_23053831 S_61673443	1445968	C	G
S_23053841 S_61673480	1446119	C	T
S_23053926 S_61673714	1446716	C	A
S_23053935 S_61673775	1446821	T	C
S_23053940 S_61673793	1446856	T	C
S_23053945 S_61673810	1446921	A	G
S_23053946 S_61673811	1446922	C	A
S_23053947 S_61673814	1446923	T	G
S_23053948 S_61673815	1446924	C	T
S_23053949 S_61673816	1446928	C	T
S_23053953 S_61673824	1446997	T	C
S_23053999 S_61673922	1447455	T	C
S_23054004 S_61673924	1447513	A	G
S_23054020 S_61673963	1447689	T	G
S_23054044 S_61674026	1448009	C	A
S_23054048 S_61674037	1448075	A	T
S_23054049 S_61674038	1448079	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23054090 S_61674112	1448568	G	T
S_23054092 S_61674115	1448589	A	T
S_23054093 S_61674119	1448612	C	A
S_23054158 S_61674256	1449568	G	T
S_23054159 S_61674262	1449604	C	G
S_23054250 S_61674364	1450260	C	T
S_23054262 S_61674390	1450431	A	G
S_23054264 S_61674393	1450445	G	A
S_23054269 S_61674412	1450517	T	C
S_23054296 S_61674483	1450796	C	A
S_23054490 S_61675076	1455240	C	T
S_23054497 S_61675092	1455331	G	T
S_23054533 S_61675209	1456101	C	G
S_23054543 S_61675239	1456207	G	C
S_23054556 S_61675267	1456302	C	G
S_23054578 S_61675305	1456447	G	A
S_23054580 S_61675306	1456455	A	T
S_23054585 S_61675316	1456525	C	G
S_23054597 S_61675364	1456708	C	A
S_23054625 S_61675446	1457249	A	T
S_23054627 S_61675451	1457304	G	A
S_23054641 S_61675476	1457480	C	T
S_23054653 S_61675508	1457659	G	T
S_23054662 S_61675542	1457752	C	A
S_23054687 S_61675632	1457994	C	T
S_23054739 S_61675757	1458405	T	C
S_23054762 S_61675786	1458521	G	T
S_23054833 S_61676005	1459399	T	G
I_1472796 I_2452352	1459534	C	CCGTA
S_23054841 S_61676024	1459536	T	G
S_23054903 S_61676294	1460497	T	C
S_23054917 S_61676347	1460689	T	G
S_23054926 S_61676390	1460858	T	A
S_23054995 S_61676557	1461445	A	G
S_23055001 S_61676575	1461506	T	G
S_23055013 S_61676631	1461685	A	G
S_23055018 S_61676653	1461754	A	T
S_23055051 S_61676778	1462273	G	T
S_23055057 S_61676800	1462468	G	A
S_23055064 S_61676829	1462612	G	A
S_23055072 S_61676860	1462721	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23055073 S_61676863	1462729	G	A
S_23055078 S_61676945	1462897	T	A
S_23055079 S_61676946	1462898	T	A
S_23055080 S_61676947	1462899	C	A
S_23055082 S_61676950	1462943	A	T
S_23055089 S_61676966	1463094	G	A
S_23055104 S_61677034	1463492	G	A
S_23055145 S_61677121	1463902	A	T
S_23055191 S_61677248	1464482	C	G
S_23055257 S_61677458	1465295	G	A
S_23055259 S_61677460	1465313	A	G
S_23055294 S_61677559	1465616	G	A
S_23055305 S_61677594	1465751	A	C
S_23055306 S_61677596	1465770	C	G
S_23055323 S_61677635	1465919	A	C
S_23055325 S_61677636	1465926	C	G
S_23055342 S_61677703	1466168	G	A
S_23055409 S_61677879	1466655	G	A
S_23055515 S_61678237	1467769	T	G
S_23055522 S_61678247	1467853	C	T
S_23055523 S_61678250	1467913	A	G
S_23055524 S_61678252	1467920	A	G
S_23055526 S_61678257	1467962	C	T
S_23055528 S_61678261	1467986	A	G
S_23055530 S_61678267	1468006	C	T
S_23055539 S_61678285	1468117	G	A
S_23055542 S_61678302	1468198	G	A
S_23055543 S_61678305	1468207	A	G
S_23055545 S_61678307	1468208	C	T
S_23055546 S_61678309	1468225	A	T
S_23055547 S_61678317	1468253	A	G
S_23055554 S_61678326	1468304	T	A
S_23055571 S_61678370	1468490	C	T
S_23055640 S_61678475	1469219	G	T
S_23055695 S_61678574	1469994	T	C
S_23055738 S_61678639	1470275	T	C
S_23055739 S_61678642	1470282	A	G
S_23055740 S_61678675	1470412	T	C
S_23055755 S_61678739	1470552	C	T
S_23055756 S_61678742	1470554	T	C
S_23055761 S_61678750	1470586	C	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23055783 S_61678814	1470811	T	C
S_23055846 S_61678996	1471301	A	C
S_23055853 S_61679012	1471410	T	C
S_23055860 S_61679030	1471462	T	G
S_23055875 S_61679044	1471562	G	T
S_23055901 S_61679103	1471800	T	A
S_23055904 S_61679124	1471849	G	A
S_23055942 S_61679247	1472284	C	A
S_23055971 S_61679294	1472551	C	T
S_23055981 S_61679321	1472661	T	A
S_23055984 S_61679324	1472682	G	A
S_23055985 S_61679328	1472691	G	T
S_23056009 S_61679466	1473074	A	G
S_23056012 S_61679472	1473097	T	C
S_23056044 S_61679544	1473304	C	T
S_23056045 S_61679546	1473307	T	C
S_23056084 S_61679652	1473709	T	C
S_61679957	1474419	A	G
S_23056244 S_61680066	1474735	A	G
S_23056249 S_61680092	1474869	A	G
S_23056277 S_61680158	1475114	T	A
S_23056285 S_61680179	1475214	A	G
S_23056314 S_61680315	1475651	T	G
S_23056330 S_61680345	1475780	G	A
S_23056342 S_61680378	1475959	T	A
S_23056395 S_61680547	1476605	A	G
S_23056401 S_61680583	1476765	C	G
S_23056405 S_61680631	1476993	G	T
S_23056406 S_61680632	1476994	G	C
S_23056411 S_61680661	1477116	T	A
S_23056412 S_61680666	1477133	T	G
S_23056417 S_61680679	1477264	T	C
S_23056427 S_61680774	1477401	A	T
S_23056454 S_61680844	1477674	T	G
S_23056470 S_61680896	1477917	T	C
S_23056489 S_61680936	1478180	A	C
S_23056490 S_61680941	1478194	G	A
S_23056513 S_61680987	1478480	T	G
S_23056517 S_61680999	1478607	C	T
S_23056519 S_61681004	1478626	T	C
S_23056520 S_61681007	1478646	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23056526 S_61681019	1478710	C	A
S_23056530 S_61681033	1478746	T	C
S_23056546 S_61681080	1478971	A	T
S_23056566 S_61681143	1479144	C	G
S_23056571 S_61681156	1479193	A	C
S_23056573 S_61681165	1479215	T	A
S_23056575 S_61681173	1479244	G	C
S_23056576 S_61681174	1479246	G	T
S_23056578 S_61681182	1479274	A	G
S_23056610 S_61681281	1479534	G	A
S_23056748 S_61681642	1480720	A	T
S_23056763 S_61681739	1481021	A	G
S_23056807 S_61681858	1481525	C	T
S_23056809 S_61681870	1481571	C	A
S_23056823 S_61681911	1481717	A	G
S_23056834 S_61681958	1481849	A	G
S_23056959 S_61682259	1483072	T	C
S_23057002 S_61682383	1483809	C	G
S_23057006 S_61682396	1483859	C	A
S_23057019 S_61682411	1483992	C	A
S_23057050 S_61682538	1484351	A	G
S_23057058 S_61682554	1484481	C	G
S_23057060 S_61682559	1484500	C	G
S_23057071 S_61682577	1484575	C	T
S_23057114 S_61682623	1484812	G	T
S_23057115 S_61682624	1484813	A	C
S_23057120 S_61682646	1484916	A	G
S_23057121 S_61682649	1484932	T	C
S_23057147 S_61682696	1485207	T	C
S_23057163 S_61682714	1485445	A	C
S_23057176 S_61682766	1485699	A	T
S_23057177 S_61682768	1485700	A	T
S_23057180 S_61682770	1485705	A	G
S_23057199 S_61682828	1485937	G	A
S_23057232 S_61682942	1486359	T	C
S_23057235 S_61682950	1486393	A	G
S_23057247 S_61682977	1486509	A	G
S_23057261 S_61683015	1486707	T	G
S_23057272 S_61683043	1486800	G	T
S_23057345 S_61683408	1488038	A	T
S_23057359 S_61683481	1488384	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23057412 S_61683666	1488957	T	A
S_23057457 S_61683778	1489531	C	T
S_23057477 S_61683819	1489705	C	A
S_23057480 S_61683825	1489738	A	C
S_23057499 S_61683833	1489763	T	C
S_23057523 S_61683864	1489861	A	T
S_23057526 S_61683868	1489886	A	T
S_23057534 S_61683899	1490115	C	T
S_23057537 S_61683903	1490150	C	A
S_23057539 S_61683908	1490186	A	T
S_23057542 S_61683924	1490270	C	A
S_23057544 S_61683933	1490314	A	G
S_23057545 S_61683940	1490353	T	C
S_23057548 S_61683944	1490423	A	C
S_23057550 S_61683960	1490510	T	A
S_23057615 S_61684072	1490924	G	A
D_1472958 D_2452633	1491314	TA	T
S_23057681 S_61684441	1491853	G	A
S_23057696 S_61684563	1492209	G	A
S_23057760 S_61684855	1493160	T	C
S_23057762 S_61684860	1493180	A	G
S_23057790 S_61684894	1493350	T	C
S_23057815 S_61684937	1493459	G	T
S_23057820 S_61684944	1493514	G	A
S_23057824 S_61684956	1493558	C	T
S_23057835 S_61685037	1493739	T	A
S_23057860 S_61685150	1494132	G	A
S_23057882 S_61685206	1494496	A	G
S_23057884 S_61685213	1494553	C	T
S_23057885 S_61685221	1494572	T	C
S_23057921 S_61685287	1494881	T	C
S_23057923 S_61685296	1494927	T	A
S_23057924 S_61685298	1494928	C	T
S_23057935 S_61685325	1495093	G	A
S_23057936 S_61685327	1495103	G	A
S_23057937 S_61685330	1495119	T	A
S_23057938 S_61685338	1495146	G	T
S_23057945 S_61685360	1495181	C	T
S_23057947 S_61685428	1495335	T	C
S_23057950 S_61685465	1495484	A	G
S_23057968 S_61685497	1495725	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23058048 S_61685728	1496753	G	A
S_23058053 S_61685752	1496834	T	G
S_23058058 S_61685762	1496892	C	A
S_23058066 S_61685799	1497060	C	T
I_1472986 I_2452690	1497178	A	ATATTT
S_23058070 S_61685822	1497179	A	T
S_23058130 S_61685950	1497747	T	G
S_23058168 S_61686079	1498224	C	T
S_23058186 S_61686143	1498483	A	G
S_23058257 S_61686444	1499406	T	C
S_23058267 S_61686484	1499614	G	C
S_23058294 S_61686554	1499863	A	T
S_23058298 S_61686558	1499903	C	A
S_23058303 S_61686565	1499933	A	C
S_23058308 S_61686574	1499981	T	C
S_23058312 S_61686579	1500008	C	G
S_23058348 S_61686729	1500562	A	T
S_23058364 S_61686779	1500767	G	A
S_23058388 S_61686869	1501119	G	A
S_23058424 S_61687115	1501666	C	T
S_23058443 S_61687175	1501950	T	A
S_23058468 S_61687221	1502227	G	A
S_23058496 S_61687286	1502564	A	T
S_23058500 S_61687295	1502631	T	C
S_23058541 S_61687497	1503162	A	G
S_23058546 S_61687535	1503299	A	C
S_23058548 S_61687541	1503322	T	A
S_23058890 S_61688115	1506107	A	G
S_23058895 S_61688128	1506214	C	A
S_23058896 S_61688130	1506228	T	C
S_23058897 S_61688131	1506230	T	A
S_23059108 S_61688706	1508934	C	T
S_23059294 S_61689026	1509845	G	T
S_23059318 S_61689108	1510093	T	C
S_23059321 S_61689118	1510163	A	G
S_23059322 S_61689123	1510181	C	T
S_23059323 S_61689126	1510200	C	T
S_23059324 S_61689130	1510234	G	C
S_23059325 S_61689133	1510248	A	T
S_23059355 S_61689201	1510721	T	C
S_23059385 S_61689259	1511011	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23059403 S_61689288	1511147	C	G
S_23059407 S_61689299	1511201	T	A
S_23059446 S_61689371	1511588	T	C
S_23059567 S_61689591	1512310	C	T
S_23059619 S_61689669	1512580	A	G
S_23059620 S_61689670	1512584	A	C
S_23059621 S_61689671	1512592	G	C
S_23059691 S_61689898	1513617	T	G
S_23059692 S_61689899	1513621	T	C
S_23059703 S_61689960	1513768	A	G
S_61690067	1513992	A	T
S_23059750 S_61690091	1514075	T	C
S_23059754 S_61690112	1514165	C	G
S_23059756 S_61690116	1514191	G	A
S_23059763 S_61690133	1514246	A	T
S_23059764 S_61690141	1514285	A	G
S_23059792 S_61690240	1514561	C	G
S_23059793 S_61690241	1514562	G	A
S_23059850 S_61690317	1514724	A	T
S_23059851 S_61690318	1514725	A	G
S_23059866 S_61690370	1515003	C	A
S_23059867 S_61690371	1515007	G	C
S_23059870 S_61690377	1515038	T	C
S_23059876 S_61690399	1515132	A	T
S_23059944 S_61690652	1516357	C	G
S_23059979 S_61690765	1516873	A	G
S_23059980 S_61690767	1516877	T	C
S_23060038 S_61690939	1517625	T	C
S_23060051 S_61690987	1517833	A	T
S_23060052 S_61690989	1517840	A	T
S_23060055 S_61691042	1517984	G	A
S_23060097 S_61691209	1518494	T	A
S_23060194 S_61691543	1519314	T	G
S_23060259 S_61691803	1520684	G	T
S_23060268 S_61691833	1520820	C	A
S_23060302 S_61691926	1521019	C	T
S_23060304 S_61691928	1521025	T	C
S_23060306 S_61691933	1521058	T	C
S_23060311 S_61691962	1521169	T	C
S_23060331 S_61691999	1521272	G	A
S_23060337 S_61692008	1521306	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23060345 S_61692017	1521360	A	G
S_23060351 S_61692034	1521418	A	G
S_23060355 S_61692045	1521485	A	C
S_23060481 S_61692473	1522905	T	A
S_23060486 S_61692483	1522945	A	G
S_23060490 S_61692490	1522979	C	T
S_23060491 S_61692491	1522982	C	T
S_23060525 S_61692674	1523583	T	C
S_23060599 S_61692944	1524417	G	A
S_23060638 S_61693135	1525021	T	A
S_23060742 S_61693557	1526310	T	G
S_23060746 S_61693577	1526406	T	A
S_23060748 S_61693586	1526462	G	T
S_23060750 S_61693589	1526472	T	A
S_23060758 S_61693604	1526543	A	G
S_23060764 S_61693614	1526616	G	T
S_23060766 S_61693623	1526642	G	A
S_23060783 S_61693671	1526880	G	A
S_23060784 S_61693675	1526886	A	T
S_23060797 S_61693714	1526955	C	G
S_23060806 S_61693743	1527060	C	T
S_23060820 S_61693782	1527233	T	A
S_23060823 S_61693786	1527257	C	T
S_23060824 S_61693792	1527283	A	G
S_23060825 S_61693793	1527284	G	C
S_23060828 S_61693819	1527381	A	G
S_23060831 S_61693845	1527480	G	T
S_23060834 S_61693859	1527597	A	C
S_23060870 S_61693912	1527768	A	G
S_23060888 S_61693975	1528198	A	G
S_23060911 S_61694024	1528386	T	A
S_23060941 S_61694058	1528490	T	A
S_23061003 S_61694276	1529293	A	C
S_23061008 S_61694327	1529422	G	A
S_23061009 S_61694330	1529443	C	T
S_23061013 S_61694345	1529500	G	C
S_23061018 S_61694366	1529561	C	A
S_23061019 S_61694367	1529563	C	T
S_23061047 S_61694424	1529892	T	A
S_23061054 S_61694441	1529991	T	C
S_23061097 S_61694531	1530409	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23061100 S_61694539	1530443	A	T
S_23061103 S_61694546	1530465	T	G
S_23061106 S_61694552	1530511	C	T
S_23061186 S_61694855	1531755	G	A
S_23061218 S_61694953	1532170	G	A
S_23061219 S_61694956	1532174	G	T
S_23061259 S_61695141	1532912	T	G
S_23061274 S_61695174	1533065	G	C
S_23061276 S_61695190	1533115	A	G
S_23061296 S_61695245	1533340	C	T
S_23061356 S_61695394	1534137	T	C
S_23061357 S_61695404	1534169	A	C
S_23061385 S_61695516	1534486	C	T
S_23061413 S_61695581	1534771	G	C
S_23061459 S_61695671	1535293	C	G
S_23061460 S_61695674	1535316	C	G
S_23061461 S_61695676	1535332	T	C
S_23061485 S_61695703	1535518	A	G
S_23061489 S_61695713	1535546	G	A
S_23061507 S_61695760	1535705	T	G
S_23061511 S_61695764	1535717	A	G
S_23061521 S_61695780	1535783	T	A
S_23061607 S_61696115	1536795	T	C
S_23061611 S_61696164	1536999	C	T
S_23061614 S_61696185	1537064	T	G
S_23061616 S_61696190	1537076	G	C
S_23061619 S_61696196	1537106	T	C
S_23061640 S_61696279	1537391	T	C
S_23061644 S_61696282	1537427	T	A
S_23061763 S_61696539	1538749	C	T
S_23061836 S_61696727	1539637	T	G
S_23061934 S_61697031	1540842	G	T
S_23061944 S_61697078	1540997	A	C
S_23061951 S_61697084	1541018	A	G
S_23061957 S_61697114	1541121	G	T
S_23062017 S_61697366	1541928	C	A
S_23062027 S_61697452	1542107	A	C
S_23062028 S_61697454	1542115	T	C
S_23062029 S_61697455	1542116	T	C
S_23062030 S_61697457	1542134	C	T
S_23062031 S_61697458	1542149	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23062034 S_61697464	1542192	T	C
S_23062041 S_61697487	1542304	A	G
S_23062046 S_61697505	1542392	C	T
S_23062064 S_61697563	1542713	T	A
S_23062087 S_61697643	1543045	T	A
S_23062114 S_61697738	1543414	G	A
S_23062115 S_61697739	1543415	T	C
S_23062117 S_61697749	1543445	G	C
S_23062226 S_61698056	1544595	A	G
S_23062263 S_61698220	1545018	C	T
S_23062336 S_61698480	1546038	T	G
S_23062409 S_61698632	1546538	G	A
S_23062432 S_61698749	1546904	C	A
S_23062448 S_61698835	1547245	A	G
S_23062477 S_61698969	1547688	T	C
S_23062491 S_61699035	1547899	C	A
S_23062493 S_61699037	1547910	G	A
S_23062494 S_61699042	1547914	T	G
S_23062497 S_61699050	1547941	T	C
S_23062517 S_61699139	1548335	G	T
S_23062518 S_61699140	1548340	G	A
S_23062519 S_61699141	1548344	C	T
S_61699143	1548356	T	A
S_23062525 S_61699159	1548494	T	C
S_23062526 S_61699160	1548496	T	G
S_23062527 S_61699161	1548498	G	C
S_23062538 S_61699180	1548648	A	C
S_23062543 S_61699194	1548851	C	A
S_23062551 S_61699219	1548955	G	A
S_23062701 S_61699604	1549778	A	G
S_23062707 S_61699618	1549857	C	T
S_23062710 S_61699627	1549883	A	T
S_23062736 S_61699687	1550162	G	T
S_23062737 S_61699689	1550173	C	G
S_23062738 S_61699690	1550178	T	G
S_23062739 S_61699691	1550179	A	G
S_23062744 S_61699727	1550338	T	A
S_23062747 S_61699735	1550370	A	G
S_23062756 S_61699754	1550466	C	T
S_23062757 S_61699760	1550508	C	G
S_23062797 S_61699843	1551383	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23062816 S_61699877	1551539	C	T
S_23062817 S_61699882	1551547	C	T
S_23062828 S_61699899	1551644	C	T
S_23062832 S_61699918	1551719	T	C
S_23062833 S_61699923	1551739	A	C
S_23062837 S_61699934	1551810	C	T
S_23062839 S_61699949	1551846	A	T
S_23062840 S_61699970	1551869	T	C
S_23062866 S_61700061	1552488	C	T
S_23062907 S_61700174	1553157	G	C
S_23062908 S_61700176	1553165	A	G
S_23062909 S_61700178	1553176	C	A
S_23062910 S_61700180	1553182	T	C
S_23062911 S_61700182	1553189	C	T
S_23063025 S_61700420	1554335	T	A
S_23063068 S_61700568	1555045	C	T
S_23063081 S_61700626	1555399	A	T
S_23063083 S_61700631	1555411	A	G
S_23063085 S_61700638	1555442	G	A
S_23063087 S_61700652	1555513	A	G
S_23063088 S_61700657	1555540	C	T
S_23063089 S_61700658	1555543	G	T
S_23063090 S_61700660	1555550	T	G
S_23063091 S_61700662	1555563	C	A
S_23063092 S_61700663	1555568	A	C
S_23063099 S_61700689	1555733	T	C
S_23063100 S_61700694	1555747	A	G
S_23063101 S_61700703	1555775	G	T
S_23063104 S_61700723	1555897	T	G
S_23063107 S_61700744	1556041	T	A
S_23063108 S_61700745	1556052	T	A
S_23063167 S_61700826	1556514	C	T
S_23063222 S_61701014	1557161	T	A
S_23063223 S_61701015	1557167	G	T
S_23063225 S_61701019	1557186	G	A
S_23063241 S_61701047	1557335	C	A
S_23063281 S_61701188	1557852	A	G
S_23063303 S_61701240	1558061	C	A
S_23063358 S_61701420	1558880	G	A
S_23063396 S_61701516	1559344	T	A
S_23063427 S_61701584	1559820	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23063438 S_61701630	1560017	T	G
S_23063465 S_61701721	1560325	A	C
S_23063467 S_61701738	1560352	T	C
S_23063470 S_61701763	1560490	C	T
S_23063475 S_61701790	1560612	T	G
S_23063486 S_61701821	1560737	G	C
S_23063540 S_61701965	1561331	G	C
S_23063567 S_61702163	1561806	A	C
S_23063613 S_61702309	1562273	A	G
S_23063637 S_61702367	1562500	C	T
S_23063707 S_61702467	1562655	A	T
S_23063718 S_61702505	1562787	C	T
S_23063826 S_61702860	1564016	A	G
S_23063981 S_61703150	1564736	G	C
S_23064008 S_61703242	1565198	A	G
S_23064018 S_61703303	1565400	A	C
S_23064021 S_61703329	1565444	T	G
S_23064050 S_61703430	1565741	A	C
S_23064070 S_61703471	1565930	G	A
S_23064084 S_61703549	1566086	T	A
S_23064096 S_61703666	1566416	A	G
S_23064100 S_61703677	1566474	G	T
S_23064115 S_61703721	1566687	A	G
S_23064120 S_61703742	1566761	G	A
S_23064125 S_61703758	1566847	C	T
S_23064126 S_61703759	1566850	T	G
S_23064127 S_61703762	1566868	A	G
S_23064139 S_61703800	1566975	G	A
S_23064171 S_61703967	1567437	G	A
S_23064174 S_61703984	1567499	T	A
S_23064180 S_61704022	1567623	G	A
S_23064189 S_61704059	1567766	T	C
S_23064244 S_61704196	1568318	G	C
S_23064271 S_61704253	1568681	A	C
S_23064286 S_61704319	1568838	T	C
S_23064287 S_61704321	1568842	G	C
S_23064298 S_61704346	1568938	A	T
S_23064299 S_61704347	1568941	G	T
S_23064305 S_61704364	1568974	T	C
S_23064307 S_61704373	1569002	T	C
S_23064308 S_61704375	1569008	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23064359 S_61704557	1569378	C	A
S_23065317 S_61706606	1574457	G	C
S_23065324 S_61706625	1574536	G	A
S_23065345 S_61706675	1574823	G	A
S_23065350 S_61706691	1574920	T	C
S_23065352 S_61706696	1574958	T	G
S_23065360 S_61706713	1575045	T	C
S_23065365 S_61706742	1575182	G	A
S_23065368 S_61706747	1575221	A	G
S_23065369 S_61706748	1575222	A	G
S_23065370 S_61706753	1575246	T	A
S_23065432 S_61706927	1575907	T	C
S_23065436 S_61706957	1576020	C	A
S_23065464 S_61707073	1576384	A	G
S_23065465 S_61707075	1576385	T	G
S_23065469 S_61707117	1576487	C	T
S_23065470 S_61707118	1576497	A	T
S_23065471 S_61707119	1576498	C	T
S_23065472 S_61707121	1576502	A	G
S_23065473 S_61707124	1576510	C	T
S_23065476 S_61707136	1576572	G	A
S_23065477 S_61707142	1576590	C	T
S_23065496 S_61707172	1576728	G	A
S_23065498 S_61707178	1576770	A	C
S_23065501 S_61707184	1576783	G	C
S_23065507 S_61707232	1576848	T	A
S_23065508 S_61707260	1576924	C	T
S_23065519 S_61707317	1577209	C	G
S_23065520 S_61707355	1577328	C	T
S_23065523 S_61707366	1577353	G	A
S_23065534 S_61707371	1577370	G	A
S_23065548 S_61707380	1577385	T	G
S_23065570 S_61707412	1577512	A	G
S_23065571 S_61707416	1577523	T	A
S_23065572 S_61707418	1577530	G	A
S_23065573 S_61707423	1577555	G	C
S_23065579 S_61707434	1577652	A	G
S_23065580 S_61707435	1577657	A	T
S_23065611 S_61707539	1578092	A	G
S_23065615 S_61707553	1578213	A	G
S_23065617 S_61707556	1578251	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
I_2453569	1578358	A	AT
S_23065623 S_61707587	1578393	G	A
S_23065624 S_61707591	1578405	G	A
S_23065625 S_61707594	1578428	A	C
S_23065646 S_61707641	1578700	A	G
S_23065711 S_61707728	1579118	G	T
S_23065713 S_61707729	1579120	G	T
S_23065734 S_61707747	1579197	C	T
S_23065742 S_61707764	1579263	T	C
S_23065763 S_61707885	1580112	A	C
S_23065765 S_61707898	1580147	T	C
S_23065786 S_61707990	1580474	A	T
S_23065787 S_61707991	1580475	T	A
S_23065807 S_61708125	1580886	T	A
S_23065824 S_61708186	1581182	G	T
S_23065828 S_61708191	1581214	T	C
S_23065837 S_61708213	1581302	A	G
S_23065849 S_61708270	1581548	A	G
S_23065853 S_61708276	1581580	A	G
S_23065854 S_61708281	1581585	C	T
S_23065855 S_61708284	1581608	A	C
S_23065856 S_61708285	1581609	G	A
S_23065857 S_61708297	1581671	T	C
S_23065858 S_61708299	1581678	G	T
S_23065874 S_61708367	1581994	C	G
S_23065886 S_61708404	1582151	T	C
S_23065895 S_61708457	1582280	G	A
S_23065896 S_61708458	1582281	C	A
S_23065897 S_61708468	1582316	A	G
S_23065898 S_61708471	1582338	G	C
S_23065917 S_61708568	1582542	G	C
S_23065918 S_61708578	1582560	C	A
S_23065928 S_61708610	1582662	A	G
S_23065929 S_61708612	1582666	G	C
S_23065932 S_61708625	1582712	A	T
S_23065935 S_61708647	1582814	C	T
S_23065942 S_61708678	1582948	C	A
S_23065950 S_61708694	1583036	T	A
S_23065952 S_61708696	1583050	G	A
S_23065953 S_61708698	1583072	T	A
S_23065955 S_61708702	1583077	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23065979 S_61708750	1583366	C	T
S_23066008 S_61708782	1583530	T	C
S_23066080 S_61708855	1583909	A	C
S_23066086 S_61708866	1583997	A	C
S_23066107 S_61708937	1584284	G	C
S_23066119 S_61708971	1584429	T	C
S_23066125 S_61708985	1584495	G	A
S_23066130 S_61708993	1584522	A	G
S_23066135 S_61708998	1584568	G	T
S_23066139 S_61709013	1584666	A	G
S_23066230 S_61709259	1585912	A	G
S_23066231 S_61709261	1585913	T	C
S_23066246 S_61709312	1586072	C	A
S_23066251 S_61709321	1586113	T	C
S_23066252 S_61709322	1586115	T	C
S_23066259 S_61709359	1586175	T	A
S_23066289 S_61709438	1586420	A	G
S_23066290 S_61709440	1586426	G	A
S_23066359 S_61709594	1587166	A	G
S_23066361 S_61709605	1587217	T	A
S_23066366 S_61709634	1587379	G	C
S_23066369 S_61709652	1587436	C	T
S_23066370 S_61709654	1587442	C	A
S_23066389 S_61709684	1587564	C	A
S_23066390 S_61709685	1587571	A	G
S_23066393 S_61709690	1587590	T	C
S_23066426 S_61709847	1588100	C	A
S_23066428 S_61709850	1588119	C	T
S_23066429 S_61709854	1588133	T	C
S_23066431 S_61709862	1588168	G	A
S_23066433 S_61709868	1588185	A	T
S_23066469 S_61709974	1588672	A	G
S_23066536 S_61710195	1589822	G	C
S_23066542 S_61710217	1589934	G	A
S_23066671 S_61710567	1592105	C	T
S_23066704 S_61710629	1592679	A	T
S_23066720 S_61710655	1592900	C	T
S_23066742 S_61710698	1593174	G	C
S_23066802 S_61710857	1593813	G	T
S_23066833 S_61710961	1594176	A	T
S_23066842 S_61710977	1594282	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23066844 S_61711022	1594432	T	A
S_23066917 S_61711238	1595077	T	A
S_23067119 S_61711909	1597389	A	T
S_23067138 S_61711996	1597683	C	G
S_23067151 S_61712067	1597958	A	G
S_23067225 S_61712390	1599116	G	T
S_23067251 S_61712462	1599325	T	C
S_23067275 S_61712498	1599414	A	T
S_23067315 S_61712602	1599892	T	A
S_23067334 S_61712628	1600016	A	G
S_23067338 S_61712638	1600055	G	C
S_23067347 S_61712660	1600147	G	A
S_23067414 S_61712721	1600371	A	G
S_23067416 S_61712741	1600553	A	G
S_23067417 S_61712742	1600556	C	A
S_23067423 S_61712753	1600583	A	T
S_23067497 S_61713057	1601590	A	G
S_23067500 S_61713063	1601624	T	A
S_23067502 S_61713070	1601642	T	C
S_23067513 S_61713117	1601836	G	A
S_23067525 S_61713150	1601955	A	C
S_23067533 S_61713198	1602097	T	C
S_23067535 S_61713211	1602128	C	T
S_23067554 S_61713314	1602442	C	T
S_23067567 S_61713434	1602762	T	C
S_23067574 S_61713453	1602881	G	T
S_23067577 S_61713460	1602908	T	A
S_23067583 S_61713498	1603008	T	C
S_23067585 S_61713500	1603013	C	G
S_23067597 S_61713551	1603189	T	G
S_23067599 S_61713553	1603197	T	C
S_23067600 S_61713564	1603228	T	C
S_23067604 S_61713571	1603253	T	C
S_23067637 S_61713655	1603575	G	T
S_23067640 S_61713658	1603593	T	A
S_23067643 S_61713669	1603637	C	T
S_23067655 S_61713699	1603869	T	C
S_23067656 S_61713700	1603870	T	G
S_23067658 S_61713704	1603895	A	G
S_23067711 S_61713830	1604596	C	T
S_23067714 S_61713836	1604636	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23067757 S_61713938	1605021	T	C
S_23067811 S_61714155	1606057	C	G
S_23067814 S_61714177	1606125	C	T
S_23067861 S_61714320	1606896	T	A
S_23067863 S_61714326	1606920	G	C
S_23067888 S_61714400	1607181	G	A
I_1473630 I_2453852	1607417	G	GCCTT
S_23067904 S_61714472	1607418	T	A
S_23067906 S_61714476	1607444	T	C
S_23067974 S_61714658	1608090	T	A
S_23067975 S_61714659	1608114	C	A
S_23067976 S_61714660	1608119	C	G
S_23068020 S_61714712	1608323	G	T
S_23068099 S_61714883	1608885	G	C
S_23068124 S_61714971	1609126	G	T
S_23068140 S_61715019	1609298	T	G
S_23068141 S_61715021	1609299	A	T
S_23068143 S_61715038	1609371	G	T
S_23068230 S_61715331	1610450	T	A
S_23068243 S_61715389	1610653	A	C
S_23068245 S_61715405	1610701	A	G
S_23068271 S_61715502	1611041	T	A
S_23068272 S_61715507	1611056	A	T
S_23068275 S_61715515	1611113	A	C
S_23068276 S_61715520	1611122	G	T
S_23068293 S_61715551	1611263	T	G
S_23068294 S_61715554	1611277	A	T
S_23068297 S_61715558	1611301	A	T
S_23068312 S_61715603	1611478	C	T
S_23068326 S_61715662	1611690	G	A
S_23068576 S_61716325	1613690	C	A
S_23068611 S_61716363	1613783	A	T
S_23068612 S_61716364	1613789	C	G
S_23068614 S_61716366	1613801	G	T
S_23068644 S_61716436	1614246	T	A
S_23068707 S_61716701	1614972	A	G
S_23068734 S_61716787	1615252	T	A
S_23068754 S_61716864	1615520	A	G
S_23068756 S_61716916	1615636	C	G
S_23068780 S_61716958	1615697	C	T
S_23068910 S_61717259	1616153	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23068999 S_61717512	1617028	C	T
S_23069067 S_61717739	1617758	T	C
S_23069073 S_61717750	1617809	T	C
S_23069272 S_61718189	1619913	T	A
S_23069275 S_61718194	1619954	G	T
S_23069277 S_61718198	1619968	T	C
S_23069278 S_61718199	1619975	A	C
S_23069284 S_61718215	1620035	A	G
S_23069287 S_61718226	1620095	T	C
S_23069292 S_61718229	1620120	C	T
S_23069309 S_61718339	1620335	T	G
S_23069314 S_61718366	1620404	A	C
S_23069315 S_61718369	1620410	A	G
S_23069334 S_61718431	1620672	T	C
S_23069336 S_61718439	1620742	C	A
S_23069337 S_61718444	1620758	T	A
S_23069344 S_61718468	1620856	T	C
S_23069347 S_61718471	1620870	C	A
S_23069369 S_61718540	1621115	T	A
S_23069384 S_61718610	1621420	C	T
S_23069400 S_61718644	1621539	G	A
S_23069425 S_61718719	1621726	C	T
S_23069433 S_61718726	1621821	T	G
S_23069434 S_61718729	1621833	A	T
S_23069438 S_61718750	1621930	A	G
S_23069439 S_61718754	1621944	C	A
S_23069460 S_61718796	1622156	C	T
S_23069467 S_61718870	1622431	C	A
S_23069470 S_61718886	1622542	A	G
S_23069478 S_61718917	1622810	A	C
S_23069479 S_61718918	1622815	T	A
S_23069496 S_61718970	1623059	C	A
S_23069508 S_61718991	1623137	A	G
S_23069567 S_61719218	1623814	T	G
S_23069569 S_61719241	1623864	T	C
S_23069571 S_61719259	1623913	T	A
S_23069690 S_61719611	1625103	C	A
S_23069699 S_61719649	1625234	A	G
S_23069820 S_61720087	1626760	T	C
S_23069879 S_61720293	1627411	T	A
S_23069889 S_61720324	1627555	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23069893 S_61720325	1627566	C	G
S_23070004 S_61720634	1628377	A	C
S_23070019 S_61720689	1628543	T	C
I_1473763 I_2454103	1628570	T	TTA
S_23070036 S_61720726	1628667	T	G
S_23070060 S_61720813	1628912	A	C
S_23070134 S_61721034	1629810	A	G
S_23070194 S_61721128	1630245	A	T
S_23070221 S_61721219	1630520	C	A
S_23070222 S_61721220	1630521	C	G
S_23070347 S_61721411	1631241	T	C
S_23070348 S_61721413	1631256	T	C
S_23070363 S_61721449	1631349	T	C
S_23070449 S_61721563	1632127	G	T
S_23070477 S_61721661	1632494	T	A
S_23070482 S_61721665	1632545	G	C
S_23070485 S_61721680	1632631	T	G
S_23070561 S_61721846	1633489	T	C
S_23070576 S_61721881	1633735	G	A
S_23070610 S_61721983	1634330	A	G
S_23070636 S_61722089	1634663	A	T
S_23070647 S_61722113	1634852	A	C
S_23070693 S_61722188	1635344	C	A
S_23070696 S_61722196	1635383	T	C
S_23070697 S_61722201	1635398	G	T
S_23070743 S_61722363	1635934	G	T
S_23070753 S_61722396	1636077	A	G
S_23070755 S_61722405	1636105	T	C
S_23070758 S_61722412	1636142	C	A
S_23070763 S_61722424	1636182	A	C
S_23070764 S_61722425	1636185	A	C
S_23070770 S_61722463	1636329	G	A
S_23070772 S_61722464	1636333	A	G
S_23070919 S_61722644	1636928	T	A
S_23070927 S_61722684	1637018	A	T
S_23070990 S_61722852	1637922	T	A
S_23070991 S_61722853	1637923	T	A
S_23070992 S_61722854	1637924	T	A
I_2454216	1638664	A	AAGAAG
S_23071035 S_61722996	1638667	G	T
S_23071042 S_61723010	1638720	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23071046 S_61723018	1638775	A	C
S_23071113 S_61723143	1639476	C	T
S_23071139 S_61723305	1639869	G	C
S_23071143 S_61723313	1639899	G	T
S_23071269 S_61723581	1640893	T	G
S_23071270 S_61723583	1640900	T	C
S_23071271 S_61723585	1640902	G	A
S_23071272 S_61723586	1640904	T	C
S_23071273 S_61723587	1640912	C	T
S_23071299 S_61723661	1641233	A	C
S_23071315 S_61723711	1641463	A	C
S_23071344 S_61723813	1641891	G	A
S_23071375 S_61723925	1642370	G	T
S_23071382 S_61723968	1642491	C	T
S_23071416 S_61724064	1642942	C	A
S_23071421 S_61724079	1643046	A	T
S_23071447 S_61724120	1643297	G	A
S_23071451 S_61724129	1643345	A	T
S_23071457 S_61724161	1643460	G	A
S_23071461 S_61724200	1643619	A	T
S_23071501 S_61724320	1644116	G	A
S_23071525 S_61724394	1644464	C	T
S_23071528 S_61724397	1644493	A	T
S_23071530 S_61724399	1644513	A	C
S_23071803 S_61725390	1648915	G	A
S_23071805 S_61725407	1648957	T	C
S_23071966 S_61725894	1650506	T	A
S_23071980 S_61725939	1650671	A	T
S_23071997 S_61725982	1650991	T	A
S_23071998 S_61725983	1650999	G	A
S_23072080 S_61726116	1651616	T	C
S_23072083 S_61726120	1651639	C	G
S_23072085 S_61726121	1651648	G	T
S_23072132 S_61726215	1652224	C	A
S_23072164 S_61726315	1652661	G	C
S_23072191 S_61726356	1652892	C	T
S_23072207 S_61726386	1653150	G	A
S_23072267 S_61726484	1653790	T	A
S_23072273 S_61726490	1653840	C	G
S_23072336 S_61726719	1654601	C	T
S_23072357 S_61726776	1654826	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23072364 S_61726847	1655035	C	T
S_23072397 S_61727019	1655572	A	G
S_23072447 S_61727190	1656378	G	T
S_23072456 S_61727230	1656549	A	T
S_23072469 S_61727254	1656678	A	T
S_23072470 S_61727256	1656684	T	A
S_23072471 S_61727258	1656685	A	T
S_23072561 S_61727595	1657912	C	A
S_23072565 S_61727614	1657962	A	T
S_23072595 S_61727717	1658329	G	A
S_23072634 S_61727829	1658626	C	T
S_23072739 S_61728131	1659744	T	A
S_23072740 S_61728134	1659754	G	A
S_23072743 S_61728139	1659775	G	C
S_23072744 S_61728141	1659788	G	T
S_23072749 S_61728164	1659894	G	A
S_23072764 S_61728215	1660058	A	T
S_23072765 S_61728216	1660062	T	A
I_1473944 I_2454461	1660078	G	GT
S_23072768 S_61728225	1660093	C	A
S_23072781 S_61728232	1660159	G	A
S_23072801 S_61728272	1660328	G	A
S_23072805 S_61728280	1660344	A	T
S_23072809 S_61728290	1660372	A	G
S_23072813 S_61728308	1660419	G	A
S_23072820 S_61728333	1660470	T	C
S_23072830 S_61728386	1660604	T	C
S_23073578 S_61730500	1666119	G	T
S_23073770 S_61731091	1667907	C	T
S_23073771 S_61731094	1667918	C	T
S_23074775 S_61733303	1674788	A	T
S_23074946 S_61733860	1677114	C	G
S_23075083 S_61734352	1679152	G	C
S_23075109 S_61734421	1679447	C	T
S_23075110 S_61734423	1679451	C	T
S_23075128 S_61734462	1679551	C	T
S_23075248 S_61734673	1680237	C	G
S_23075249 S_61734681	1680279	C	T
S_23075470 S_61735229	1682434	T	A
S_23075620 S_61735625	1683806	C	T
S_23075649 S_61735677	1684230	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23075709 S_61735794	1684646	A	G
S_23075738 S_61735823	1684758	A	C
S_23075739 S_61735824	1684763	T	C
S_23075740 S_61735825	1684769	T	A
S_23075742 S_61735832	1684805	A	T
S_23075746 S_61735852	1684913	C	T
S_23075748 S_61735860	1684940	A	C
S_23075752 S_61735873	1684991	T	G
S_23075755 S_61735877	1685019	A	T
S_23075799 S_61736060	1685642	A	C
S_23075805 S_61736080	1685772	A	G
S_23075814 S_61736115	1685889	A	T
S_23075823 S_61736161	1686103	G	A
S_23075826 S_61736178	1686150	A	C
S_23075881 S_61736331	1686762	G	C
S_23075955 S_61736480	1687019	T	C
S_23075974 S_61736553	1687309	T	C
S_23075977 S_61736555	1687317	C	T
S_23076074 S_61736867	1688334	A	C
S_23076078 S_61736875	1688354	A	G
S_23076083 S_61736886	1688389	G	A
S_23076145 S_61737059	1689087	A	G
S_23076204 S_61737306	1690255	T	C
S_23076206 S_61737316	1690285	A	G
S_23076207 S_61737317	1690286	G	T
S_23076226 S_61737372	1690473	G	A
S_23076227 S_61737374	1690478	T	C
S_23076229 S_61737381	1690516	T	C
S_23076255 S_61737451	1690811	T	G
S_23076256 S_61737454	1690817	T	A
S_23076291 S_61737588	1691395	A	T
S_23076304 S_61737615	1691561	A	C
S_23076356 S_61737742	1692242	A	C
S_23076357 S_61737743	1692245	T	C
S_23076397 S_61737824	1692717	T	C
S_23076398 S_61737826	1692729	T	A
S_23076465 S_61738071	1693670	A	T
S_23076510 S_61738196	1694308	A	C
S_23076511 S_61738199	1694313	G	C
S_23076513 S_61738202	1694338	T	G
S_23076515 S_61738208	1694357	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23076527 S_61738259	1694604	C	T
S_23076548 S_61738356	1694883	T	C
S_23076557 S_61738376	1695012	C	G
S_23076583 S_61738423	1695170	T	C
S_23076587 S_61738477	1695290	A	G
S_23076589 S_61738480	1695303	A	G
S_23076592 S_61738485	1695339	T	G
S_23076605 S_61738514	1695489	T	C
S_23076606 S_61738518	1695527	A	C
S_23076620 S_61738542	1695592	G	A
S_23076656 S_61738636	1696003	G	T
S_23076661 S_61738656	1696083	T	C
S_23076669 S_61738665	1696094	A	T
S_23076682 S_61738687	1696150	A	T
S_23076694 S_61738721	1696302	G	C
S_23076737 S_61738823	1697019	G	T
S_23076738 S_61738825	1697025	G	T
S_23076902 S_61739162	1698546	C	A
S_23076936 S_61739228	1698908	A	T
S_23076937 S_61739232	1698920	G	T
S_23076948 S_61739302	1699182	C	T
I_1474221 I_2454945	1699979	A	AG
S_23076999 S_61739523	1699980	A	G
S_23077004 S_61739537	1700047	C	A
S_23077006 S_61739541	1700086	G	C
S_23077075 S_61739738	1701623	T	A
S_23077134 S_61739943	1702517	G	A
S_23077262 S_61740359	1704356	A	G
S_23077264 S_61740360	1704360	C	T
S_23077273 S_61740402	1704510	T	C
I_1474243 I_2454982	1704815	C	CT
S_23077309 S_61740581	1705114	C	T
S_23077310 S_61740587	1705129	G	A
S_23077351 S_61740764	1705718	C	T
S_23077361 S_61740825	1705978	A	T
S_23077453 S_61741242	1707041	G	T
S_23077501 S_61741417	1707444	T	A
S_23077645 S_61741855	1709563	C	T
S_23077652 S_61741882	1709772	C	A
S_23077653 S_61741883	1709778	T	A
S_23077658 S_61741890	1709816	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23077661 S_61741902	1709870	G	A
S_23077682 S_61741940	1710107	A	C
S_23077688 S_61741950	1710147	C	G
S_61742131	1710636	C	T
S_23077753 S_61742138	1710649	G	A
S_23077784 S_61742187	1710779	C	T
S_23077786 S_61742195	1710793	T	C
S_23077787 S_61742203	1710814	C	T
S_23077834 S_61742285	1711102	G	A
S_23077836 S_61742286	1711109	T	C
S_23077942 S_61742482	1711807	T	C
S_23077944 S_61742493	1711836	T	G
S_23077945 S_61742497	1711855	T	C
S_23077954 S_61742535	1712026	T	C
S_23077955 S_61742537	1712035	C	T
S_23077963 S_61742547	1712139	A	C
S_23078021 S_61742742	1713149	G	A
S_23078023 S_61742749	1713206	T	A
S_23078024 S_61742753	1713215	G	C
S_23078029 S_61742760	1713254	G	T
S_23078066 S_61742881	1713698	T	C
S_23078068 S_61742885	1713713	T	A
S_23078073 S_61742900	1713780	A	G
S_23078160 S_61743247	1714959	C	T
S_23078288 S_61743477	1715746	A	T
S_23078399 S_61743821	1717243	A	G
S_23078600 S_61744349	1719316	T	G
S_23078619 S_61744426	1719648	G	A
S_61744432	1719659	G	A
S_23078660 S_61744565	1719935	T	G
S_23078661 S_61744568	1719955	C	T
S_23078673 S_61744619	1720180	A	G
S_23078674 S_61744622	1720185	A	G
S_23078675 S_61744632	1720223	A	C
S_23078676 S_61744633	1720225	A	G
S_23078744 S_61744822	1720784	A	T
S_23078750 S_61744830	1720827	G	A
S_23078752 S_61744839	1720851	A	C
S_23078756 S_61744847	1720883	A	G
S_23078839 S_61745040	1721505	T	C
S_23078841 S_61745044	1721527	C	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23078842 S_61745047	1721535	A	C
S_23078870 S_61745128	1721976	T	G
S_23078877 S_61745149	1722090	T	A
S_23078904 S_61745202	1722397	A	C
S_23078910 S_61745214	1722485	G	T
S_23078925 S_61745268	1722809	C	G
S_23078936 S_61745288	1722908	A	C
S_23078988 S_61745437	1723518	C	G
S_23078989 S_61745438	1723525	C	G
S_23079002 S_61745458	1723625	C	T
S_23079008 S_61745469	1723686	T	A
S_23079014 S_61745477	1723755	T	G
S_23079079 S_61745601	1724493	T	A
S_23079102 S_61745668	1724791	G	A
S_23079105 S_61745680	1724857	A	T
S_23079111 S_61745701	1724974	G	A
S_23079118 S_61745716	1725046	A	G
S_23079119 S_61745725	1725059	C	T
S_23079136 S_61745774	1725205	G	A
S_23079188 S_61745872	1725561	T	C
S_23079350 S_61746193	1727455	C	T
S_23079351 S_61746196	1727472	C	T
S_23079352 S_61746198	1727477	T	G
S_23079355 S_61746202	1727524	T	A
S_23079422 S_61746457	1728986	C	G
S_23079514 S_61746762	1729774	G	T
S_23079565 S_61746833	1730002	T	G
S_23079567 S_61746860	1730115	C	T
S_23079569 S_61746865	1730123	A	T
S_23079617 S_61747034	1730841	A	G
S_23079669 S_61747262	1731705	G	T
S_23079684 S_61747300	1731950	G	A
S_23079718 S_61747369	1732195	C	G
S_23079720 S_61747371	1732216	A	G
S_23079769 S_61747460	1732607	T	A
S_23079770 S_61747461	1732609	T	A
S_23079781 S_61747513	1732791	A	C
S_23079790 S_61747559	1732889	A	G
S_23079792 S_61747564	1732896	C	G
S_23079797 S_61747578	1732949	A	C
S_23079881 S_61747767	1733561	G	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23079926 S_61747915	1734089	T	C
S_23079928 S_61747918	1734100	A	C
S_23079934 S_61747924	1734124	A	G
S_23080018 S_61748257	1735325	G	T
S_23080200 S_61748811	1737533	C	G
S_23080226 S_61748868	1737802	T	G
S_23080227 S_61748869	1737803	A	T
S_23080301 S_61749017	1738329	C	A
S_23080308 S_61749040	1738427	T	C
S_23080309 S_61749041	1738430	T	G
S_23080348 S_61749128	1738813	A	G
S_23080350 S_61749137	1738843	C	T
S_23080353 S_61749145	1738865	T	G
S_23080357 S_61749155	1738919	G	A
S_23080367 S_61749181	1739045	C	G
S_23080372 S_61749185	1739106	T	C
S_23080374 S_61749186	1739112	A	G
S_23080376 S_61749192	1739126	G	C
S_23080377 S_61749193	1739132	A	G
S_23080383 S_61749203	1739170	T	C
S_23080412 S_61749274	1739610	A	T
S_23080413 S_61749276	1739614	T	G
S_23080436 S_61749344	1740040	T	G
S_23080451 S_61749411	1740189	G	T
S_23080460 S_61749438	1740395	T	C
S_23080461 S_61749439	1740398	T	G
S_23080474 S_61749481	1740590	G	T
S_23080475 S_61749482	1740596	G	C
S_23080478 S_61749489	1740640	T	G
S_23083370 S_61755557	1754343	C	G
S_23083535 S_61755936	1756155	C	T
S_23083612 S_61756170	1756947	T	C
S_23083622 S_61756193	1756988	A	G
S_23083661 S_61756341	1757264	A	G
S_23083663 S_61756344	1757275	A	G
S_23083823 S_61756841	1759252	A	T
S_23083870 S_61756969	1759717	A	G
S_23083987 S_61757348	1761218	C	A
S_23084009 S_61757490	1761711	A	T
S_23084036 S_61757585	1762056	G	A
S_23084043 S_61757603	1762142	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23084045 S_61757611	1762165	T	A
S_23084050 S_61757617	1762182	A	G
S_23084080 S_61757720	1762594	C	T
S_23084081 S_61757723	1762603	T	A
S_23084133 S_61757892	1763488	G	A
S_23084228 S_61758034	1763931	T	A
S_23084257 S_61758169	1764368	T	A
S_23084258 S_61758172	1764371	C	T
S_23084260 S_61758199	1764400	T	C
S_23084299 S_61758333	1765157	A	C
S_23084302 S_61758349	1765205	G	A
S_23084318 S_61758420	1765504	A	G
S_23084325 S_61758444	1765571	C	A
S_23084335 S_61758492	1765780	G	T
S_23084354 S_61758560	1766018	T	A
S_23084389 S_61758651	1766384	T	A
S_23084448 S_61758883	1767210	T	C
S_23084471 S_61758952	1767446	G	A
S_23084555 S_61759159	1768272	T	C
S_23084558 S_61759164	1768306	G	A
S_23084608 S_61759371	1769051	G	T
S_23084613 S_61759396	1769138	C	T
S_23084648 S_61759556	1769841	C	T
S_23084772 S_61760004	1771972	C	T
S_23084780 S_61760035	1772077	A	G
S_23084816 S_61760159	1772442	C	T
S_23084828 S_61760287	1772752	C	T
S_23084830 S_61760291	1772770	A	C
S_23084832 S_61760296	1772786	T	G
S_23084988 S_61760667	1774045	G	A
S_23084989 S_61760669	1774057	G	A
S_23085002 S_61760722	1774250	C	G
S_23085043 S_61760855	1774741	G	A
S_23085045 S_61760859	1774751	C	T
S_23085046 S_61760863	1774758	C	T
S_23085055 S_61760897	1774826	C	T
S_23085057 S_61760905	1774856	T	C
S_23085059 S_61760923	1774936	G	T
S_23085060 S_61760925	1774942	A	G
S_23085065 S_61760934	1774969	A	C
S_23085066 S_61760937	1774994	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23085067 S_61760938	1775000	G	A
S_23085089 S_61760982	1775315	C	T
S_23085090 S_61760983	1775320	C	T
S_23085121 S_61761054	1775677	G	A
S_23085122 S_61761064	1775725	A	T
S_23085124 S_61761068	1775753	A	G
S_23085143 S_61761135	1776096	T	G
S_23085261 S_61761388	1777324	T	C
S_23085285 S_61761477	1777655	T	A
S_23085308 S_61761641	1778133	C	A
S_23085311 S_61761664	1778195	A	G
S_23085419 S_61762109	1779807	G	T
S_23085430 S_61762124	1779895	G	C
S_23085636 S_61762604	1781440	A	G
S_23085667 S_61762811	1781966	T	C
S_23085689 S_61762844	1782163	A	G
S_23085746 S_61763069	1782924	C	T
S_23086090 S_61764041	1786514	A	C
S_23086092 S_61764042	1786518	T	A
S_23086128 S_61764174	1787019	A	G
S_23086129 S_61764176	1787029	G	T
S_23086130 S_61764187	1787059	A	T
S_23086170 S_61764307	1787537	A	T
S_23086172 S_61764314	1787557	G	C
S_23086173 S_61764317	1787566	T	C
S_23086176 S_61764330	1787637	T	A
S_23086301 S_61764550	1788670	C	A
S_23086307 S_61764574	1788836	C	T
S_23086340 S_61764681	1789184	T	A
S_23086430 S_61764957	1790322	C	A
S_23086532 S_61765173	1790970	C	T
S_23086534 S_61765175	1790996	C	A
S_23086539 S_61765183	1791020	A	T
S_23086543 S_61765193	1791047	C	A
S_23086546 S_61765209	1791128	G	A
S_23086548 S_61765210	1791134	T	C
S_23086552 S_61765216	1791161	T	G
S_23086691 S_61765549	1792291	T	C
S_23086700 S_61765600	1792498	C	T
S_23086756 S_61765794	1793214	A	C
S_23086776 S_61765833	1793380	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23086784 S_61765855	1793485	T	C
S_23086788 S_61765864	1793524	T	C
S_23086789 S_61765866	1793528	G	A
S_23086791 S_61765888	1793606	A	G
S_23086798 S_61765917	1793700	C	G
S_23086803 S_61765932	1793779	A	T
S_23086806 S_61765952	1793865	A	G
S_23086807 S_61765960	1793908	T	G
S_23086808 S_61765961	1793909	T	C
S_23086811 S_61765966	1793934	G	T
S_23087022 S_61766558	1796525	T	G
S_23087041 S_61766628	1796936	T	A
S_23087042 S_61766640	1796951	A	G
S_23087044 S_61766657	1796976	G	C
S_23087045 S_61766665	1796982	A	G
S_23087046 S_61766686	1797044	A	C
S_23087047 S_61766688	1797055	C	T
S_23087262 S_61767139	1798251	C	G
S_23087265 S_61767154	1798290	C	T
S_23087298 S_61767228	1798539	C	T
S_23087308 S_61767274	1798659	A	C
S_23087327 S_61767323	1798814	A	T
S_23087341 S_61767347	1798904	C	T
S_23087448 S_61767562	1799651	T	C
S_23087611 S_61767984	1800949	A	G
S_23087633 S_61768066	1801290	G	A
D_1474763 D_2455957	1801306	CA	C
S_23087653 S_61768129	1801497	C	A
S_23087654 S_61768131	1801503	T	C
S_23087687 S_61768322	1802086	C	T
S_23087712 S_61768443	1802421	C	A
S_23087769 S_61768593	1803072	T	A
S_23087861 S_61768850	1804584	C	G
S_23087905 S_61768970	1804916	C	T
S_23088003 S_61769422	1806345	C	T
S_23088127 S_61769740	1807563	C	T
S_23088171 S_61769864	1807967	C	T
S_23088188 S_61769931	1808172	T	C
S_23088189 S_61769934	1808175	G	A
D_1474801 D_2456030	1808629	AGTAC	A
S_23088232 S_61770074	1808637	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23088236 S_61770094	1808694	T	C
S_23088247 S_61770126	1808797	T	G
S_23088268 S_61770177	1809006	A	G
S_23088275 S_61770190	1809092	A	T
S_23088303 S_61770241	1809358	T	A
S_23088330 S_61770317	1809759	C	A
S_23088335 S_61770344	1809844	A	G
S_23088368 S_61770478	1810357	A	G
S_23088477 S_61770842	1811821	C	G
S_23089822 S_61775809	1821915	G	A
S_23089881 S_61776039	1822691	A	G
S_23089882 S_61776043	1822699	G	T
S_23089910 S_61776114	1822937	G	C
I_1474863 I_2456144	1823162	G	GAT
S_23089980 S_61776260	1823558	G	A
S_23090033 S_61776370	1823994	A	T
S_23090046 S_61776396	1824171	C	T
S_23090048 S_61776399	1824181	C	A
S_23090065 S_61776479	1824543	T	G
S_23090067 S_61776484	1824558	T	C
S_23092081 S_61780304	1835680	T	C
S_23093105 S_61782038	1840371	C	G
S_23093115 S_61782078	1840518	C	T
S_23093162 S_61782219	1840941	G	C
S_23093279 S_61782463	1841760	G	C
S_23093283 S_61782472	1841800	G	A
I_1475049 I_2456489	1844434	T	TG
S_23093526 S_61783243	1844618	G	A
S_23093531 S_61783277	1844767	A	T
S_23093532 S_61783278	1844768	A	T
S_23093533 S_61783280	1844771	G	A
S_23093534 S_61783282	1844772	T	G
S_23093535 S_61783283	1844774	T	G
S_23093541 S_61783308	1844864	C	G
S_23093605 S_61783467	1845311	T	C
S_23093618 S_61783511	1845456	G	A
S_23093628 S_61783548	1845620	A	G
S_23093629 S_61783557	1845647	G	A
S_23093630 S_61783564	1845683	A	T
S_23093631 S_61783566	1845687	G	T
S_23093639 S_61783590	1845810	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23093646 S_61783620	1845909	A	G
S_23093647 S_61783626	1845942	G	C
S_23093648 S_61783628	1845945	T	C
S_23093690 S_61783779	1846506	C	T
S_23093691 S_61783781	1846520	G	T
S_23093695 S_61783805	1846573	G	A
S_23093742 S_61783969	1847241	G	A
S_23093746 S_61783978	1847273	A	T
S_23093751 S_61783997	1847362	C	T
S_23093755 S_61784002	1847397	T	C
S_23093842 S_61784153	1847940	A	C
S_23093847 S_61784167	1847985	G	T
S_23093857 S_61784196	1848087	G	A
S_23093864 S_61784216	1848155	T	A
S_23093865 S_61784218	1848158	A	G
S_23093869 S_61784238	1848228	T	G
S_23093878 S_61784252	1848288	T	C
S_23093890 S_61784289	1848430	A	G
S_23093913 S_61784353	1848708	A	G
S_23093919 S_61784379	1848773	C	T
S_23093941 S_61784431	1849021	T	G
S_23093950 S_61784457	1849132	C	G
S_23093952 S_61784469	1849161	G	A
S_23093970 S_61784524	1849387	G	A
S_23094067 S_61784804	1850182	C	T
S_23094186 S_61785305	1852182	A	G
S_23094188 S_61785309	1852208	T	C
S_23094189 S_61785310	1852211	A	G
S_23094195 S_61785318	1852252	T	C
S_23094221 S_61785360	1852502	T	C
S_23094223 S_61785364	1852514	T	A
S_23094224 S_61785366	1852526	A	G
S_23094243 S_61785413	1852838	C	A
S_23094244 S_61785414	1852846	A	G
S_23094392 S_61785826	1854688	T	C
S_23094503 S_61786092	1855563	C	G
S_23094620 S_61786298	1856201	G	T
S_23094925 S_61787449	1859889	G	A
S_23095026 S_61787844	1861101	T	C
S_23095032 S_61787900	1861316	G	C
S_23095058 S_61788038	1861827	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23095060 S_61788041	1861837	G	C
S_23095081 S_61788090	1862064	A	G
S_23095123 S_61788217	1862706	A	C
S_23095125 S_61788225	1862726	G	A
S_23095143 S_61788294	1863069	G	A
S_23095237 S_61788558	1864518	A	G
S_23095238 S_61788561	1864540	A	T
S_23095240 S_61788572	1864602	T	C
S_23095242 S_61788578	1864661	T	G
S_23095243 S_61788585	1864680	T	G
S_23095244 S_61788588	1864701	A	G
S_23095248 S_61788592	1864757	T	C
S_23095323 S_61788721	1865656	A	C
S_23095332 S_61788731	1865768	G	A
S_23095337 S_61788739	1865851	G	C
S_23095343 S_61788753	1865928	A	T
S_23095344 S_61788754	1865930	C	A
S_23095441 S_61788800	1866331	A	C
S_23095639 S_61789314	1867965	C	G
S_23095963 S_61790011	1870580	G	A
S_23095997 S_61790083	1870891	G	T
S_23096072 S_61790399	1871927	C	T
S_23096151 S_61790639	1872839	T	G
S_23096230 S_61790992	1874031	A	T
S_23096234 S_61790997	1874063	G	A
S_23096252 S_61791080	1874404	T	G
S_23096297 S_61791286	1875281	G	T
S_23096313 S_61791318	1875419	A	G
S_23096314 S_61791319	1875422	T	A
S_23096315 S_61791320	1875423	G	A
S_23096500 S_61791872	1877067	A	G
S_23096543 S_61792057	1877690	T	G
S_23096558 S_61792091	1877872	T	C
S_23096559 S_61792092	1877873	G	A
S_23096709 S_61792547	1879405	C	T
S_23096740 S_61792702	1879900	A	G
S_23096741 S_61792707	1879905	G	C
S_23096742 S_61792710	1879915	A	C
S_23096749 S_61792747	1880059	C	A
S_23096774 S_61792838	1880350	C	A
S_23097116 S_61793929	1884375	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23097163 S_61794056	1884981	G	T
S_23097174 S_61794084	1885136	T	A
S_23097178 S_61794090	1885180	G	C
S_23097369 S_61794604	1887081	T	C
S_23097476 S_61794814	1887677	C	G
S_23097541 S_61794925	1888293	G	A
S_23097610 S_61795019	1888663	C	A
S_23097611 S_61795021	1888665	G	T
S_23097623 S_61795041	1888772	T	A
S_23097721 S_61795372	1890361	A	G
S_23097737 S_61795428	1890592	A	T
S_23097794 S_61795608	1891467	G	A
S_23100338 S_61800018	1897698	T	G
S_23100367 S_61800050	1897933	G	A
S_23100574 S_61800736	1900655	G	A
S_23100581 S_61800762	1900786	G	A
S_23100582 S_61800770	1900811	T	A
S_23100584 S_61800779	1900842	T	A
S_23100593 S_61800794	1900913	C	A
S_23100700 S_61801082	1902076	G	T
S_23100703 S_61801083	1902098	C	A
S_23100764 S_61801247	1902934	C	T
S_23100836 S_61801305	1903134	A	G
S_23100837 S_61801306	1903135	T	A
S_23100838 S_61801308	1903145	A	G
S_23100840 S_61801311	1903174	G	A
S_23100980 S_61801693	1904528	C	G
S_23101020 S_61801793	1905057	A	T
S_23101423 S_61803081	1908700	A	T
S_23101834 S_61804229	1912651	A	C
S_61804284	1912817	C	T
S_23101879 S_61804296	1912878	G	A
S_23101880 S_61804297	1912886	A	G
S_23101881 S_61804299	1912900	T	C
S_23101882 S_61804302	1912912	A	C
S_23101883 S_61804303	1912927	A	G
S_23101929 S_61804423	1913423	T	G
S_23102090 S_61804972	1915284	A	G
S_23102109 S_61805049	1915577	C	A
S_23102145 S_61805159	1915909	G	A
S_23102200 S_61805333	1916578	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23102224 S_61805389	1916792	G	A
S_23102225 S_61805391	1916795	G	C
S_23102229 S_61805409	1916875	T	A
S_23102239 S_61805432	1916978	G	A
S_23102426 S_61805716	1917643	G	A
S_23102834 S_61806787	1920780	C	T
S_23102867 S_61806941	1921457	A	C
S_23102893 S_61807007	1921803	A	G
S_23102895 S_61807011	1921820	C	T
S_23102899 S_61807018	1921843	A	T
S_23102917 S_61807062	1922230	A	T
S_23103011 S_61807173	1922655	A	T
S_23103048 S_61807290	1923085	C	T
S_23103178 S_61807603	1924883	G	A
S_23103227 S_61807747	1925414	A	T
S_23103382 S_61808113	1926643	G	T
S_23103384 S_61808114	1926648	A	G
S_23103400 S_61808188	1926896	A	G
S_23103532 S_61808720	1928680	G	A
S_23103555 S_61808793	1929007	T	C
S_23103725 S_61809280	1930762	T	A
S_23103726 S_61809281	1930766	C	G
S_23103788 S_61809468	1931491	A	T
S_23103790 S_61809472	1931498	C	T
S_23103796 S_61809494	1931547	A	G
S_23103842 S_61809819	1932558	T	G
S_23103850 S_61809836	1932687	A	T
S_23103851 S_61809837	1932692	T	A
S_23103852 S_61809838	1932693	T	A
S_23103853 S_61809839	1932694	T	A
S_23103862 S_61809862	1932819	A	G
S_23103864 S_61809872	1932842	T	A
S_23103950 S_61810063	1933849	T	A
S_23104028 S_61810297	1934590	T	C
S_23104030 S_61810302	1934626	A	G
S_23104047 S_61810364	1934910	A	G
S_23104051 S_61810372	1934950	C	A
S_23104100 S_61810519	1935639	G	A
S_23104109 S_61810578	1935779	A	C
S_23104113 S_61810600	1935842	C	A
S_23104116 S_61810606	1935883	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23104117 S_61810607	1935884	C	G
S_23104142 S_61810646	1936097	G	A
S_23104145 S_61810652	1936145	G	T
S_23104260 S_61810954	1937581	C	T
S_23104310 S_61811052	1938292	T	C
S_23104311 S_61811053	1938300	G	C
S_23104312 S_61811055	1938311	A	G
S_23104314 S_61811057	1938320	C	T
S_23104327 S_61811093	1938502	C	A
S_23104342 S_61811162	1938732	A	C
S_23104348 S_61811178	1938799	C	A
S_23104362 S_61811210	1939021	G	A
S_23104376 S_61811241	1939261	A	G
S_23104535 S_61811713	1940797	A	C
S_23104538 S_61811721	1940834	C	A
S_23104544 S_61811750	1940977	C	T
S_23104637 S_61812076	1941953	C	T
S_23104825 S_61812511	1943660	G	A
S_23104832 S_61812519	1943697	T	C
S_23104859 S_61812596	1943979	C	A
S_23104894 S_61812743	1944478	A	G
S_23105080 S_61813196	1946180	A	T
S_23105082 S_61813205	1946211	G	A
S_23105178 S_61813547	1947473	G	T
S_23105179 S_61813552	1947486	C	T
S_23105197 S_61813616	1947842	T	C
S_23105214 S_61813691	1948100	C	T
S_23105271 S_61813827	1948649	C	T
S_23105272 S_61813830	1948660	A	T
S_23105277 S_61813858	1948858	T	C
S_23105620 S_61815025	1953021	A	T
S_23105659 S_61815125	1953444	A	T
S_23105823 S_61815606	1955258	T	G
S_23105838 S_61815645	1955555	T	C
S_23105879 S_61815806	1956158	G	A
S_23105975 S_61816269	1957613	T	G
S_23106008 S_61816371	1958005	A	T
S_23106545 S_61817749	1962091	T	G
S_23106603 S_61817851	1962614	G	T
S_23106604 S_61817853	1962616	T	G
S_23106633 S_61817964	1963024	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23106635 S_61817967	1963052	C	T
S_23106742 S_61818249	1964388	A	T
S_23106781 S_61818410	1964875	G	C
S_23106953 S_61818945	1966333	T	C
S_23107265 S_61819748	1969576	C	T
S_23107374 S_61819983	1970137	T	C
S_23107443 S_61820229	1971063	C	T
S_23107445 S_61820233	1971102	T	G
S_23107455 S_61820244	1971220	T	C
S_23107459 S_61820254	1971290	C	T
S_23107541 S_61820420	1972249	G	T
S_23107764 S_61820952	1974052	C	T
S_23107766 S_61820959	1974070	A	G
S_23107767 S_61820960	1974075	C	T
S_23107775 S_61820973	1974124	T	A
S_23107790 S_61821002	1974275	A	T
S_23107791 S_61821007	1974294	A	G
S_23107792 S_61821014	1974306	T	C
S_23107850 S_61821114	1974957	A	G
S_23107864 S_61821146	1975088	A	G
S_23107867 S_61821148	1975114	T	C
S_23107874 S_61821180	1975300	T	G
S_23107942 S_61821308	1976036	A	G
S_23107974 S_61821428	1976492	T	A
S_23107975 S_61821429	1976495	A	T
S_23108251 S_61822049	1978738	T	C
S_23108252 S_61822052	1978759	A	G
S_23108253 S_61822053	1978764	A	T
S_23108384 S_61822404	1979825	C	A
S_23108394 S_61822422	1979895	A	G
S_23108570 S_61822805	1981307	T	A
S_23108571 S_61822807	1981310	T	C
S_23108621 S_61822979	1981904	C	G
S_23108810 S_61823648	1984319	C	T
S_23108813 S_61823664	1984356	G	A
S_23108918 S_61824031	1985636	C	A
S_23108919 S_61824032	1985640	T	A
S_23108974 S_61824242	1986433	T	C
S_23108982 S_61824248	1986483	T	C
S_23108986 S_61824268	1986533	A	C
S_23108996 S_61824311	1986671	T	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23109134 S_61824507	1987268	T	C
S_23109165 S_61824562	1987468	A	T
S_23109166 S_61824564	1987478	G	A
S_23109169 S_61824570	1987505	T	A
S_23109185 S_61824627	1987739	G	A
S_23109268 S_61825062	1991476	G	C
S_23109295 S_61825139	1991958	G	C
S_23109297 S_61825140	1991966	T	C
S_23109419 S_61825572	1993794	C	T
S_23109442 S_61825619	1994158	T	A
S_23109611 S_61826081	1995507	A	G
S_23109647 S_61826205	1996195	T	A
S_23109752 S_61826550	1997649	T	C
S_23109869 S_61826807	1998700	G	A
S_23109889 S_61826834	1998840	A	G
S_23109903 S_61826879	1999060	C	T
S_23109922 S_61826964	1999464	C	A
S_23109928 S_61826975	1999556	G	T
S_23109930 S_61827001	1999618	A	C
S_23109931 S_61827009	1999629	C	A
S_23109989 S_61827208	2000436	G	T
S_23110203 S_61827679	2002288	G	C
S_23110204 S_61827680	2002294	G	A
S_23110279 S_61827878	2003424	G	A
S_23110280 S_61827881	2003456	T	G
S_23110296 S_61827944	2003748	A	C
S_23110299 S_61827959	2003813	C	A
S_23110325 S_61828025	2004115	C	G
S_23110373 S_61828070	2004571	G	T
S_23110374 S_61828071	2004587	T	G
S_23110375 S_61828072	2004599	C	T
S_23110376 S_61828073	2004601	G	C
S_23110377 S_61828074	2004607	T	C
S_23110378 S_61828075	2004610	T	C
S_23110404 S_61828156	2004981	A	T
S_23110405 S_61828164	2005005	G	A
S_23110407 S_61828169	2005029	A	T
S_23110418 S_61828226	2005318	G	A
S_23110540 S_61828704	2007093	G	T
S_23110583 S_61828812	2007490	A	C
S_23110584 S_61828814	2007497	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23110691 S_61828952	2008115	T	C
S_23110763 S_61829161	2008999	T	C
S_23110777 S_61829189	2009193	G	A
S_23111293 S_61830273	2012496	C	G
S_23111295 S_61830276	2012505	G	T
S_23111323 S_61830349	2012865	A	C
S_23111509 S_61830729	2014320	T	C
S_23111543 S_61830833	2014852	A	G
S_23111890 S_61831800	2018952	T	G
S_23112045 S_61832304	2020518	G	C
S_23112118 S_61832424	2020745	C	T
S_23112146 S_61832460	2020781	A	T
S_23112210 S_61832662	2021382	G	A
S_23112245 S_61832754	2021697	T	C
S_23112301 S_61832900	2022250	G	T
S_23112320 S_61832986	2022511	G	A
S_23112362 S_61833122	2023013	C	T
S_23112397 S_61833210	2023322	T	C
S_23112403 S_61833234	2023452	C	G
S_23112456 S_61833352	2023987	G	T
S_23112462 S_61833356	2024030	C	T
S_23112466 S_61833366	2024063	A	G
S_23112472 S_61833378	2024111	A	C
S_23112473 S_61833383	2024154	A	T
S_23112475 S_61833385	2024165	A	G
S_23112481 S_61833415	2024363	C	T
S_23112936 S_61834808	2028930	G	T
S_23113146 S_61835416	2030815	A	G
S_23113196 S_61835578	2031571	A	T
S_23113253 S_61835710	2032282	C	T
S_23113258 S_61835723	2032348	C	T
S_23113290 S_61835805	2032680	A	G
S_23113306 S_61835860	2033026	C	T
S_23113546 S_61836453	2034965	C	G
S_23113687 S_61836944	2036756	A	G
S_23113704 S_61837003	2036946	A	G
S_23113705 S_61837006	2036951	A	C
S_23113706 S_61837007	2036956	G	C
S_23113869 S_61837436	2038148	A	C
S_23114068 S_61837921	2041149	T	A
S_23114071 S_61837922	2041157	T	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23114109 S_61837993	2041664	A	G
S_23114121 S_61838009	2041935	A	T
S_23114123 S_61838014	2041945	A	T
S_23114251 S_61838343	2044121	C	T
S_23114252 S_61838344	2044123	G	C
S_23114319 S_61838394	2044554	T	C
S_23114343 S_61838463	2044917	G	T
S_23114350 S_61838487	2045042	G	A
S_23114380 S_61838561	2045476	C	A
S_23114385 S_61838566	2045512	T	G
S_23114547 S_61839023	2047641	C	T
S_23114556 S_61839041	2047697	A	G
S_23114648 S_61839273	2048850	A	T
S_23114661 S_61839299	2049016	C	T
S_23114674 S_61839334	2049221	G	A
S_23114675 S_61839337	2049231	G	T
S_23114688 S_61839379	2049468	G	T
S_23114692 S_61839382	2049484	A	G
S_23114818 S_61839651	2050391	G	A
S_23114849 S_61839770	2050794	A	T
S_23114852 S_61839775	2050838	G	T
S_23114855 S_61839786	2050880	G	T
S_61839808	2050983	C	T
S_23114870 S_61839821	2051015	T	A
S_23114876 S_61839832	2051053	T	C
S_23114887 S_61839910	2051281	A	T
S_23114953 S_61840026	2051711	G	A
S_23115031 S_61840172	2052103	T	C
S_23115032 S_61840176	2052146	A	G
S_23115033 S_61840177	2052152	A	G
S_23115034 S_61840178	2052159	T	G
S_23115035 S_61840179	2052163	T	C
S_23116421 S_61843331	2062516	C	A
S_23116424 S_61843338	2062559	T	C
S_23116425 S_61843340	2062573	T	A
S_23116483 S_61843457	2063053	T	G
S_23116546 S_61843616	2063591	T	C
S_23116684 S_61843963	2064762	A	G
S_23116685 S_61843965	2064770	C	G
S_23116787 S_61844365	2066163	C	T
S_23116797 S_61844386	2066229	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23116853 S_61844536	2066647	G	A
S_23116861 S_61844559	2066820	G	T
S_23116862 S_61844560	2066827	C	T
S_23116879 S_61844631	2067158	A	C
S_23116885 S_61844640	2067245	A	C
S_23116886 S_61844645	2067275	A	T
S_23116888 S_61844647	2067298	T	G
S_23116889 S_61844649	2067304	G	T
S_23116890 S_61844650	2067308	T	A
S_23117007 S_61845043	2068765	T	C
S_23117024 S_61845087	2068929	A	G
S_23117194 S_61845609	2070894	A	T
S_23117195 S_61845610	2070895	T	G
S_23117196 S_61845611	2070905	G	T
S_23117199 S_61845616	2070932	A	G
S_23117202 S_61845622	2070960	G	A
S_23117237 S_61845786	2071561	G	A
S_23117238 S_61845787	2071564	G	A
S_23117243 S_61845794	2071622	A	G
S_23117245 S_61845798	2071629	T	C
S_23117246 S_61845801	2071648	C	T
S_23117254 S_61845828	2071716	C	T
S_23117272 S_61845899	2071990	A	G
S_23117273 S_61845901	2072009	A	C
S_23117340 S_61846006	2072529	T	C
S_23117343 S_61846010	2072536	A	C
S_23117470 S_61846333	2073625	A	T
S_23117484 S_61846376	2073823	T	A
S_23117505 S_61846437	2074128	T	C
S_23117507 S_61846439	2074150	G	A
S_23117514 S_61846449	2074177	G	A
S_23117525 S_61846464	2074290	C	T
S_23117700 S_61847046	2076449	C	T
S_23117731 S_61847237	2076943	T	C
S_23117792 S_61847424	2077721	T	C
S_23117835 S_61847528	2078069	A	T
S_23117836 S_61847532	2078107	A	T
S_23117895 S_61847773	2079108	T	C
S_23117896 S_61847780	2079132	T	C
S_23117907 S_61847837	2079398	T	A
S_23118011 S_61848118	2080471	A	G

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23118013 S_61848121	2080485	A	G
S_23118017 S_61848161	2080662	T	A
S_23118018 S_61848176	2080726	C	T
S_23118141 S_61848578	2082356	T	A
S_23118145 S_61848596	2082430	T	G
S_23118166 S_61848627	2082590	T	C
S_23118211 S_61848732	2082963	T	A
S_23118276 S_61848977	2083971	C	T
S_23118290 S_61849041	2084259	A	T
S_23118294 S_61849046	2084290	C	T
S_23118295 S_61849047	2084302	G	C
S_23118298 S_61849054	2084335	A	G
S_23118388 S_61849245	2085681	C	G
S_23118416 S_61849338	2086409	C	T
S_23118417 S_61849339	2086410	T	C
S_23118420 S_61849369	2086567	A	G
S_23118468 S_61849438	2086971	C	T
S_23118480 S_61849495	2087231	A	C
S_23118482 S_61849497	2087257	A	G
S_23118540 S_61849628	2088128	A	C
S_23118623 S_61849787	2088760	G	A
S_23118640 S_61849896	2089131	G	T
S_23118682 S_61850017	2089720	A	G
S_23118683 S_61850022	2089743	C	G
S_23118728 S_61850194	2090257	A	C
S_23119277 S_61851470	2095323	C	A
S_23119416 S_61851722	2096066	T	A
S_23119459 S_61851866	2096606	A	C
S_23119461 S_61851878	2096645	A	G
S_23119544 S_61852146	2097803	T	A
S_23119546 S_61852148	2097808	T	A
S_23119551 S_61852196	2097930	T	C
S_23119553 S_61852207	2097985	A	T
S_23119555 S_61852210	2097994	C	T
S_23119566 S_61852237	2098115	T	C
S_23119569 S_61852246	2098170	A	C
S_23119570 S_61852248	2098173	A	C
S_23119845 S_61853005	2100287	C	A
S_23119909 S_61853180	2101291	G	A
S_23119931 S_61853266	2101667	T	C
S_23119932 S_61853274	2101726	A	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23119939 S_61853300	2101804	T	A
S_23119943 S_61853310	2101844	C	T
S_23120084 S_61853623	2103048	G	T
S_23120114 S_61853679	2103497	C	T
S_23120116 S_61853684	2103512	C	G
S_23120117 S_61853690	2103540	A	T
S_23120118 S_61853692	2103555	A	G
S_23120119 S_61853694	2103568	T	A
S_23120156 S_61853890	2104266	A	T
S_23120179 S_61853965	2104714	G	T
S_23120285 S_61854296	2106066	C	T
S_23120344 S_61854388	2106594	A	C
S_23120614 S_61855294	2109328	A	C
S_23120676 S_61855438	2110283	A	G
S_23120751 S_61855633	2111485	T	A
S_23120822 S_61855855	2112376	G	A
S_23120824 S_61855857	2112389	C	A
S_23120949 S_61856197	2113959	A	G
S_23120950 S_61856206	2113998	A	T
S_23120951 S_61856207	2114001	A	T
S_23121248 S_61856922	2117150	C	G
S_23121381 S_61857235	2118694	A	T
S_23121382 S_61857238	2118700	G	A
S_23121525 S_61857744	2120252	C	A
S_23121527 S_61857746	2120263	C	G
S_23121530 S_61857752	2120289	G	T
S_23121531 S_61857753	2120290	A	T
S_23121677 S_61858289	2122383	C	A
S_23121836 S_61858767	2124247	A	T
S_23121839 S_61858773	2124279	T	G
S_23122168 S_61859750	2127830	A	G
S_23122197 S_61859853	2128204	C	G
S_23122205 S_61859893	2128438	G	A
S_23122207 S_61859899	2128483	A	G
S_23122357 S_61860188	2130065	T	A
S_23122401 S_61860286	2130434	T	C
S_23122402 S_61860299	2130496	G	A
S_23122404 S_61860301	2130508	C	A
S_23122413 S_61860315	2130585	A	T
S_23122417 S_61860340	2130711	T	A
S_23122433 S_61860386	2130992	G	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23122709 S_61861315	2134196	A	T
S_23122828 S_61861649	2135231	G	A
S_23122929 S_61861863	2135882	C	T
S_23122935 S_61861874	2135897	G	A
S_23122986 S_61862057	2136415	G	T
S_23124198 S_61864974	2144439	A	G
S_23124199 S_61864978	2144457	A	G
S_23124309 S_61865267	2145618	A	G
S_23124462 S_61865755	2147373	G	A
S_23124467 S_61865770	2147408	T	C
S_23124470 S_61865789	2147447	G	A
S_23124472 S_61865802	2147478	C	T
S_23124491 S_61865903	2147841	C	T
S_23124648 S_61866489	2149633	T	C
S_23124695 S_61866625	2150237	A	G
S_23124702 S_61866696	2150462	C	G
S_23124818 S_61867079	2151823	C	T
S_23124826 S_61867118	2151953	T	C
S_23124828 S_61867122	2151971	T	A
S_23124834 S_61867146	2152034	T	C
S_23124882 S_61867268	2152562	G	A
S_23125184 S_61868415	2156580	A	G
S_23125274 S_61868741	2157615	T	G
S_23125584 S_61869717	2160860	G	T
S_23125652 S_61869852	2161506	C	G
S_23126054 S_61871073	2165288	C	T
S_23126055 S_61871074	2165289	A	G
S_23126084 S_61871147	2165518	C	T
S_23126140 S_61871287	2165981	A	G
S_23126143 S_61871292	2165997	G	A
S_23126405 S_61871869	2168263	A	C
S_23126406 S_61871872	2168310	T	C
S_23126407 S_61871873	2168317	G	A
S_23126505 S_61872068	2169545	T	A
S_23126634 S_61872440	2170709	A	G
S_23126650 S_61872478	2170814	T	C
S_23126652 S_61872496	2170883	T	A
S_23126708 S_61872675	2171421	C	T
S_23126987 S_61873506	2174261	C	T
S_23127188 S_61874204	2176720	A	G
S_23127198 S_61874227	2176801	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23127254 S_61874269	2177012	T	A
S_23127325 S_61874506	2177741	A	T
S_23127377 S_61874675	2178316	T	C
S_23127378 S_61874676	2178317	G	T
S_23127424 S_61874793	2178847	G	A
S_23127431 S_61874810	2179011	A	C
S_23127432 S_61874812	2179015	C	A
S_23127456 S_61874872	2179244	C	G
S_23127458 S_61874884	2179289	T	A
S_23127463 S_61874900	2179363	A	T
S_23127779 S_61875821	2182913	C	T
S_23127780 S_61875822	2182914	A	C
S_23127844 S_61876098	2184358	A	G
S_23128368 S_61877200	2188186	G	T
S_23128384 S_61877285	2188462	T	C
S_23128601 S_61877846	2190245	T	C
S_23128616 S_61877889	2190564	T	C
S_23128641 S_61877934	2190793	C	A
S_23128642 S_61877935	2190794	A	G
S_23128728 S_61878089	2191439	G	T
S_23128734 S_61878119	2191533	G	A
S_23128787 S_61878299	2192098	A	G
S_23128833 S_61878459	2192538	T	G
S_23128842 S_61878476	2192589	C	T
S_23128900 S_61878637	2193612	G	T
S_23128901 S_61878638	2193617	G	A
S_23129051 S_61879044	2195488	T	G
S_23129073 S_61879131	2195742	G	T
S_23129275 S_61879808	2198236	C	G
S_23129276 S_61879809	2198237	A	C
S_23129590 S_61880652	2201801	A	T
S_23129596 S_61880669	2201896	T	C
S_23129647 S_61880869	2202676	A	G
S_23129766 S_61881259	2203951	A	C
S_23129767 S_61881261	2203952	C	T
S_23129816 S_61881368	2204572	A	G
S_23129817 S_61881372	2204589	G	A
S_23130027 S_61881960	2207023	A	G
S_23130031 S_61881974	2207063	G	T
S_23130036 S_61881992	2207107	A	G
S_23130179 S_61882324	2208806	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23130183 S_61882328	2208812	G	T
S_23130216 S_61882417	2209215	T	A
S_23130218 S_61882425	2209232	C	A
S_23130342 S_61882803	2211026	A	C
S_23130379 S_61882943	2211731	A	T
S_23130396 S_61882993	2211924	T	G
S_23130601 S_61883680	2214157	G	T
S_23130606 S_61883690	2214210	C	T
S_23130607 S_61883697	2214231	C	A
S_23130675 S_61883895	2214925	G	T
S_23130706 S_61883944	2215103	T	C
S_23130713 S_61883973	2215227	A	G
S_23130714 S_61883976	2215238	T	C
S_23130723 S_61883999	2215387	G	A
S_23130724 S_61884004	2215405	T	C
S_23130769 S_61884124	2216037	A	G
S_23130771 S_61884126	2216042	C	T
S_23130772 S_61884128	2216050	A	G
S_23130782 S_61884155	2216182	A	T
S_23131062 S_61885028	2219094	A	C
S_23131069 S_61885034	2219122	T	A
S_23131081 S_61885078	2219358	C	A
S_23131091 S_61885100	2219457	C	T
S_23131148 S_61885278	2220654	A	T
S_23131149 S_61885282	2220687	T	C
S_23131150 S_61885284	2220691	G	A
S_23131152 S_61885288	2220725	C	T
S_23131220 S_61885490	2221607	C	A
S_23131221 S_61885496	2221627	A	G
S_23131224 S_61885509	2221685	G	C
S_23131225 S_61885513	2221694	T	A
S_23131249 S_61885627	2222090	G	C
S_23131250 S_61885628	2222091	T	C
S_23131252 S_61885632	2222126	T	C
S_23131268 S_61885674	2222342	A	C
S_23131276 S_61885691	2222417	A	G
S_23131277 S_61885696	2222466	A	C
S_23131278 S_61885697	2222475	G	A
S_23131279 S_61885698	2222476	A	G
S_23131398 S_61885961	2223538	C	T
S_23131553 S_61886328	2224904	A	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23131634 S_61886520	2226062	G	T
S_23131733 S_61886812	2226851	A	G
S_23132068 S_61887867	2230096	A	T
S_23132232 S_61888197	2231940	C	A
S_23132653 S_61889262	2237478	G	A
S_23132658 S_61889273	2237532	G	C
S_23132660 S_61889275	2237552	C	T
S_23132995 S_61889993	2241162	T	C
S_23133270 S_61890417	2243321	A	C
S_23133284 S_61890477	2243512	G	A
S_23133328 S_61890621	2244297	T	C
S_23133332 S_61890624	2244320	C	A
S_23133334 S_61890630	2244341	G	T
S_23133349 S_61890690	2244557	C	T
S_23133392 S_61890807	2244979	G	A
S_23133702 S_61891701	2247978	A	C
S_23134139 S_61892641	2251275	T	A
S_23134158 S_61892694	2251421	A	T
S_23134185 S_61892748	2251652	C	T
S_23134187 S_61892752	2251675	A	C
S_23134337 S_61893075	2253069	T	C
S_23134400 S_61893296	2253731	G	A
S_23134429 S_61893376	2254095	A	G
S_23134431 S_61893387	2254166	C	T
S_23135200 S_61895217	2258818	A	T
S_23135219 S_61895302	2258986	C	T
S_23135401 S_61896081	2261224	C	A
S_23135727 S_61897537	2268702	G	C
S_23135797 S_61897698	2269221	C	G
S_23135832 S_61897795	2269951	G	A
S_23135835 S_61897796	2269968	A	G
S_23135871 S_61897864	2270599	G	C
S_23135872 S_61897865	2270600	T	C
S_23135874 S_61897866	2270615	G	T
S_23136109 S_61898415	2273819	A	T
S_23136140 S_61898489	2274279	A	T
S_23136252 S_61898848	2275658	C	T
S_23136255 S_61898854	2275682	A	T
S_23136261 S_61898892	2275829	A	T
S_23136358 S_61899113	2276730	C	T
S_23136361 S_61899120	2276797	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23136489 S_61899333	2278190	A	T
S_23136496 S_61899379	2278305	T	C
S_23136537 S_61899504	2278933	A	T
S_23136539 S_61899515	2279000	C	T
S_23136540 S_61899516	2279002	T	C
S_23136542 S_61899520	2279030	C	T
S_23136736 S_61900258	2281730	G	T
S_23136737 S_61900261	2281742	T	A
S_23136828 S_61900739	2283224	T	C
S_23136829 S_61900740	2283227	G	C
S_23136885 S_61900853	2284009	T	G
S_23136886 S_61900855	2284022	T	C
S_23136893 S_61900886	2284196	C	G
S_23136906 S_61900922	2284427	C	A
S_23137001 S_61901198	2285321	T	G
S_23137057 S_61901339	2285768	T	A
S_23137058 S_61901340	2285772	A	T
S_23137059 S_61901342	2285780	C	T
S_23137214 S_61901774	2287252	C	T
S_23137341 S_61902386	2289732	C	T
S_23137616 S_61903236	2292565	T	C
S_23137890 S_61903929	2295029	G	A
S_23137944 S_61904102	2295733	T	A
S_23138073 S_61904669	2297551	T	C
S_23139638 S_61907587	2303767	T	G
S_23139674 S_61907640	2304037	C	T
S_23139681 S_61907671	2304132	C	T
S_23139703 S_61907751	2304497	G	T
S_23139884 S_61908241	2306150	G	A
S_23140689 S_61909993	2310858	G	A
S_23140708 S_61910038	2311009	G	T
S_23141080 S_61911156	2314028	G	C
S_23141083 S_61911166	2314059	G	A
S_23141656 S_61912688	2318884	A	T
S_23141942 S_61913760	2322225	T	C
S_23141943 S_61913761	2322227	A	G
S_23142040 S_61913968	2323139	A	G
S_23142043 S_61913974	2323171	T	C
S_23142045 S_61913982	2323187	C	T
S_23142062 S_61914074	2323461	C	T
S_23142069 S_61914087	2323517	C	T

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23142101 S_61914201	2323990	A	G
S_23142102 S_61914204	2323999	C	T
S_23142434 S_61914976	2327248	G	C
S_23142471 S_61915162	2327859	G	A
S_23143209 S_61917031	2333363	C	T
S_23143512 S_61917521	2335098	T	C
S_23144052 S_61918629	2338650	T	A
S_23144390 S_61919539	2341655	C	T
S_23144431 S_61919631	2342146	T	C
S_23144441 S_61919644	2342251	G	A
S_23144848 S_61920739	2346274	G	A
S_23144934 S_61920944	2347159	T	G
S_23144938 S_61920955	2347209	C	T
S_23144940 S_61920957	2347217	G	A
S_23145139 S_61921606	2349409	A	T
S_23145219 S_61921754	2349717	T	C
S_23145223 S_61921757	2349738	G	A
S_23145224 S_61921766	2349755	C	G
D_1478135 D_2461790	2349855	CT	C
S_23145252 S_61921943	2350236	T	C
S_23145254 S_61921944	2350245	T	C
S_23145522 S_61922564	2351375	C	T
S_23145545 S_61922640	2351639	G	A
S_23145550 S_61922652	2351674	C	T
S_23145911 S_61923775	2355413	A	T
S_23145931 S_61923845	2355788	C	T
S_23145934 S_61923857	2355849	T	C
S_23146229 S_61924681	2359487	C	A
S_23146535 S_61925742	2362716	A	T
S_23146783 S_61926493	2365043	A	T
S_23146850 S_61926599	2365306	G	A
S_23147099 S_61927466	2368548	A	T
S_23147476 S_61928196	2371772	C	G
S_23147660 S_61928675	2373857	T	G
S_23147912 S_61929283	2376656	C	T
S_23148030 S_61929515	2377636	A	G
S_23148055 S_61929633	2378116	A	G
S_23148060 S_61929647	2378154	A	G
S_23148144 S_61929825	2378810	A	G
S_23148149 S_61929833	2378871	T	A
S_23148150 S_61929834	2378886	T	C

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23148237 S_61930013	2379755	A	C
S_23148266 S_61930099	2380043	A	G
S_23148446 S_61930635	2382161	T	G
S_23148970 S_61932173	2387367	G	C
S_23148971 S_61932174	2387368	G	A
S_23148987 S_61932209	2387533	G	A
S_23148992 S_61932220	2387582	T	A
S_23149020 S_61932300	2387959	G	A
S_23149347 S_61933471	2391974	A	G
S_23149476 S_61933979	2393615	C	T
S_23149637 S_61934515	2395882	G	C
S_23149642 S_61934526	2395918	G	A
S_23149749 S_61934695	2396865	C	G
S_23149753 S_61934709	2396948	G	T
S_23149815 S_61934956	2397997	G	A
S_23149817 S_61934959	2398018	C	A
S_23149818 S_61934961	2398029	G	T
S_23149840 S_61934985	2398152	C	A
S_23149842 S_61934986	2398156	C	A
S_23150390 S_61936711	2403773	C	T
S_23150409 S_61936758	2404093	A	G
S_23150410 S_61936763	2404114	A	T
S_23150411 S_61936766	2404125	A	G
S_23150885 S_61938284	2409177	T	C
S_23151025 S_61938845	2411189	G	T
S_23151117 S_61939150	2412296	T	G
S_23151491 S_61940087	2416027	A	C
S_23151534 S_61940304	2416675	A	T
S_23151542 S_61940313	2416715	T	C
S_23151544 S_61940320	2416764	C	T
S_23151559 S_61940340	2416915	C	T
S_23152020 S_61941918	2422114	A	G
S_23152021 S_61941919	2422121	G	A
S_23152022 S_61941920	2422123	T	C
S_23152023 S_61941921	2422128	A	G
S_23152025 S_61941934	2422179	A	G
S_23152026 S_61941935	2422180	A	G
S_23152030 S_61941943	2422201	T	C
S_23152096 S_61942054	2422434	G	C
S_23152098 S_61942058	2422449	A	G
S_23152100 S_61942059	2422450	G	A

SNP Name	Position (SEQ ID NO: 2)	Favorable Allele (Rust Resistant)	Unfavorable Allele (Rust Susceptible)
S_23152102 S_61942062	2422465	C	A
S_23152142 S_61942139	2422616	T	C
S_23152143 S_61942143	2422628	G	C
S_23152216 S_61942335	2423154	C	A
S_23152220 S_61942352	2423198	A	G
S_23152221 S_61942358	2423217	G	A
S_23152239 S_61942428	2423504	G	A
S_23152387 S_61943021	2424999	C	G
S_23152461 S_61943253	2426003	C	T
S_23152503 S_61943334	2426266	G	T
S_23152510 S_61943373	2426469	T	A
S_23152511 S_61943374	2426470	T	A
S_23152727 S_61943892	2428755	G	A
S_23152770 S_61944055	2429304	T	C
S_23152842 S_61944397	2430623	C	T
S_23152848 S_61944413	2430711	T	C
S_23152883 S_61944552	2431274	A	G

Table 3: SNP Positions within SEQ ID NO: 3 that are associated with increased resistance to

5

ASR

RefSeq	Position	Favorable Allele	Unfavorable Allele
000132F	33660	A	G
000132F	47660	T	A
000132F	79385	T	A
000132F	117403	T	A
000132F	157518	G	T
000132F	192546	G	T
000132F	226720	G	T
000132F	230335	A	G
000132F	231354	T	C
000132F	249986	T	C
000132F	259859	T	C
000132F	281178	T	C
000132F	305961	C	T
000132F	319502	T	G
000132F	360354	G	T

000132F	373163	A	T
000132F	401310	A	T
000132F	432427	C	G
000132F	447585	A	G
000132F	455849	G	C
000132F	517494	G	T
000132F	523781	A	C
000132F	550080	T	C
000132F	568057	T	C
000132F	583164	A	G
000132F	603415	T	C
000132F	620944	T	C
000132F	635395	G	A
000132F	642743	G	A
000132F	675110	C	T
000132F	726523	C	T
000132F	743401	C	T
000132F	758790	A	G
000132F	762318	G	T
000132F	772452	T	C
000132F	785250	G	A
000132F	817601	A	T
000132F	818682	C	T
000132F	876544	A	G
000132F	892425	C	T
000132F	920142	G	C
000132F	938292	G	T
000132F	948671	T	C
000132F	973541	G	C
000132F	977232	T	C
000132F	1000237	T	C
000132F	1036303	T	G
000132F	1066085	T	C
000132F	1085690	G	A
000132F	1088855	G	A
000132F	1090029	C	T
000132F	1095842	G	A
000132F	1104225	G	A
000132F	1105287	A	G
000132F	1105896	C	T
000132F	1130936	C	T
000132F	1131612	G	T
000132F	1135444	A	G
000132F	1147457	T	G
000132F	1148939	G	A

000132F	1180730	G	T
000132F	1233671	C	T
000132F	1253344	T	C
000132F	1266772	G	A
000132F	1276594	G	C
000132F	1282394	G	A
000132F	1293582	G	A
000132F	1340471	T	C
000132F	1420388	T	C
000132F	1483043	C	A
000132F	1501651	T	G
000132F	1504883	C	A
000132F	1508972	C	A
000132F	1564562	G	T
000132F	1589089	A	G
000132F	1597852	T	C
000132F	1607501	T	A
000132F	1615924	A	G
000132F	1679827	A	G
000132F	1694841	C	T
000132F	1731209	T	G
000132F	1747932	G	C
000132F	1749670	A	G
000132F	1775700	T	C
000132F	1788283	A	T
000132F	1792363	A	G
000132F	1801200	A	G
000132F	1814495	T	G
000132F	1817365	C	A
000132F	1820064	T	C
000132F	1835302	T	C
000132F	1839046	T	C
000132F	1841764	A	T
000132F	1843631	T	A
000132F	1847517	A	G
000132F	1854387	C	A
000132F	1862524	T	A
000132F	1869642	G	A
000132F	1910757	G	A
000132F	1974668	A	G
000132F	1997944	A	C
000132F	2007140	C	T
000132F	2023171	A	T
000132F	2026573	G	T
000132F	2027697	C	A

000132F	2039458	A	T
000132F	2075550	T	C

It is well known in the art that given the sequence and the SNP allele associated with a given trait (e.g. ASR resistance), one having ordinary skill in the art could develop oligonucleotide primers and use said primers to identify plants carrying any one of the chromosomal intervals depicted in SEQ ID NOs 1-3. A TAQMAN® assay (e.g. generally a two-step allelic discrimination assay or similar), a KASP™ assay (generally a one-step allelic discrimination assay defined below or similar), or both can be employed to assay the SNPs as disclosed herein. In an exemplary two-step assay, a forward primer, a reverse primer, and two assay probes (or hybridization oligos) are employed. The forward and reverse primers are employed to amplify genetic loci that comprise SNPs that are associated with ASR resistance loci. The particular nucleotides that are present at the SNP positions are then assayed using the assay primers (which in some embodiments are differentially labeled with, for example, fluorophores to permit distinguishing between the two assay probes in a single reaction), which in each pair differ from each other with respect to the nucleotides that are present at the SNP position (although it is noted that in any given pair, the probes can differ in their 5' or 3' ends without impacting their abilities to differentiate between nucleotides present at the corresponding SNP positions). In some embodiments, the assay primers and the reaction conditions are designed such that an assay primer will only hybridize to the reverse complement of a 100% perfectly matched sequence, thereby permitting identification of which allele(s) is/are present based upon detection of hybridizations.

Compositions and methods for identifying, selecting and producing *Glycine* plants (including wild *Glycines* and *Glycine max* lines) with enhanced disease resistance are provided. Disease resistant soybean plants and germplasms are also provided.

In some embodiments, methods of identifying a disease resistant soybean plant or germplasm are provided. Such methods may comprise detecting, in the soybean plant or germplasm, a genetic loci or molecular marker (e.g. SNP or a Quantitative Trait Loci (QTL)) associated with enhanced disease resistance, in particular ASR resistance. In some embodiments the genetic loci or molecular marker associates with the presence of a chromosomal interval comprising the nucleotide sequence or a portion thereof of SEQ ID NOs 1-3.

In some embodiments, methods of producing a disease resistant soybean plant are provided. Such methods may comprise detecting, in a soybean germplasm, the presence of a genetic loci and/or a genetic marker associated with enhanced pathogen resistance (e.g. ASR) and producing a progeny plant from said soybean germplasm.

In some embodiments, methods of selecting a disease resistant soybean plant or germplasm are provided. Such methods may comprise crossing a first soybean plant or germplasm with a second soybean plant or germplasm, wherein the first soybean plant or germplasm comprises a genetic loci

derived from soybean *Glycine canescens* accession PI440935, PI483193, PI595799, or a progeny or seed thereof comprising any one of SEQ ID NOs 1, 2, 3 or a portion thereof associated with enhanced disease resistance and/or tolerance, and selecting a progeny plant or germplasm that possesses the genetic loci.

5 In some embodiments, methods of introgressing a genetic loci derived from soybean accession number PI440935, PI483193, PI595799 or a progeny thereof associated with enhanced pathogen resistance into a soybean plant or germplasm are provided. Such methods may comprise crossing a first soybean plant or germplasm comprising a chromosomal interval derived from soybean accession number PI440935, PI483193, PI595799, or a progeny thereof associated with enhanced
10 pathogen resistance with a second soybean plant or germplasm that lacks said genetic loci and optionally repeatedly backcrossing progeny plants comprising said genetic allele with the second soybean plant or germplasm to produce a soybean plant (e.g. *Glycine max*) or germplasm with enhanced pathogen resistance comprising the chromosomal interval derived from soybean accession number PI440935, PI483193, PI595799, or a progeny thereof associated with enhanced pathogen
15 resistance. Progeny comprising the chromosomal interval associated with enhanced pathogen resistance may be identified by detecting, in their genomes, the presence of a marker associated with said chromosomal interval derived from soybean accession number PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises SEQ ID NOs 1-3 or a portion thereof. R-Genes from PI440935, PI483193, PI595799, or a progeny thereof can be introgressed
20 into a *Glycine max* line through the use of embryo rescue methods known by those skilled in the art for example as is disclosed in U.S. Patent 7,842,850 herein incorporated by reference and through methods as described in the working Examples herein.

Soybean plants and/or germplasms identified, produced or selected by the methods of this invention are also provided, as are any progeny and/or seeds derived from a soybean plant or
25 germplasm identified, produced or selected by these methods. In one embodiment a molecular markers associating with the presence of a chromosomal intervals depicted in any one of SEQ ID NOs 1-3 may be used to identify or select for plant lines resistant to ASR. Further said molecular markers may be located within 20cM, 10cM, 5cM, 4cM, 3cM, 2cM, 1cM of said chromosomal interval. In another embodiment, said molecular marker may be located within 20cM, 10cM, 5cM, 4cM, 3cM,
30 2cM, 1cM of any SNP markers associated with ASR as described in any one of Tables 1-3.

Non-naturally occurring soybean seeds, plants and/or germplasms comprising one or genetic loci derived from soybean plant accession number PI440935, PI483193, PI595799, or a progeny thereof associated with enhanced pathogen resistance (e.g. ASR, Cyst Nematode, Phytophthora, brown stem rot etc.) are also provided.

35 A marker associated with enhanced pathogen resistance may comprise, consist essentially of or consist of a single allele or a combination of alleles at one or more genetic loci derived from PI440935, PI483193, PI595799, or a progeny thereof that associate with enhanced pathogen

resistance. In one embodiment the marker is within a chromosomal interval as described by any one of SEQ ID NOs 1-3.

The foregoing and other objects and aspects of the present invention are explained in detail in the drawings and specification set forth below.

5

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows the screening of Wild Glycine lines for rust resistance against a panel of 16 rust isolates.

Figure 2 illustrates the rust rating scale used to measure plant phenotype.

10 **Figure 3** shows a depiction of *Glycine canescens* (PI440935) SNPs associated with ASR Resistance.

Figure 4 is a marker association map for *Glycine canescens* (PI440935) where bands indicate regions/intervals of respective chromosomes associated with ASR resistance.

Figure 5 shows a mapping interval on scaffold 000056F associated with ASR resistance.

15

DETAILED DESCRIPTION OF THE INVENTION

The presently disclosed subject matter relates at least in part to the identification of a genomic region (i.e. chromosomal interval) derived from *Glycine canescens* accession line PI440935, PI483193, PI595799, or a progeny thereof associated with enhanced pathogen resistance (e.g., resistance to Asian soy rust (ASR) or Soybean cyst nematode (SCN)). As such, said chromosomal interval from PI440935, PI483193, PI595799, or a progeny thereof, may be introgressed into *Glycine max* lines via somatic embryo rescue (see for example U.S. Patent Publication 2007/0261139 and examples herein) or through the use of a *Glycine max* donor line having introgressed into its genome the genetic region from PI440935, PI483193, PI595799, or a progeny thereof wherein the region comprises SEQ ID NO: 1-3 or a portion thereof where presence of said genetic region is associated with increased soybean disease resistance to, for example, ASR, SCN, Stem termination, Stem Canker, Bacterial pustule, root knot nematode, brown stem rot, Frogeye leaf spot, or phytophthora. In another embodiment, a chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof is introduced into a *Glycine max* line not comprising said chromosomal interval wherein said introduction confers in the *Glycine max* line or its progeny increased resistances to disease (e.g. ASR) wherein the said chromosome interval is derived from chromosome 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, or chromosome 20 of *Glycine canescens* and further wherein said chromosomal interval comprises at least one allele that associates with the trait of increased disease resistance wherein said allele is any one of the alleles respectively selected from any one of Tables 1-3.

35 All references listed below, as well as all references cited in the instant disclosure, including but not limited to all patents, patent applications and publications thereof, scientific journal articles, and database entries (e.g., GENBANK® database entries and all annotations available therein) are

incorporated herein by reference in their entireties to the extent that they supplement, explain, provide a background for, or teach methodology, techniques, and/or compositions employed herein.

Definitions

5 Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which the presently disclosed subject matter belongs.

Although the following terms are believed to be well understood by one of ordinary skill in the art, the following definitions are set forth to facilitate understanding of the presently disclosed
10 subject matter.

As used herein, the terms "a" or "an" or "the" may refer to one or more than one. For example, "a" marker can mean one marker or a plurality of markers.

As used herein, the term "and/or" refers to and encompasses any and all possible combinations of one or more of the associated listed items, as well as the lack of combinations when
15 interpreted in the alternative ("or").

As used herein, the term "about," when used in reference to a measurable value such as an amount of mass, dose, time, temperature, and the like, is meant to encompass variations of 20%, 10%, 5%, 1%, 0.5%, or even 0.1% of the specified amount.

The term "consists essentially of" (and grammatical variants thereof), as applied to a
20 polynucleotide sequence of this invention, means a polynucleotide sequence that consists of both the recited sequence (e.g., SEQ ID NO) and a total of ten or less (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10) additional nucleotides on the 5' and/or 3' ends of the recited sequence such that the function of the polynucleotide is not materially altered. The total of ten or less additional nucleotides includes the total number of additional nucleotides on both ends added together. The term "materially altered," as
25 applied to polynucleotides of the invention, refers to an increase or decrease in ability to express the polynucleotide sequence of at least about 50% or more as compared to the expression level of a polynucleotide sequence consisting of the recited sequence.

As used herein, the term "wild glycine" refers to a *Glycine canescens* plant.

As used herein, the term "allele" refers to one of two or more different nucleotides or
30 nucleotide sequences that occur at a specific locus.

A marker is "associated with" a trait when it is linked to it and when the presence of the marker is an indicator of whether and/or to what extent the desired trait or trait form will occur in a plant/germplasm comprising the marker. Similarly, a marker is "associated with" an allele when it is linked to it and when the presence of the marker is an indicator of whether the allele is present in a
35 plant/germplasm comprising the marker. For example, "a marker associated with enhanced pathogen

resistance” refers to a marker whose presence or absence can be used to predict whether and/or to what extent a plant will display a pathogen resistant phenotype.

As used herein, the terms “backcross” and “backcrossing” refer to the process whereby a progeny plant is repeatedly crossed back to one of its parents. In a backcrossing scheme, the “donor” parent refers to the parental plant with the desired gene or locus to be introgressed. The “recipient” parent (used one or more times) or “recurrent” parent (used two or more times) refers to the parental plant into which the gene or locus is being introgressed. For example, see Ragot, M. et al. *Marker-assisted Backcrossing: A Practical Example*, in *TECHNIQUES ET UTILISATIONS DES MARQUEURS MOLECULAIRES LES COLLOQUES*, Vol. 72, pp. 45-56 (1995); and Openshaw et al., *Marker-assisted Selection in Backcross Breeding*, in *PROCEEDINGS OF THE SYMPOSIUM “ANALYSIS OF MOLECULAR MARKER DATA,”* pp. 41-43 (1994). The initial cross gives rise to the F1 generation. The term “BC1” refers to the second use of the recurrent parent, “BC2” refers to the third use of the recurrent parent, and so on.

A centimorgan (“cM”) is a unit of measure of recombination frequency. One cM is equal to a 1% chance that a marker at one genetic locus will be separated from a marker at a second locus due to crossing over in a single generation.

As used herein, the term “chromosomal interval defined by and including,” used in reference to particular loci and/or alleles, refers to a chromosomal interval delimited by and encompassing the stated loci/alleles.

As used herein, the terms “cross” or “crossed” refer to the fusion of gametes via pollination to produce progeny (e.g., cells, seeds or plants). The term encompasses both sexual crosses (the pollination of one plant by another) and selfing (self-pollination, e.g., when the pollen and ovule are from the same plant). The term “crossing” refers to the act of fusing gametes via pollination to produce progeny.

As used herein, the terms “cultivar” and “variety” refer to a group of similar plants that by structural or genetic features and/or performance can be distinguished from other varieties within the same species.

As used herein, the terms “desired allele” and “allele of interest” are used interchangeably to refer to an allele associated with a desired trait. In some embodiments, a “desired allele” and/or “allele of interest” may be associated with either an increase or a decrease of or in a given trait, depending on the nature of the desired phenotype. In some embodiments, a “desired allele” and/or “allele of interest” may be associated with a change in morphology, color, etc.

As used herein, the terms “enhanced pathogen resistance” or “enhanced disease resistance” refers to an improvement, enhancement, or increase in a plant’s ability to endure and/or thrive despite being infected with a disease (e.g. Asian soybean rust) as compared to one or more control plants (e.g., one or both of the parents, or a plant lacking a marker associated with enhanced pathogen resistance to respective pathogen/disease). Enhanced disease resistance includes any mechanism

(other than whole-plant immunity or resistance) that reduces the expression of symptoms indicative of infection for a respective disease such as Asian soybean rust, soybean cyst nematode, *Pytophthora*, etc.

5 As used herein, the terms “elite” and “elite line” refer to any line that has resulted from breeding and selection for desirable agronomic performance. An elite line may be substantially homozygous. Numerous elite lines are available and known to those of skill in the art.

As used herein, the term “elite germplasm” refers to any germplasm that is derived from or is capable of giving rise to an elite plant.

10 As used herein, the terms “exotic,” “exotic line” and “exotic germplasm” refer to any plant, line or germplasm that is not elite. In general, exotic plants/germplasms are not derived from any known elite plant or germplasm, but rather are selected to introduce one or more desired genetic elements into a breeding program (e.g., to introduce novel alleles into a breeding program).

15 A “genetic map” is a description of genetic linkage relationships among loci on one or more chromosomes within a given species, generally depicted in a diagrammatic or tabular form. For each genetic map, distances between loci are measured by the recombination frequencies between them. Recombinations between loci can be detected using a variety of markers. A genetic map is a product of the mapping population, types of markers used, and the polymorphic potential of each marker between different populations. The order and genetic distances between loci can differ from one genetic map to another.

20 As used herein, the term “genotype” refers to the genetic constitution of an individual (or group of individuals) at one or more genetic loci, as contrasted with the observable and/or detectable and/or manifested trait (the phenotype). Genotype is defined by the allele(s) of one or more known loci that the individual has inherited from its parents. The term genotype can be used to refer to an individual's genetic constitution at a single locus, at multiple loci, or more generally, the term
25 genotype can be used to refer to an individual's genetic make-up for all the genes in its genome. Genotypes can be indirectly characterized, e.g., using markers and/or directly characterized by nucleic acid sequencing.

30 As used herein, the term “germplasm” refers to genetic material of or from an individual (e.g., a plant), a group of individuals (e.g., a plant line, variety or family), or a clone derived from a line, variety, species, or culture. The germplasm can be part of an organism or cell, or can be separate from the organism or cell. In general, germplasm provides genetic material with a specific molecular makeup that provides a physical foundation for some or all of the hereditary qualities of an organism or cell culture. As used herein, germplasm may refer to seeds, cells (including protoplasts and calli) or tissues from which new plants may be grown, as well as plant parts that can be cultured into a
35 whole plant (e.g., stems, buds, roots, leaves, etc.).

A “haplotype” is the genotype of an individual at a plurality of genetic loci, i.e., a combination of alleles. Typically, the genetic loci that define a haplotype are physically and

genetically linked, *i.e.*, on the same chromosome segment. The term “haplotype” can refer to polymorphisms at a particular locus, such as a single marker locus, or polymorphisms at multiple loci along a chromosomal segment.

5 As used herein, the term “heterozygous” refers to a genetic status wherein different alleles reside at corresponding loci on homologous chromosomes.

As used herein, the term “homozygous” refers to a genetic status wherein identical alleles reside at corresponding loci on homologous chromosomes.

As used herein, the term “hybrid” refers to a seed and/or plant produced when at least two genetically dissimilar parents are crossed.

10 As used herein, the term “inbred” refers to a substantially homozygous plant or variety. The term may refer to a plant or variety that is substantially homozygous throughout the entire genome or that is substantially homozygous with respect to a portion of the genome that is of particular interest.

As used herein, the term “indel” refers to an insertion or deletion in a pair of nucleotide sequences, wherein a first sequence may be referred to as having an insertion relative to a second
15 sequence or the second sequence may be referred to as having a deletion relative to the first sequence.

As used herein, the terms “introgression,” “introgressing” and “introgressed” refer to both the natural and artificial transmission of a desired allele or combination of desired alleles of a genetic locus or genetic loci from one genetic background to another. For example, a desired allele at a specified locus can be transmitted to at least one progeny via a sexual cross between two parents of
20 the same species, where at least one of the parents has the desired allele in its genome. Alternatively, for example, transmission of an allele can occur by recombination between two donor genomes, *e.g.*, in a fused protoplast, where at least one of the donor protoplasts has the desired allele in its genome. The desired allele may be a selected allele of a marker, a QTL, a transgene, or the like. Offspring comprising the desired allele can be repeatedly backcrossed to a line having a desired genetic
25 background and selected for the desired allele, with the result being that the desired allele becomes fixed in the desired genetic background. For example, a marker associated with enhanced ASR tolerance may be introgressed from a donor into a recurrent parent that is not Disease resistant. The resulting offspring could then be repeatedly backcrossed and selected until the progeny possess the ASR tolerance allele(s) in the recurrent parent background.

30 As used herein, the term “linkage” refers to the degree with which one marker locus is associated with another marker locus or some other locus (for example, an ASR tolerance locus). The linkage relationship between a molecular marker and a phenotype may be given as a “probability” or “adjusted probability.” Linkage can be expressed as a desired limit or range. For example, in some embodiments, any marker is linked (genetically and physically) to any other marker when the markers
35 are separated by less than about 50, 40, 30, 25, 20, or 15 map units (or cM).

In some aspects of the present invention, it is advantageous to define a bracketed range of linkage, for example, from about 10 cM and about 20 cM, from about 10 cM and about 30 cM, or

from about 10 cM and about 40 cM. The more closely a marker is linked to a second locus, the better an indicator for the second locus that marker becomes. Thus, “closely linked loci” such as a marker locus and a second locus display an inter-locus recombination frequency of about 10%, 9%, 8%, 7%, 6%, 5%, 4%, 3%, or 2% or less. In some embodiments, the relevant loci display a recombination frequency of about 1% or less, e.g., about 0.75%, 0.5%, 0.25% or less. Two loci that are localized to the same chromosome, and at such a distance that recombination between the two loci occurs at a frequency of less than about 10% (e.g., about 9%, 8%, 7%, 6%, 5%, 4%, 3%, 2%, 1%, 0.75%, 0.5%, or 0.25%, or less) may also be said to be “proximal to” each other. Since one cM is the distance between two markers that show a 1% recombination frequency, any marker is closely linked (genetically and physically) to any other marker that is in close proximity, e.g., at or less than about 10 cM distant. Two closely linked markers on the same chromosome may be positioned about 9, 8, 7, 6, 5, 4, 3, 2, 1, 0.75, 0.5 or 0.25 cM or less from each other.

As used herein, the term “linkage disequilibrium” refers to a non-random segregation of genetic loci or traits (or both). In either case, linkage disequilibrium implies that the relevant loci are within sufficient physical proximity along a length of a chromosome so that they segregate together with greater than random (*i.e.*, non-random) frequency (in the case of co-segregating traits, the loci that underlie the traits are in sufficient proximity to each other). Markers that show linkage disequilibrium are considered linked. Linked loci co-segregate more than 50% of the time, e.g., from about 51% to about 100% of the time. In other words, two markers that co-segregate have a recombination frequency of less than 50% (and, by definition, are separated by less than 50 cM on the same chromosome). As used herein, linkage can be between two markers, or alternatively between a marker and a phenotype. A marker locus can be “associated with” (linked to) a trait, e.g., Asian Soybean Rust (herein ‘ASR’). The degree of linkage of a molecular marker to a phenotypic trait is measured, e.g., as a statistical probability of co-segregation of that molecular marker with the phenotype.

Linkage disequilibrium is most commonly assessed using the measure r^2 , which is calculated using the formula described by Hill and Robertson, *Theor. Appl. Genet.* 38:226 (1968). When $r^2=1$, complete linkage disequilibrium exists between the two marker loci, meaning that the markers have not been separated by recombination and have the same allele frequency. Values for r^2 above 1/3 indicate sufficiently strong linkage disequilibrium to be useful for mapping. Ardlie et al., *Nature Reviews Genetics* 3:299 (2002). Hence, alleles are in linkage disequilibrium when r^2 values between pairwise marker loci are greater than or equal to about 0.33, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, or 1.0.

As used herein, the term “linkage equilibrium” describes a situation where two markers independently segregate, *i.e.*, sort among progeny randomly. Markers that show linkage equilibrium are considered unlinked (whether or not they lie on the same chromosome).

A “locus” is a position on a chromosome where a gene or marker or allele is located. In some embodiments, a locus may encompass one or more nucleotides.

As used herein, the terms “marker” and “genetic marker” are used interchangeably to refer to a nucleotide and/or a nucleotide sequence that has been associated with a phenotype, trait or trait form. In some embodiments, a marker may be associated with an allele or alleles of interest and may be indicative of the presence or absence of the allele or alleles of interest in a cell or organism. A marker may be, but is not limited to, an allele, a gene, a haplotype, a restriction fragment length polymorphism (RFLP), a simple sequence repeat (SSR), random amplified polymorphic DNA (RAPD), cleaved amplified polymorphic sequences (CAPS) (Rafalski and Tingey, *Trends in Genetics* 9:275 (1993)), an amplified fragment length polymorphism (AFLP) (Vos et al., *Nucleic Acids Res.* 23:4407 (1995)), a single nucleotide polymorphism (SNP) (Brookes, *Gene* 234:177 (1993)), a sequence-characterized amplified region (SCAR) (Paran and Michelmore, *Theor. Appl. Genet.* 85:985 (1993)), a sequence-tagged site (STS) (Onozaki et al., *Euphytica* 138:255 (2004)), a single-stranded conformation polymorphism (SSCP) (Orita et al., *Proc. Natl. Acad. Sci. USA* 86:2766 (1989)), an inter-simple sequence repeat (ISSR) (Blair et al., *Theor. Appl. Genet.* 98:780 (1999)), an inter-retrotransposon amplified polymorphism (IRAP), a retrotransposon-microsatellite amplified polymorphism (REMAP) (Kalendar et al., *Theor. Appl. Genet.* 98:704 (1999)), a chromosome interval, or an RNA cleavage product (such as a Lynx tag). A marker may be present in genomic or expressed nucleic acids (e.g., ESTs). The term marker may also refer to nucleic acids used as probes or primers (e.g., primer pairs) for use in amplifying, hybridizing to and/or detecting nucleic acid molecules according to methods well known in the art. A large number of soybean molecular markers are known in the art, and are published or available from various sources, such as the SoyBase internet resource.

Markers corresponding to genetic polymorphisms between members of a population can be detected by methods well-established in the art. These include, e.g., nucleic acid sequencing, hybridization methods, amplification methods (e.g., PCR-based sequence specific amplification methods), detection of restriction fragment length polymorphisms (RFLP), detection of isozyme markers, detection of polynucleotide polymorphisms by allele specific hybridization (ASH), detection of amplified variable sequences of the plant genome, detection of self-sustained sequence replication, detection of simple sequence repeats (SSRs), detection of single nucleotide polymorphisms (SNPs), and/or detection of amplified fragment length polymorphisms (AFLPs). Well established methods are also known for the detection of expressed sequence tags (ESTs) and SSR markers derived from EST sequences and randomly amplified polymorphic DNA (RAPD).

A “marker allele,” also described as an “allele of a marker locus,” can refer to one of a plurality of polymorphic nucleotide sequences found at a marker locus in a population that is polymorphic for the marker locus.

“Marker-assisted selection” (MAS) is a process by which phenotypes are selected based on marker genotypes. In some embodiments, marker genotypes are used to identify plants that will be selected for a breeding program or for planting. In some embodiments, marker genotypes are used to

identify plants that will not be selected for a breeding program or for planting (*i.e.*, counter-selected plants), allowing them to be removed from the breeding/planting population.

As used herein, the terms “marker locus” and “marker loci” refer to a specific chromosome location or locations in the genome of an organism where a specific marker or markers can be found.

- 5 A marker locus can be used to track the presence of a second linked locus, *e.g.*, a linked locus that encodes or contributes to expression of a phenotypic trait. For example, a marker locus can be used to monitor segregation of alleles at a locus, such as a QTL or single gene, that are genetically or physically linked to the marker locus.

- 10 As used herein, the terms “marker probe” and “probe” refer to a nucleotide sequence or nucleic acid molecule that can be used to detect the presence of one or more particular alleles within a marker locus (*e.g.*, a nucleic acid probe that is complementary to all of or a portion of the marker or marker locus, through nucleic acid hybridization). Marker probes comprising about 8, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 or more contiguous nucleotides may be used for nucleic acid hybridization. Alternatively, in some aspects, a marker probe refers to a probe of any type that is able to distinguish
15 (*i.e.*, genotype) the particular allele that is present at a marker locus.

- As used herein, the terms “molecular marker” or “genetic marker” may be used to refer to a genetic marker, as defined above, or an encoded product thereof (*e.g.*, a protein) used as a point of reference when identifying a linked locus. A molecular marker can be derived from genomic nucleotide sequences or from expressed nucleotide sequences (*e.g.*, from a spliced RNA, a cDNA, etc.). The term also refers to nucleotide sequences complementary to or flanking the marker
20 sequences, such as nucleotide sequences used as probes and/or primers capable of amplifying the marker sequence. Nucleotide sequences are “complementary” when they specifically hybridize in solution, *e.g.*, according to Watson-Crick base pairing rules. Some of the markers described herein are also referred to as hybridization markers when located on an indel region. This is because the
25 insertion region is, by definition, a polymorphism *vis-à-vis* a plant without the insertion. Thus, the marker need only indicate whether the indel region is present or absent. Any suitable marker detection technology may be used to identify such a hybridization marker, *e.g.*, SNP technology is used in the examples provided herein.

- A “non-naturally occurring variety of soybean” is any variety of soybean that does not
30 naturally exist in nature. A “non-naturally occurring variety of soybean” may be produced by any method known in the art, including, but not limited to, transforming a soybean plant or germplasm, transfecting a soybean plant or germplasm and crossing a naturally occurring variety of soybean with a non-naturally occurring variety of soybean. In some embodiments, a “non-naturally occurring variety of soybean” may comprise one or more heterologous nucleotide sequences. In some
35 embodiments, a “non-naturally occurring variety of soybean” may comprise one or more non-naturally occurring copies of a naturally occurring nucleotide sequence (*i.e.*, extraneous copies of a gene that naturally occurs in soybean). In some embodiments, a “non-naturally occurring variety of

soybean" may comprise a non-natural combination of two or more naturally occurring nucleotide sequences (*i.e.*, two or more naturally occurring genes that do not naturally occur in the same soybean, for instance genes not found in *Glycine max* lines).

5 As used herein, the terms "phenotype," "phenotypic trait" or "trait" refer to one or more traits and/or manifestations of an organism. The phenotype can be a manifestation that is observable to the naked eye, or by any other means of evaluation known in the art, *e.g.*, microscopy, biochemical analysis, or an electromechanical assay. In some cases, a phenotype or trait is directly controlled by a single gene or genetic locus, *i.e.*, a "single gene trait." In other cases, a phenotype or trait is the result of several genes. It is noted that, as used herein, the term "disease resistant phenotype" takes into
10 account environmental conditions that might affect the respective disease such that the effect is real and reproducible.

As used herein, the term "plant" may refer to a whole plant, any part thereof, or a cell or tissue culture derived from a plant. Thus, the term "plant" can refer to any of: whole plants, plant components or organs (*e.g.*, roots, stems, leaves, buds, flowers, pods, *etc.*), plant tissues, seeds and/or
15 plant cells. A plant cell is a cell of a plant, taken from a plant, or derived through culture from a cell taken from a plant. Thus, the term "soybean plant" may refer to a whole soybean plant, one or more parts of a soybean plant (*e.g.*, roots, root tips, stems, leaves, buds, flowers, pods, seeds, cotyledons, *etc.*), soybean plant cells, soybean plant protoplasts and/or soybean plant calli.

As used herein, the term "polymorphism" refers to a variation in the nucleotide sequence at a
20 locus, where said variation is too common to be due merely to a spontaneous mutation. A polymorphism can be a single nucleotide polymorphism (SNP) or an insertion/deletion polymorphism, also referred to herein as an "indel." Additionally, the variation can be in a transcriptional profile or a methylation pattern. The polymorphic site or sites of a nucleotide sequence can be determined by comparing the nucleotide sequences at one or more loci in two or
25 more germplasm entries.

As used herein, the term "population" refers to a genetically heterogeneous collection of plants sharing a common genetic derivation.

As used herein, the terms "progeny" and "progeny plant" refer to a plant generated from a vegetative or sexual reproduction from one or more parent plants. A progeny plant may be obtained
30 by cloning or selfing a single parent plant, or by crossing two parental plants.

As used herein, the term "reference sequence" refers to a defined nucleotide sequence used as a basis for nucleotide sequence comparison. The reference sequence for a marker, for example, is obtained by genotyping a number of lines at the locus or loci of interest, aligning the nucleotide sequences in a sequence alignment program, and then obtaining the consensus sequence of the
35 alignment. Hence, a reference sequence identifies the polymorphisms in alleles at a locus. A reference sequence may not be a copy of an actual nucleic acid sequence from any particular

organism; however, it is useful for designing primers and probes for actual polymorphisms in the locus or loci.

As used herein, the terms “disease tolerance” and “Disease resistant” refer to a plant’s ability to endure and/or thrive despite being infected with a respective disease. When used in reference to germplasm, the terms refer to the ability of a plant that arises from that germplasm to endure and/or thrive despite being infected with a respective disease. In some embodiments, infected Disease resistant soybean plants may yield as well (or nearly as well) as uninfected soybean plants. In general, a plant or germplasm is labeled as “Disease resistant” if it displays “enhanced pathogen resistance.”

An “unfavorable allele” of a marker is a marker allele that segregates with the unfavorable plant phenotype, therefore providing the benefit of identifying plants that can be removed from a breeding program or planting.

“PI440935, PI483193, PI595799” refers to *Glycine canescens* accession numbers PI440935, PI483193, and PI595799 respectively.

Genetic Mapping

Genetic loci correlating with particular phenotypes, such as disease resistance, can be mapped in an organism’s genome. By identifying a marker or cluster of markers that co-segregate with a trait of interest, the breeder is able to rapidly select a desired phenotype by selecting for the proper marker (a process called marker-assisted selection, or MAS). Such markers may also be used by breeders to design genotypes *in silico* and to practice whole genome selection.

The present invention provides markers associated with enhanced disease resistance. Detection of these markers and/or other linked markers can be used to identify, select and/or produce Disease resistant plants and/or to eliminate plants that are not Disease resistant from breeding programs or planting.

Glycine Canescens Genetic Loci Associated with Enhanced Disease Resistance

Markers associated with enhanced disease resistance are identified herein (see Tables 1-3). A marker of the present invention may comprise a single allele or a combination of alleles at one or more genetic loci (for example, any combination of a marker from any combination of marker alleles listed in Tables 1-3). For example, the marker may comprise one or more marker alleles located within a first chromosomal interval (e.g. SEQ ID NO: 1) and one or more marker alleles located within a second chromosomal interval (e.g. SEQ ID NO: 2).

Markers of the present invention are described herein with respect to the positions of marker loci within chromosomal intervals comprising sequenced genomic DNA of PI440935, PI483193, PI595799, or a progeny or seed thereof as depicted by any one of SEQ ID NOs 1-3, and as represented in Tables 1-3.

Marker-Assisted Selection

Markers can be used in a variety of plant breeding applications. *See, e.g.,* Staub et al., *Hortscience* 31: 729 (1996); Tanksley, *Plant Molecular Biology Reporter* 1: 3 (1983). One of the main areas of interest is to increase the efficiency of backcrossing and introgressing genes using marker-assisted selection (MAS). In general, MAS takes advantage of genetic markers that have been identified as having a significant likelihood of co-segregation with a desired trait. Such markers are presumed to be in/near the gene(s) that give rise to the desired phenotype, and their presence indicates that the plant will possess the desired trait. Plants which possess the marker are expected to transfer the desired phenotype to their progeny.

A marker that demonstrates linkage with a locus affecting a desired phenotypic trait provides a useful tool for the selection of the trait in a plant population. This is particularly true where the phenotype is hard to assay or occurs at a late stage in plant development. Since DNA marker assays are less laborious and take up less physical space than field phenotyping, much larger populations can be assayed, increasing the chances of finding a recombinant with the target segment from the donor line moved to the recipient line. The closer the linkage, the more useful the marker, as recombination is less likely to occur between the marker and the gene causing or imparting the trait. Having flanking markers decreases the chances that false positive selection will occur. The ideal situation is to have a marker within the causative gene itself, so that recombination cannot occur between the marker and the gene. Such a marker is called a "perfect marker."

When a gene is introgressed by MAS, it is not only the gene that is introduced but also the flanking regions. Gepts, *Crop Sci* 42:1780 (2002). This is referred to as "linkage drag." In the case where the donor plant is highly unrelated to the recipient plant, these flanking regions carry additional genes that may code for agronomically undesirable traits. This "linkage drag" may also result in reduced yield or other negative agronomic characteristics even after multiple cycles of backcrossing into the elite soybean line. This is also sometimes referred to as "yield drag." The size of the flanking region can be decreased by additional backcrossing, although this is not always successful, as breeders do not have control over the size of the region or the recombination breakpoints. Young et al., *Genetics* 120:579 (1998). In classical breeding, it is usually only by chance that recombinations that contribute to a reduction in the size of the donor segment are selected. Tanksley et al., *Biotechnology* 7: 257 (1989). Even after 20 backcrosses, one might find a sizeable piece of the donor chromosome still linked to the gene being selected. With markers, however, it is possible to select those rare individuals that have experienced recombination near the gene of interest. In 150 backcross plants, there is a 95% chance that at least one plant will have experienced a crossover within 1 cM of the gene, based on a single meiosis map distance. Markers allow for unequivocal identification of those individuals. With one additional backcross of 300 plants, there would be a 95% chance of a crossover within 1 cM single meiosis map distance of the other side of the gene, generating a segment

around the target gene of less than 2 cM based on a single meiosis map distance. This can be accomplished in two generations with markers, while it would have required on average 100 generations without markers. *See Tanksley et al., supra*. When the exact location of a gene is known, flanking markers surrounding the gene can be utilized to select for recombinations in different population sizes. For example, in smaller population sizes, recombinations may be expected further away from the gene, so more distal flanking markers would be required to detect the recombination.

The availability of integrated linkage maps of the soybean genome containing increasing densities of public soybean markers has facilitated soybean genetic mapping and MAS.

Of all the molecular marker types, SNPs are the most abundant and have the potential to provide the highest genetic map resolution. Bhatramakki et al., *Plant Molec. Biol.* 48:539 (2002). SNPs can be assayed in a so-called "ultra-high-throughput" fashion because they do not require large amounts of nucleic acid and automation of the assay is straight-forward. SNPs also have the benefit of being relatively low-cost systems. These three factors together make SNPs highly attractive for use in MAS. Several methods are available for SNP genotyping, including but not limited to, hybridization, primer extension, oligonucleotide ligation, nuclease cleavage, mini-sequencing and coded spheres. Such methods have been reviewed in various publications: Gut, *Hum. Mutat.* 17:475 (2001); Shi, *Clin. Chem.* 47:164 (2001); Kwok, *Pharmacogenomics* 1:95 (2000); Bhatramakki and Rafalski, *Discovery and application of single nucleotide polymorphism markers in plants*, in PLANT GENOTYPING: THE DNA FINGERPRINTING OF PLANTS, CABI Publishing, Wallingford (2001). A wide range of commercially available technologies utilize these and other methods to interrogate SNPs, including Masscode™ (Qiagen, Germantown, MD), Invader® (Hologic, Madison, WI), SnapShot® (Applied Biosystems, Foster City, CA), Taqman® (Applied Biosystems, Foster City, CA) and Beadarrays™ (Illumina, San Diego, CA).

A number of SNP alleles together within a sequence, or across linked sequences, can be used to describe a haplotype for any particular genotype. Ching et al., *BMC Genet.* 3:19 (2002); Gupta et al., (2001), Rafalski, *Plant Sci.* 162:329 (2002b). Haplotypes can be more informative than single SNPs and can be more descriptive of any particular genotype. For example, a single SNP may be allele "T" for a specific Disease resistant line or variety, but the allele "T" might also occur in the soybean breeding population being utilized for recurrent parents. In this case, a combination of alleles at linked SNPs may be more informative. Once a unique haplotype has been assigned to a donor chromosomal region, that haplotype can be used in that population or any subset thereof to determine whether an individual has a particular gene. The use of automated high throughput marker detection platforms known to those of ordinary skill in the art makes this process highly efficient and effective.

The markers of the present invention can be used in marker-assisted selection protocols to identify and/or select progeny with enhanced Asian soybean rust tolerance. Such methods can comprise, consist essentially of, or consist of crossing a first soybean plant or germplasm with a second soybean plant or germplasm, wherein the first soybean plant or germplasm comprises a

chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1 or wherein the chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2; or nucleotide base 1-2622791 of SEQ ID NO: 3; and selecting a progeny plant that possesses the marker. Either of the first and second soybean plants, or both, may be of a non-naturally occurring variety of soybean. In some embodiments, the second soybean plant or germplasm is of an elite variety of soybean. In some embodiments, the genome of the second soybean plant or germplasm is at least about 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 97%, 99% or 100% identical to that of an elite variety of soybean. In another embodiment, the first soybean plant comprises a chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1 or nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2; or nucleotide base 1-2622791 of SEQ ID NO: 3; wherein the chromosome interval further comprises at least one allele as depicted in any one of respective Tables 1-3.

Methods for identifying and/or selecting a disease resistant soybean plant or germplasm may comprise, consist essentially of, or consist of detecting the presence of a marker associated with enhanced ASR tolerance. The marker may be detected in any sample taken from the plant or germplasm, including, but not limited to, the whole plant or germplasm, a portion of said plant or germplasm (e.g., a seed chip, a leaf punch disk or a cell from said plant or germplasm) or a nucleotide sequence from said plant or germplasm. Such a sample may be taken from the plant or germplasm using any present or future method known in the art, including, but not limited to, automated methods of removing a portion of endosperm with a sharp blade, drilling a small hole in the seed and collecting the resultant powder, cutting the seed with a laser and punching a leaf disk. The soybean plant may be of a non-naturally occurring variety of soybean. In some embodiments, the genome of the soybean plant or germplasm is at least about 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 97%, 99% or 100% identical to that of an elite variety of soybean.

In some embodiments, the marker detected in the sample may comprise, consist essentially of or consist of one or more marker alleles located within a chromosomal interval selected from the group consisting of:

- 1) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1; or
- 2) chromosomal interval derived from PI440935, PI483193, PI595799 or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2.; or

- 3) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to 2622791 of SEQ ID NO: 3; or
- 4) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises a portion of any one of the chromosome intervals described in 1)-3) wherein the chromosome interval comprises at least one SNP marker as demonstrated respectfully in any one of Tables 1-3; or
- 5) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, or 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3.

Methods for producing an disease resistant soybean plant may comprise, consist essentially of or consist of detecting, in a germplasm, a marker associated with enhanced disease resistance (e.g. ASR) wherein said marker is selected from any one of Tables 1-3 or wherein marker is a closely linked loci of any marker described in any of Tables 1-3 and producing a soybean plant from said germplasm. The marker may be detected in any sample taken from the germplasm, including, but not limited to, a portion of said germplasm (e.g., a seed chip or a cell from said germplasm) or a nucleotide sequence from said germplasm. Such a sample may be taken from the germplasm using any present or future method known in the art, including, but not limited to, automated methods of removing a portion of endosperm with a sharp blade, drilling a small hole in the seed and collecting the resultant powder, cutting the seed with a laser and punching a leaf disk. The germplasm may be of a non-naturally occurring variety of soybean. In some embodiments, the genome of the germplasm is at least about 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 97%, 99% or 100% identical to that of an elite variety of soybean. A disease resistant soybean plant is then produced from the germplasm identified as having the marker associated with enhanced disease resistance (e.g. ASR) according to methods well known in the art for breeding and producing plants from germplasm.

In some embodiments, the marker detected in the germplasm may comprise, consist essentially of or consist of one or more marker alleles located within a chromosomal interval selected from the group consisting of:

- 1) A chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1; or
- 2) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2.; or

- 3) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to 2622791 of SEQ ID NO: 3; or
- 4) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises a portion of any one of the chromosome intervals described in 1)-3) wherein the chromosome interval comprises at least one SNP marker as demonstrated respectfully in any one of Tables 1-3; or
- 5) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3.

Methods for producing and/or selecting an Asian soy rust resistant/tolerant soybean plant or germplasm may comprise crossing a first soybean plant or germplasm with a second soybean plant or germplasm, wherein said first soybean plant or germplasm comprises a chromosomal interval selected from the group consisting of:

- 1) A chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1; or
- 2) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2.; or
- 3) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to 2622791 of SEQ ID NO: 3; or
- 4) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises a portion of any one of the chromosome intervals described in 1)-3) wherein the chromosome interval comprises at least one SNP marker as demonstrated respectfully in any one of Tables 1-3; or
- 5) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3.
- 6) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the

SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3; or

- 7) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3, and crossing with a second soybean plant not comprising the chromosome interval then producing a progeny plant with increased ASR resistance. Either the first or second soybean plant or germplasm, or both, may be of a non-naturally occurring variety of soybean. In some embodiments, the second soybean plant or germplasm is of an elite variety of soybean. In some embodiments, the genome of the second soybean plant or germplasm is at least about 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 97%, 99% or 100% identical to that of an elite variety of soybean.

Also provided herein is a method of introgressing an allele associated with enhanced Disease (e.g. ASR, SCN, SDS, RKN, Phytophthora, etc.) resistance / tolerance (e.g. ASR, SCN, SDS, RKN, Phytophthora, etc.) in to a soybean plant. Such methods for introgressing an allele associated with enhanced Disease (e.g. ASR, SCN, SDS, RKN, Phytophthora, etc.) resistance / tolerance into a soybean plant or germplasm may comprise, consist essentially of or consist of crossing a first soybean plant or germplasm comprising said allele (the donor) wherein said allele is selected from any allele listed in Tables 1-3 or a marker in "close proximity" to a marker listed in Tables 1-3 with a second soybean plant or germplasm that lacks said allele (the recurrent parent) and repeatedly backcrossing progeny comprising said allele with the recurrent parent. Progeny comprising said allele may be identified by detecting, in their genomes, the presence of a marker associated with enhanced Disease (e.g. ASR, SCN, SDS, RKN, Phytophthora, etc.) resistance / tolerance. The marker may be detected in any sample taken from the progeny, including, but not limited to, a portion of said progeny (e.g., a seed chip, a leaf punch disk or a cell from said plant or germplasm) or a nucleotide sequence from said progeny. Such a sample may be taken from the progeny using any present or future method known in the art, including, but not limited to, automated methods of removing a portion of endosperm with a sharp blade, drilling a small hole in the seed and collecting the resultant powder, cutting the seed with a laser and punching a leaf disk. Either the donor or the recurrent parent, or both, may be of a non-naturally occurring variety of soybean. In some embodiments, the recurrent parent is of an elite variety of soybean. In some embodiments, the genome of the recurrent parent is at least about 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 97%, 99% or 100% identical to that of an elite variety of soybean.

In some embodiments, the marker used to identify progeny comprising an allele associated with enhanced Disease (e.g. ASR, SCN, SDS, RKN, Phytophthora, brown stem rot etc.) resistance /

tolerance may comprise, consist essentially of or consist of one or more marker alleles located within a chromosomal interval selected from the group consisting of:

- 1) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1; or
- 2) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2.; or
- 3) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to 2622791 of SEQ ID NO: 3; or
- 4) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises a portion of any one of the chromosome intervals described in 1)-3) wherein the chromosome interval comprises at least one SNP marker as demonstrated respectfully in any one of Tables 1-3; or
- 5) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3; or
- 6) a chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in Tables 1-3 or any closely linked markers in close proximity to said intervals 1) – 4).

In some embodiments, the marker may comprise, consist essentially of or consist of marker alleles located in at least two different chromosomal intervals. For example, the marker may comprise one or more alleles located in the chromosomal interval defined by and including any two markers in Table 1, any two markers located in Table 2 any two markers in Table 3 or a combination of any SNP markers thereof.

Disease resistant Soybean Plants and Germplasms

The present invention provides disease resistant soybean plants and germplasms. As discussed above, the methods of the present invention may be utilized to identify, produce and/or select a disease resistant soybean plant or germplasm (for example a soybean plant resistant or having increased tolerance to Asian Soybean Rust). In addition to the methods described above, a disease resistant soybean plant or germplasm may be produced by any method whereby a marker associated with enhanced Disease tolerance is introduced into the soybean plant or germplasm, including, but not

limited to, transformation, protoplast transformation or fusion, a double haploid technique, embryo rescue, gene editing and/or by any other nucleic acid transfer system.

In some embodiments, the soybean plant or germplasm comprises a non-naturally occurring variety of soybean. In some embodiments, the soybean plant or germplasm is at least about 50%,
 5 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 97%, 99% or 100% identical to that of an elite variety of soybean.

The Disease resistant soybean plant or germplasm may be the progeny of a cross between an elite variety of soybean and a variety of soybean that comprises an allele associated with enhanced Disease tolerance (e.g. ASR) wherein the allele is within a chromosomal interval selected from the
 10 group consisting of:

- 1) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1; or
- 15 2) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2.; or
- 3) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to 2622791 of SEQ ID NO: 3; or
- 20 4) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises a portion of any one of the chromosome intervals described in 1)-3) wherein the chromosome interval comprises at least one SNP marker as demonstrated respectfully in any one of Tables 1-3; or
- 25 5) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3; or
- 30 6) a chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in Tables 1-3 or any closely linked markers in close proximity to said intervals 1) – 4).

The disease resistant soybean plant or germplasm may be the progeny of an introgression
 35 wherein the recurrent parent is an elite variety of soybean and the donor comprises an allele associated with enhanced disease tolerance and/or resistance wherein the donor carries a chromosomal interval

or a portion thereof comprising any one of SEQ ID NOs: 1 – 3 and wherein the chromosome interval comprises at least one allele selected respectively from Tables 1-3.

5 The disease resistant soybean plant or germplasm may be the progeny of a cross between a first elite variety of soybean (e.g., a tester line) and the progeny of a cross between a second elite variety of soybean (e.g., a recurrent parent) and a variety of soybean that comprises an allele associated with enhanced ASR tolerance (e.g., a donor).

10 The Disease resistant soybean plant or germplasm may be the progeny of a cross between a first elite variety of soybean and the progeny of an introgression wherein the recurrent parent is a second elite variety of soybean and the donor comprises an allele associated with enhanced ASR tolerance.

A Disease resistant soybean plant and germplasm of the present invention may comprise one or more markers of the present invention (e.g. any marker described in Tables 1-3; or any marker in close proximity to any marker as described in Tables 1-3).

15 In some embodiments, the Disease resistant soybean plant or germplasm may comprise within its genome, a marker associated with enhanced ASR tolerance, wherein said marker is located within a chromosomal interval selected from the group consisting of:

- 1) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1; or
- 20 2) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2.; or
- 3) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to 2622791 of SEQ ID NO: 3; or
- 25 4) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises a portion of any one of the chromosome intervals described in 1)-3) wherein the chromosome interval comprises at least one SNP marker as demonstrated respectfully in any one of Tables 1-3; or
- 30 5) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3; or
- 35 6) a chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP

marker is selected from the group consisting of any SNP marker displayed in Tables 1-3 or any closely linked markers in close proximity to said intervals 1) – 4).

In some embodiments, the disease resistant soybean plant or germplasm may comprise within its genome a marker that comprises, consists essentially of or consists of marker alleles located in at least two different chromosomal intervals. For example, the marker may comprise one or more alleles located in the chromosomal interval defined by and including any combination of two markers in any one of Tables 1-3.

Disease resistant Soybean Seeds

The present invention provides disease resistant soybean seeds. As discussed above, the methods of the present invention may be utilized to identify, produce and/or select a Disease resistant soybean seed. In addition to the methods described above, a disease resistant soybean seed may be produced by any method whereby a marker associated with enhanced ASR tolerance is introduced into the soybean seed, including, but not limited to, transformation, protoplast transformation or fusion, a double haploid technique, embryo rescue, genetic editing (e.g. CRISPR or TALEN or MegaNucleases) and/or by any other nucleic acid transfer system.

In some embodiments, the disease resistant soybean seed comprises a non-naturally occurring variety of soybean. In some embodiments, the soybean seed is at least about 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 97%, 99% or 100% identical to that of an elite variety of soybean.

The disease resistant soybean seed may be produced by a disease resistant soybean plant identified, produced or selected by the methods of the present invention. In some embodiments, the disease resistant soybean seed is produced by a disease resistant soybean plant of the present invention.

A disease resistant soybean seed of the present invention may comprise one or more markers from Tables 1-3 of the present invention.

In some embodiments, the Disease resistant soybean seed may comprise within its genome, a marker associated with enhanced ASR tolerance, wherein said marker is located within a chromosomal interval selected from the group consisting of:

- 1) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 5873075 of SEQ ID NO: 1; or
- 2) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to nucleotide base 2442980 of SEQ ID NO: 2.; or

- 3) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval corresponds with nucleotide base 1 to 2622791 of SEQ ID NO: 3; or
- 5 4) chromosomal interval derived from PI440935, PI483193, PI595799, or a progeny thereof wherein said chromosomal interval comprises a portion of any one of the chromosome intervals described in 1)-3) wherein the chromosome interval comprises at least one SNP marker as demonstrated respectfully in any one of Tables 1-3; or
- 10 5) A chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in any one of Tables 1-3; or
- 15 6) a chromosomal interval spanning 20cM, 15cM, 10cM, 5cM, 1cM, 0.5cM from a SNP marker that associates with increased ASR resistance in soybean wherein the SNP marker is selected from the group consisting of any SNP marker displayed in Tables 1-3 or any closely linked markers in close proximity to said intervals 1) – 4).

EXAMPLES

20 The following examples are not intended to be a detailed catalog of all the different ways in which the present invention may be implemented or of all the features that may be added to the present invention. Persons skilled in the art will appreciate that numerous variations and additions to the various embodiments may be made without departing from the present invention. Hence, the following descriptions are intended to illustrate some particular embodiments of the invention, and not to exhaustively specify all permutations, combinations and variations thereof.

25

Example 1: Identification of ASR Resistant Wild Glycine Lines

Wild glycine lines were evaluated for rust resistance against sixteen rust strains (See Figure 1). The rust data were generated using single pustule derived isolates from USDA-ARS (FL Q09, FL Q12, LABR13, FLQ11) and field populations (FL Q15, NC06, Vero, GLC15, UBL, BR south and BR central), the screening was carried out in contained facilities (FL Q09, FL Q12, LABR13, FLQ11, FL Q15, NC06, Vero, GLC15, UBL, BR South, BR central).

30

The rust rating is categorized based on groupings modified from Burdon and Speer, TAG, 1984 (see FIG 2). Each accession was screened >2 times with ~4 plants each time in North & South America.

35

Example 2: Allele Mining & Associations to PI440935, PI483193, PI595799 ASR Loci

A resistant parent was crossed to a susceptible *G. canescens* line and an F1 plant was generated (See Table 4). The F1 plant was self-fertilized and F2 seed was harvested from the selfed F1 plant. Around 200 F2 seed were sown and leaf tissue from each plant was collected for DNA preps and then the plants were inoculated with *Phakopsora pachyrhizi* to determine the resistance/susceptible phenotype of each F2 individual. Tissue from 50 resistant F2s and 50 susceptible F2s were combined in separate pools and genomic DNA was prepared from each pool. Illumina sequencing libraries were prepared from DNA for each of the pools and each library was sequenced in two Illumina HiSeq2000 2x100bp Paired-End (PE) lanes. The average yield per sample was 383 million read pairs, which equals 77 gigabases of sequence per library. The sequencing reads were trimmed to remove bases with PHRED quality scores of <15.

As one non-limiting example, an ASR resistance phenotype may include the formation of lesions without spores on leaves of a plant exposed to ASR, while an ASR susceptible phenotype includes the formation of spores on the leaves of a plant exposed to ASR. Still other phenotypes may be used to distinguish ASR resistant plants from susceptible plants.

Quality trimmed reads were aligned to the PI440935 and PI595799 reference genome sequence using GSNAP (WU and NACU 2010) as paired-end fragments. If a pair of reads could not be aligned together, they were treated as singletons for alignment. Reads were used in subsequent analyses if they mapped uniquely to the reference (≤ 2 mismatches every 36 bp and less than 5 bases for every 75 bp as tails).

SNPs were filtered prior to BSA analysis based on read depth, with SNPs having between 40 and 200x read depth being retained. A Chi-square test was used to select SNPs with significantly different read counts between the two alleles in the two pools. An empirical Bayesian approach (LIU et al. 2012) was used to estimate the conditional probability that there is no recombination between each SNP marker and the causal locus in both the resistant pool and in the susceptible pool. The probability of the linkage between the SNP and the causal gene is the geometric mean of these two conditional probabilities. Around 1000 SNPs were found to have possible linkage to the target locus. A subset of these putatively linked SNPs was used to fine map the locus using phenotyped F2 individuals.

See references: LIU, S., C.-T. YEH, H. M. TANG, D. NETTLETON AND P. S. SCHNABLE, 2012 Gene Mapping via Bulk Segregant RNA-Seq (BSR-Seq). PLoS ONE 7: e36406 & Wu, T. D., and S. Nacu, 2010 Fast and SNP-tolerant detection of complex variants and splicing in short reads.

Bioinformatics 26: 873-881.

TABLE 4: Plant Crossings & Study Type

Species	PI# (male)	PI # (female)	Study Type	F2: Resistant to Susceptible Ratio
<i>G. canescens</i>	PI 440935	PI 505154	BSA	3:01
<i>G. canescens</i>	PI 440935	PI 505154	Indexing	3:01
<i>G. canescens</i>	PI 483193	PI 505154	BSR+DEG	3:01
<i>G. canescens</i>	PI 595799	PI 505154	Indexing	3:01

1. PI440935 Data2Bio LLC (Ames, Iowa) Lab Methodology for gBSA-Seq Analysis for Tetraploid Soybean.

5 Chromosome discovery for causal loci in the tetraploid soybean population, PI440935 was carried out using Data2Bio's Genomic Bulk Segregant Analysis (gBSA) technology. It was theorized that resistance is controlled by a single dominant gene. Data2Bio generated several libraries from DNA samples extracted from two susceptible tissue pools and two resistant tissue pools and sequenced these in eight (8) Illumina HiSeq2000 2x100bp Paired-End (PE) lanes. A summary of the reference genomes used for subsequent analyses, read processing from raw data to quality trimming, alignment, SNP discovery and SNP impact are demonstrated in Figures 3-5. After various filtering steps 1,099,754 and 324,931 informative SNPs were identified in the PI440935 genome. A Bayesian approach was then used to calculate trait-associated probabilities. Next, physical maps of trait-associated SNPs (probability cutoff 0.01) for the top contigs were created (Figures 3-5). One scaffold, scaffold 000056F, was identified and mapped to chromosome 14 of PI440953 (SEQ ID NOs: 1). SNPs from this enriched scaffold were mapped to the public *G. max* genome. An additional smaller cluster of SNPs from other scaffolds were also observed on chromosome 6 (see Figures 3-4).

20

2. PI595799 Data2Bio LLC (Ames, Iowa) Lab Methodology for gBSA-Seq Analysis for Tetraploid Soybean

25 Chromosome discovery for causal loci in the tetraploid soybean population, PI595799 was carried out. A physical map of trait-associated SNPs on contigs was created. The clustering of these SNPs indicates that the resistance gene is located on or near scaffold 000090F (SEQ ID NO: 2). The context sequences associated with these SNPs were also aligned to the public *G. max* genome to create a chromosome-level understanding of the mapping interval. The chromosomal positions of the

trait-associated SNPs were then displayed graphically.

Example 3 Embryo Rescue & Introgression of R Gene Intervals Into *Glycine max* Lines

Embryo rescue is performed and chemical treatment is applied in order to generate amphidiploid shoots (that is, shoots from plants having chromosomes from both parents that have been doubled in number through the use of chemical treatment). If the amphidiploid plants are fertile they will be used to backcross with *G. max*. Backcrossing with *G. max* and subsequent embryo rescue will need to be performed for several generations in order to gradually eliminate the perennial *Glycine* chromosomes.

Wide crosses: Elite Syngenta soybean lines (RM 3.7 to 4.8) are used as the females (pollen recipients) and multiple accessions of *Glycine canescens* are used as the males or pollen donors. Selecting flowers from the glycine plant containing anthers at the proper developmental stage is important. New, fully-opened, brightly colored flowers hold anthers with mature pollen. The pollen should appear as loose, yellow dust. These flowers are removed from the glycine plant and taken to the soybean plant for pollination. Pollen from the *Glycine* plants should be used within 30 minutes of flower removal. It is also important to identify and select soybean flower buds that are ready for pollination. A soybean flower bud is generally ready when it is larger in size when compared to an immature bud. The sepals of the soybean blossoms are lighter in color and the petals are just beginning to appear. First, use a pair of fine-tipped tweezers to carefully detach the sepals from the flower bud to expose the outer set of petals. Then gently grasp and remove the petals (5 in total) from the flower exposing the ring of stamens surrounding the pistil. Since the stigma is receptive to pollen 1 day before the anthers begin shedding pollen it is important to recognize the stage development of “female ready, male not ready”. When pollinating soybean flowers at this developmental stage it is not necessary to emasculate the female flower. Locate the stigma on the soybean flower. Then using 1 male flower, carefully peel off the petals to expose the anthers and gently dust the pollen grains onto the stigma of the soybean flower. Care should be taken not to damage the stigma at any time during this process. Starting the day after pollination a hormone mixture is sprayed onto the pollinated flower and eventual developing F1 pod 1X every day until harvest. The pollinated flower or pod is saturated with a light mist of the hormone mixture, taking care not to cause the flower/pod to prematurely detach from the plant. The mixture contains 100 mg GA3, 25 mg NAA and 5 mg kinetin / L distilled water. These hormones aid in the retention of the developing pod and in increased pod growth.

Harvest: Pods from wide crosses are harvested at approximately 14 to 16 days post pollination. (Harvest dates in the literature suggest 19 to 21 days. Herein, the harvest is ~5 days earlier than literature, reducing timeline. Before selecting an individual pod to harvest verify that the sepals were removed (this indicates a wide cross attempt) and that the seed size is as expected for a

wide cross. Pods are collected and counted according to wide cross combination to determine crossing success. The average crossing success across multiple soybean females and 5 different accessions of *Glycine canescens* is approximately 40%. The wide cross pods can contain 1 to 3 seeds but generally 2 seeds are found in each F1 pod.

5 Embryo rescue: Our embryo rescue protocol involves direct shoot regeneration from embryos, rather than regeneration through embryogenesis, thus making plant recovery quicker (shoot recovery in approximately 2 – 3 months, compared to reported up to 1 year timeline). Our protocol does not include culture in the dark following transfer to germination medium. Our protocol does not require a transfer to rooting medium.

10 Harvested pods are collected and brought back to the lab to be sterilized. The pods are first rinsed with 70% EtOH for 2 to 3 minutes and then placed in 10% Clorox bleach for an additional 30 minutes on a platform shaker at approximately 130 RPM. Finally, the pods are rinsed multiple times with sterile water to remove any residual bleach. Embryo isolation can begin immediately following pod sterilization or pods can be stored at 4°C for up to 24 hours prior to embryo isolation. The
15 sterilized pods are next taken to a laminar flow hood where the embryos can be rescued. Individual pods are placed in a sterile petri dish and opened using a scalpel and forceps. An incision is made along the length of the wide cross pod away from the seed. The pod can then be easily opened to expose the seed. Alternatively, two pair of forceps can be used to separate the pod shell. Carefully remove the seed from the pod and place in a sterile petri dish under the dissection microscope. Very
20 fine forceps are needed to isolate the embryo from the seed. With forceps in one hand, gently hold the side of the seed away from the embryo, with hilum facing up. Use another pair of forceps in the other hand to remove the seed coat from the side of the seed containing the embryo. Peel off the membrane surrounding the embryo and push the embryo up from its bottom side. Embryos should be past the globular developmental stage and preferably past the early heart developmental stage (middle to late
25 heart stage, cotyledon stage and early maturation stage embryos are desired). Isolated embryos are transferred to embryo rescue medium such as Soy ER1-1. Embryos can be treated to induce chromosome doubling at this time. (See below for chromosome doubling details.) Isolated embryos remain on embryo rescue medium for 21 to 30 days at 24°C. Embryos may remain in the dark for the entire incubation on ER1-1, may begin the incubation in the dark and complete it in the light, or may
30 spend the entire incubation in the light. There is not a callus induction stage in this protocol. Shoots are developed directly from the embryos.

 Chromosome doubling treatments: Either colchicine or trifluralin can be used to induce chromosome doubling to produce a doubled F1 plant. The chemical treatment can be done immediately following embryo rescue. Ideally, late heart stage wide cross embryos (or larger) are
35 chemically treated to induce chromosome doubling at any time from immediately following isolation up to 1 week post isolation. The doubling agent can be mixed in either solid or liquid medium and applied for several hours or up to a few days. Trifluralin is used at a concentration of 10 – 40uM in

either solid or liquid media. Additionally, colchicine is used at a concentration of 0.4 – 1 mg/ml in either solid or liquid media. Following the chemical treatment the embryos are transferred to fresh embryo rescue medium.

Shoot regeneration: Developing embryos are transferred from rescue medium to germination medium such as Soy ER GSMv2 for approximately 3 to 5 weeks in the light at 24°C. Alternatively, developing embryos may be transferred from rescue medium to elongation medium such as Soy E1 0 No TCV for approximately 3 to 5 weeks in the light at 24°C. Developing shoots may be transferred from media plates to Phytocons containing either germination or elongation medium for further shoot development. Established shoots are moved to soil. Initial plant care is critical for survival of these shoots.

Ploidy Analysis: Ploidy analysis is conducted using a flow cytometer. Leaf tissue for ploidy analysis is collected from small shoots either in culture or after establishment in soil. Tissue is collected on dry ice and stored at -80°C until analysis, or collected on wet ice and analyzed the same day. A sample size of 0.5cm² is sufficient. Samples are prepared according to the instructions in the Sysmex kit. Each sample set contains an untreated F1 plant (not treated to induce chromosome doubling) as a control. The following are method notes: Wide crosses – Our wide cross success rate is significantly higher than that reported in the literature. No emasculation of female flowers is performed, which saves time and reduces risk of damage to the stigma.

The above examples clearly illustrate the advantages of the invention. Although the present invention has been described with reference to specific details of certain embodiments thereof, it is not intended that such details should be regarded as limitations upon the scope of the invention except as and to the extent that they are included in the accompanying claims.

For example, the current disclosure is also directed to an elite *Glycine max* plant having introduced into its genome a chromosomal interval from a *Glycine tomentella* line selected from at least one of PI509501 or a progeny thereof, wherein said chromosomal interval confers increased Asian soy rust (ASR) resistance as compared to a control plant not comprising said chromosomal interval. The chromosomal interval may vary and may include SEQ ID NO: 5, SEQ ID NO: 6, both, or a portion of either. Table 5 illustrates, by way of example, a few of the SNP marker associated with increased ASR resistance within SEQ ID NO: 5. Similar SNPs are expected to be present in SEQ ID NO: 6 due to homology. The current disclosure also includes progeny of those plants, as well as plant cells.

In one embodiment, the disclosure is directed to an elite soybean plant comprising a ASR resistant allele which confers increased resistance to ASR, and wherein the ASR allele comprises at least one single nucleotide polymorphism (SNP) selected from the group of “favorable” SNPs described in Table 5.

In another embodiment, the disclosure is directed to an elite soybean plant comprising a chromosomal interval from *Glycine tomentella* comprising at least one favorable SNP marker selected from Table 5.

The current disclosure also includes methods for producing a *Glycine max* plant shaving increased resistance to ASR. In one example, a method comprises the steps of:

- (a) providing a *Glycine tomentella* plant line, or progeny thereof comprising a chromosomal interval corresponding to any one of SEQ ID NOs 4-5; (b) carrying out the embryo rescue method essentially as described in Example 3 or as described in US 7,842,850; (c) collecting the seeds resulting from the method of (b); and (d) regenerating the seeds of (c) into plants.

The *Glycine tomentella* plant line of (a) may be PI509501 or a progeny thereof.

In another embodiment, the current disclosure is directed to methods of identifying or selecting soybean plants having an ASR resistance allele derived from *Glycine tomentella*. In one example, a method comprises the steps of: (a) isolating a nucleic acid from a soybean plant; (b) detecting in the nucleic acid the presence of a molecular marker that associates with increased ASR resistance wherein the molecular marker is located within an interval corresponding to SEQ ID NO: 4 or SEQ ID NO: 5; and (c) Identifying or selecting a soybean plant having a ASR resistance allele derived from *Glycine tomentella*.

Table 5

Cross	RefSeq	Position	Favorable Allele	Unfavorable Allele
PI_537294_x_PI_509501	scaffold4269	23239	T	C
PI_537294_x_PI_509501	scaffold4269	79983	C	T
PI_537294_x_PI_509501	scaffold4269	99272	T	A
PI_537294_x_PI_509501	scaffold4269	104752	T	C
PI_537294_x_PI_509501	scaffold4269	124092	A	G
PI_537294_x_PI_509501	scaffold4269	129565	A	G
PI_537294_x_PI_509501	scaffold4269	129705	G	C
PI_537294_x_PI_509501	scaffold4269	130014	C	T
PI_537294_x_PI_509501	scaffold4269	135090	T	C
PI_537294_x_PI_509501	scaffold4269	167337	T	A
PI_537294_x_PI_509501	scaffold4269	167965	A	G
PI_537294_x_PI_509501	scaffold4269	168112	C	T
PI_537294_x_PI_509501	scaffold4269	168232	G	T
PI_537294_x_PI_509501	scaffold4269	177749	T	C
PI_537294_x_PI_509501	scaffold4269	178004	A	G
PI_537294_x_PI_509501	scaffold4269	185159	T	C
PI_537294_x_PI_509501	scaffold4269	186815	A	C

PI_537294_x_PI_509501	scaffold4269	241213	T	C
PI_537294_x_PI_509501	scaffold4269	293570	A	G
PI_537294_x_PI_509501	scaffold4269	298588	G	A
PI_537294_x_PI_509501	scaffold4269	301999	A	C
PI_537294_x_PI_509501	scaffold4269	306886	A	G
PI_537294_x_PI_509501	scaffold4269	306945	A	G
PI_537294_x_PI_509501	scaffold4269	318152	A	G
PI_537294_x_PI_509501	scaffold4269	334509	C	A
PI_537294_x_PI_509501	scaffold4269	335048	C	T
PI_537294_x_PI_509501	scaffold4269	363718	G	T
PI_537294_x_PI_509501	scaffold4269	365520	A	G
PI_537294_x_PI_509501	scaffold4269	388565	G	A
PI_537294_x_PI_509501	scaffold4269	396540	A	G
PI_537294_x_PI_509501	scaffold4269	404113	CT	C
PI_537294_x_PI_509501	scaffold4269	406222	A	G
PI_537294_x_PI_509501	scaffold4269	450526	G	A
PI_537294_x_PI_509501	scaffold4269	451859	A	C
PI_537294_x_PI_509501	scaffold4269	534852	T	C
PI_537294_x_PI_509501	scaffold4269	603200	A	T
PI_537294_x_PI_509501	scaffold4269	606351	G	T
PI_537294_x_PI_509501	scaffold4269	615832	G	T
PI_537294_x_PI_509501	scaffold4269	651624	C	A
PI_537294_x_PI_509501	scaffold4269	652357	T	C
PI_537294_x_PI_509501	scaffold4269	653033	A	T
PI_537294_x_PI_509501	scaffold4269	653720	A	G
PI_537294_x_PI_509501	scaffold4269	667853	C	T
PI_537294_x_PI_509501	scaffold4269	667989	G	A
PI_537294_x_PI_509501	scaffold4269	668172	T	C
PI_537294_x_PI_509501	scaffold4269	669025	A	AG
PI_537294_x_PI_509501	scaffold4269	669075	A	G
PI_537294_x_PI_509501	scaffold4269	669262	G	A
PI_537294_x_PI_509501	scaffold4269	669335	A	G
PI_537294_x_PI_509501	scaffold4269	669403	T	C
PI_537294_x_PI_509501	scaffold4269	670340	G	T
PI_537294_x_PI_509501	scaffold4269	671701	A	G
PI_537294_x_PI_509501	scaffold4269	672067	C	T
PI_537294_x_PI_509501	scaffold4269	672353	A	C
PI_537294_x_PI_509501	scaffold4269	743371	T	A
PI_537294_x_PI_509501	scaffold4269	785665	A	G
PI_537294_x_PI_509501	scaffold4269	834490	T	G
PI_537294_x_PI_509501	scaffold4269	947136	C	G
PI_537294_x_PI_509501	scaffold4269	1043091	C	G
PI_537294_x_PI_509501	scaffold4269	1051471	G	C
PI_537294_x_PI_509501	scaffold4269	1091749	A	G
PI_537294_x_PI_509501	scaffold4269	1141217	T	A

PI_537294_x_PI_509501	scaffold4269	1185573	C	CA
PI_537294_x_PI_509501	scaffold4269	1186111	C	T
PI_537294_x_PI_509501	scaffold4269	1189165	T	C
PI_537294_x_PI_509501	scaffold4269	1189407	A	G
PI_537294_x_PI_509501	scaffold4269	1192588	T	C
PI_537294_x_PI_509501	scaffold4269	1258706	C	T
PI_537294_x_PI_509501	scaffold4269	1259100	G	T
PI_537294_x_PI_509501	scaffold4269	1260122	A	C
PI_537294_x_PI_509501	scaffold4269	1261232	A	G
PI_537294_x_PI_509501	scaffold4269	1443299	T	C
PI_537294_x_PI_509501	scaffold4269	1445035	G	A
PI_537294_x_PI_509501	scaffold4269	1476447	G	T
PI_537294_x_PI_509501	scaffold4269	1497620	G	A
PI_537294_x_PI_509501	scaffold4269	1502459	A	G
PI_537294_x_PI_509501	scaffold4269	1560486	A	C
PI_537294_x_PI_509501	scaffold4269	1591755	T	A
PI_537294_x_PI_509501	scaffold4269	1614887	T	A
PI_537294_x_PI_509501	scaffold4269	1618869	T	C
PI_537294_x_PI_509501	scaffold4269	1623989	G	A
PI_537294_x_PI_509501	scaffold4269	1629367	G	A
PI_537294_x_PI_509501	scaffold4269	1638390	T	C
PI_537294_x_PI_509501	scaffold4269	1678873	G	A
PI_537294_x_PI_509501	scaffold4269	1716722	A	C
PI_537294_x_PI_509501	scaffold4269	1726691	A	T
PI_537294_x_PI_509501	scaffold4269	1728080	T	C
PI_537294_x_PI_509501	scaffold4269	1730100	C	T
PI_537294_x_PI_509501	scaffold4269	1730273	C	A
PI_537294_x_PI_509501	scaffold4269	1737567	G	A
PI_537294_x_PI_509501	scaffold4269	1745729	A	G
PI_537294_x_PI_509501	scaffold4269	1765553	C	T
PI_537294_x_PI_509501	scaffold4269	1779607	A	G
PI_537294_x_PI_509501	scaffold4269	1786196	C	T
PI_537294_x_PI_509501	scaffold4269	1795928	G	A
PI_537294_x_PI_509501	scaffold4269	1958636	A	G
PI_537294_x_PI_509501	scaffold4269	1975738	C	G
PI_537294_x_PI_509501	scaffold4269	1983209	T	G
PI_537294_x_PI_509501	scaffold4269	2008372	T	C
PI_537294_x_PI_509501	scaffold4269	2021838	T	C
PI_537294_x_PI_509501	scaffold4269	2049875	G	C
PI_537294_x_PI_509501	scaffold4269	2050047	T	G
PI_537294_x_PI_509501	scaffold4269	2062531	G	T
PI_537294_x_PI_509501	scaffold4269	2177333	T	A
PI_537294_x_PI_509501	scaffold4269	2180268	G	A
PI_537294_x_PI_509501	scaffold4269	2260853	A	T
PI_537294_x_PI_509501	scaffold4269	2307445	G	A

PI_537294_x_PI_509501	scaffold4269	2307823	C	T
PI_537294_x_PI_509501	scaffold4269	2313465	A	G
PI_537294_x_PI_509501	scaffold4269	2316786	T	C
PI_537294_x_PI_509501	scaffold4269	2328060	A	C
PI_537294_x_PI_509501	scaffold4269	2343963	T	C
PI_537294_x_PI_509501	scaffold4269	2382088	A	G
PI_537294_x_PI_509501	scaffold4269	2382218	C	T
PI_537294_x_PI_509501	scaffold4269	2383429	T	C
PI_537294_x_PI_509501	scaffold4269	2383578	GGGA	G
PI_537294_x_PI_509501	scaffold4269	2390431	A	T
PI_537294_x_PI_509501	scaffold4269	2409220	A	C
PI_537294_x_PI_509501	scaffold4269	2429440	C	G
PI_537294_x_PI_509501	scaffold4269	2521364	T	C
PI_537294_x_PI_509501	scaffold4269	2572932	A	C
PI_537294_x_PI_509501	scaffold4269	2629073	T	C
PI_537294_x_PI_509501	scaffold4269	2651246	T	C
PI_537294_x_PI_509501	scaffold4269	2663637	G	T
PI_537294_x_PI_509501	scaffold4269	2749090	C	T
PI_537294_x_PI_509501	scaffold4269	2920846	T	C
PI_537294_x_PI_509501	scaffold4269	2945928	T	C
PI_537294_x_PI_509501	scaffold4269	2968546	A	T
PI_537294_x_PI_509501	scaffold4269	2970465	C	T
PI_537294_x_PI_509501	scaffold4269	2973995	A	T
PI_537294_x_PI_509501	scaffold4269	2993695	T	A

Throughout this application, various patents, patent publications and non-patent publications are referenced. The disclosures of these patents, patent publications and non-patent publications in their entireties are incorporated by reference herein into this application in order to more fully

5 describe the state of the art to which this invention pertains.

THAT WHICH IS CLAIMED:

1. A elite *Glycine max* plant having introduced into its genome a chromosomal interval from a *Glycine canescens* line selected from an accession line group consisting of PI440935, PI483193, PI595799 or a progeny thereof, wherein said chromosomal interval confers increased resistance to Asian soy rust (ASR) as compared to a control plant not comprising said chromosomal interval.
2. The plant of claim 1, wherein the chromosomal interval comprises SEQ ID NOs: 1, 2, or 3 or a portion of SEQ ID Nos: 1, 2, or 3.
3. The plant of claims 1-2, wherein the chromosomal interval comprises a SNP marker associated with increased ASR resistance wherein said SNP marker corresponds with any one of the favorable SNP markers as listed in Tables 1-3.
4. The plant of claims 1-3, wherein the chromosomal interval is derived from *Glycine canescens* chromosome 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, or 20.
5. The plant of claims 1-4, wherein the chromosomal interval corresponds to a position within the *Glycine canescens* genome that corresponds to SEQ ID NOs: 1-3.
6. A progeny plant or seed of any of claims 1-5.
7. A plant cell or plant part derived from the plant of claims 1-6.
8. The plant of claims 1-8, wherein the plant further shows increased resistance, relative to a control plant, to any one of the stresses selected from: diseases (such as powdery mildew, *Pythium ultimum*, *Phytophthora* root rot, leaf spot, blast, brown spot, root-knot nematode, soybean cyst nematode, soybean vein necrosis virus, soybean stem canker, soybean sudden death syndrome, leaf and neck blast, rust, frogeye leaf spot, brown stem rot, *Fusarium*, or sheath blight); insect pests (such as whitefly, aphid, grey field slug, sugarcane borer, green bug, or aphid); abiotic stress (such as drought tolerance, flooding, high level of salinity, heavy metal, aluminum, manganese, cadmium, zinc, UV-B, boron, iron deficiency chlorosis or cold tolerance (i.e. extreme temperatures)).

9. An elite soybean plant comprising an ASR resistant allele which confers increased resistance to ASR, and wherein the ASR allele comprises at least one single nucleotide polymorphism (SNP) selected from the group of “favorable” SNPs described in any one of Tables 1-3.
- 5 10. An elite soybean plant comprising a chromosomal interval from *Glycine canescens* comprising at least one favorable SNP marker selected from any one of Tables 1-3.
11. The plant of claim 10, wherein the *Glycine canescens* is any one of accession lines PI440935, PI483193, PI595799, or a progeny thereof.
- 10 12. A method for producing a *Glycine max* plant having increased resistance to ASR, the method comprising the steps of:
- 15 a. Providing a *Glycine canescens* plant line, or progeny thereof comprising a chromosomal interval corresponding to any one of SEQ ID NOs 1-3;
- b. Carrying out the embryo rescue method essentially as described in Example 3 or as described in US 7,842,850;
- c. Collecting the seeds resulting from the method of b)
- d. Regenerating the seeds of c) into plants.
- 20 13. The method of claim 12, wherein the *Glycine canescens* plant line of a) is any one of PI440935, PI483193, PI595799, or a progeny thereof.
- 25 14. A method of identifying or selecting a soybean plant having a ASR resistance allele derived from *Glycine canescens*, the method comprising the steps of:
- a. Isolating a nucleic acid from a soybean plant;
- b. Detecting in the nucleic acid the presence of a molecular marker that associates with increased ASR resistance, wherein the molecular marker is located within 20cM, 10cM, 5cM, 1cM, 0.5cM of a marker as described in any one of Tables 1-3; and
- 30 c. thereby Identifying or selecting a soybean plant having a ASR resistance allele derived from *Glycine canescens*.
15. An elite *Glycine max* plant having introduced into its genome a chromosomal interval from *Glycine tomentella*, a representative line being PI509501 or a progeny thereof, wherein said
- 35 chromosomal interval confers increased Asian soy rust (ASR) resistance as compared to a control plant not comprising said chromosomal interval.

16. The plant of claim 15, wherein the chromosomal interval comprises SEQ ID NOs: 5, 6, 5 and 6, or a portion of either.

5 17. The plant of claims 15-16, wherein the chromosomal interval comprises a SNP marker associated with increased ASR resistance, wherein said SNP marker corresponds with any one of the favorable SNP markers as listed in Table 5.

10 18. The plant of claims 15-17, wherein the chromosomal interval is derived from *Glycine tomentella* chromosome 14.

19. The plant of claims 15-18, wherein the chromosomal interval corresponds to a position within the *Glycine tomentella* genome that corresponds to SEQ ID NOs: 5 or 6.

15 20. A progeny plant or seed of any of claims 15-19.

21. A plant cell or plant part derived from the plant of claims 15-19.

20 22. An elite soybean plant comprising an ASR resistant allele which confers increased resistance to ASR, and wherein the ASR allele comprises at least one single nucleotide polymorphism (SNP) selected from the group of "favorable" SNPs described in Table 5.

23. An elite soybean plant comprising a chromosomal interval from *Glycine tomentella* comprising at least one favorable SNP marker selected from Table 5.

25 24. The plant of claim 23, wherein the *Glycine tomentella* is PI509501 or a progeny thereof.

25. A method for producing a Glycine max plant having increased resistance to ASR, the method comprising the steps of:

- 30 a. Providing a *Glycine tomentella* plant line, or progeny thereof comprising a chromosomal interval corresponding to any one of SEQ ID NOs 4-5;
- b. Carrying out the embryo rescue method essentially as described in Example 3 or as described in US 7,842,850;
- c. Collecting the seeds resulting from the method of b)
- d. Regenerating the seeds of c) into plants.

35 26. The method of claim 25, wherein the *Glycine tomentella* plant line of a) is PI509501 or a progeny thereof.

27. A method of identifying or selecting a soybean plant having a ASR resistance allele derived from *Glycine tomentella*, the method comprising the steps of:

a. Isolating a nucleic acid from a soybean plant;

5 b. Detecting in the nucleic acid the presence of a molecular marker that associates with increased ASR resistance wherein the molecular marker is located within an interval corresponding to SEQ ID NO: 4 or SEQ ID NO: 5; and

c. Identifying or selecting a soybean plant having an ASR resistance allele derived from *Glycine tomentella*.

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28. A plant of the species *Glycine max*, wherein a portion of a genome of the plant is obtained from a wild glycine species through the use of chemically induced chromosome doubling, and wherein said portion confers the plant with increased resistance to ASR as compared to a control plant not comprising the portion.

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29. A plant of the species *Glycine max*, wherein a genome of the plant comprises a chromosomal interval that confers increased resistance to ASR as compared to a control plant not comprising the interval, wherein said chromosomal interval is introduced into the plant from a wild glycine species, and wherein said plant with said chromosomal interval is obtained through chemically induced

20

30. The plant of claim 28 or 29, wherein the portion of the genome or the chromosomal interval is introduced from a *Glycine tomentella* plant line or a *Glycine canescens* plant line.

31. The plant of claim any of claims 28-30, wherein the *Glycine tomentella* plant line is accession
25 line PI509501 or a progeny thereof, or the *Glycine canescens* plant line is one of accession line PI440935, PI483193, PI595799 or a progeny thereof .

32. The plant of any of claims 28-31, wherein the chromosomal interval introduced from *Glycine tomentella* is introduced from chromosome 14 of *Glycine tomentella*.

30

33. The plant of any of claims 28-32, wherein the chromosomal interval introduced from *Glycine tomentella* corresponds to a position within the *Glycine tomentella* genome that corresponds to SEQ ID NOs: 5 or 6 or a portion of either.

34. The plant of any of claims 28-31, wherein the chromosomal interval introduced from *Glycine canescens* is introduced from chromosome 14 of *Glycine canescens*.

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35. The plant of any of claims 28-31 or 34, wherein the chromosomal interval introduced from *Glycine canescens* corresponds to a position within the *Glycine canescens* genome that corresponds to SEQ ID NOs: 1, 2, 3, or a portion thereof.

5 36. A progeny plant or seed of any of claims 28-35.

37. A plant cell or plant part derived from the plant of claims 28-36.

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FIG. 2: Rust Rating Scale

RB0-NSP	No reaction to infection, or extremely small flecks/lesions
RB1-2-NSP	Necrotic or chlorotic flecks only, no sporulation Large or dense necrotic or chlorotic flecks only, no sporulation
RB3-NSP	Minute uredia, large necrotic or chlorotic zones, few spores
RB4-SP	Small uredia with some associated necrotic or chlorotic tissues
TAN1-5-SP	Large profusely sporulating uredia. Little necrosis or chlorosis. 1-5 is the level of sporulation density and severity

FIG. 4: Depiction of *Glycine canescens* PI440935 SNPs Associated with ASR Resistance with chromosome number (i.e. each dot equals 1 SNP that associates with ASR resistance)

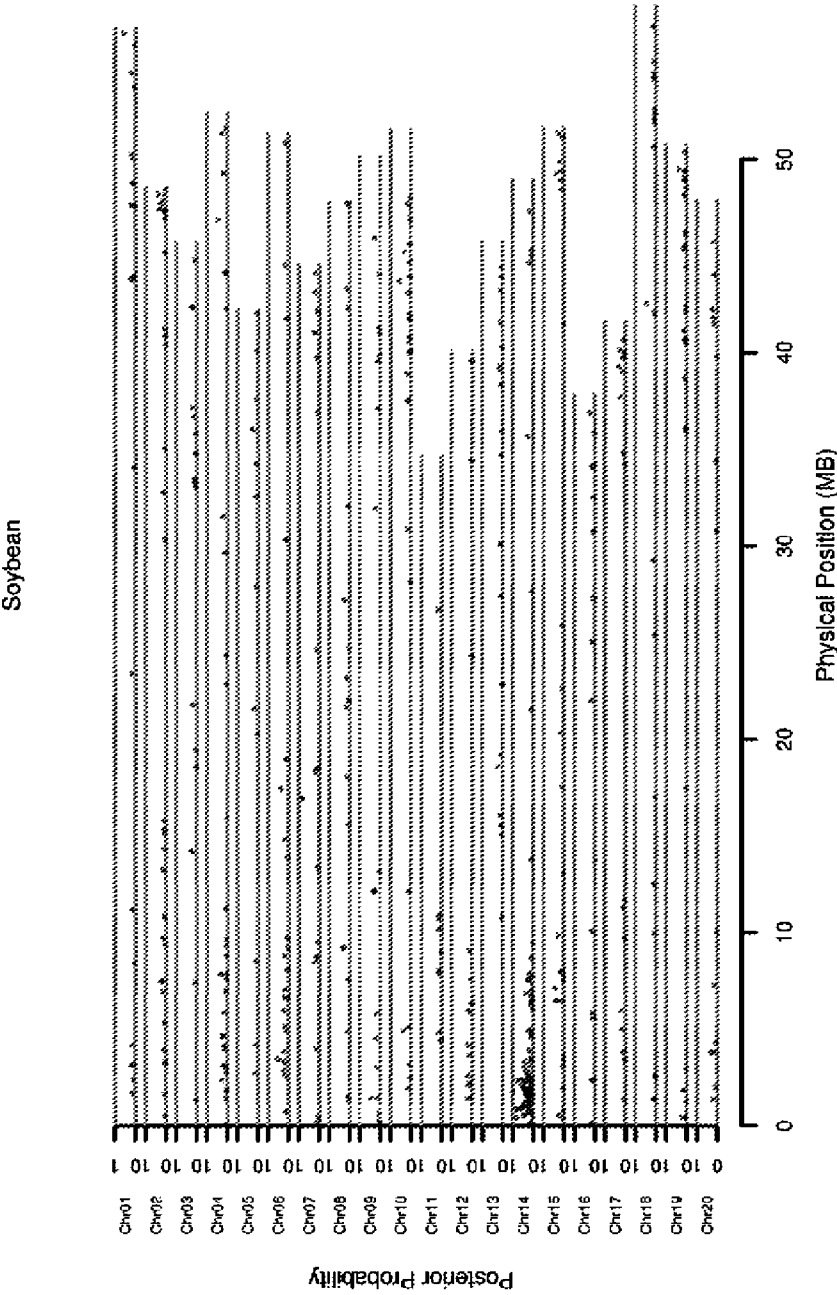


FIG. 5: Mapping Interval Discovery for Scaffold 000056F (Suggested interval Chromosome 14 0.85 – 2.5 Mb)

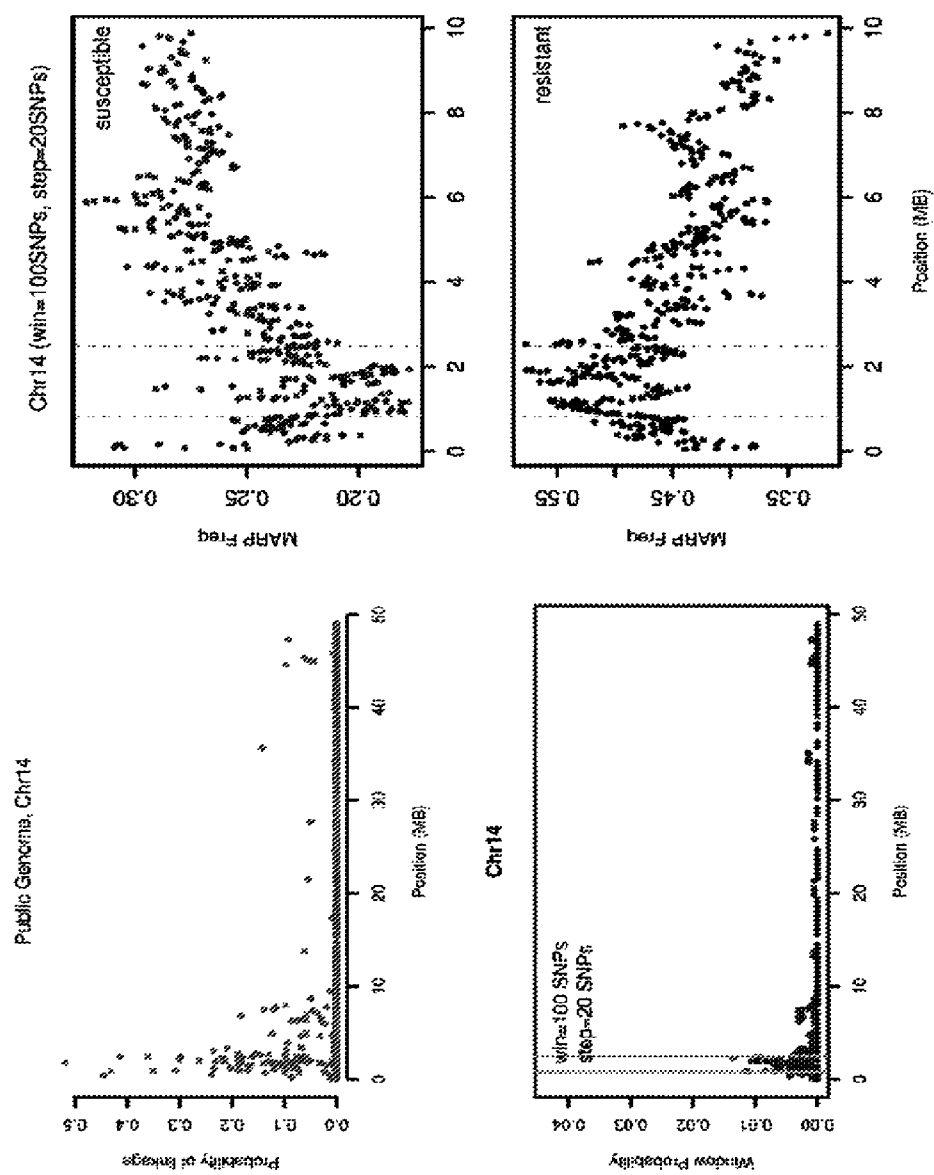


FIG. 3: Depiction of *Glycine canescens* PI440935 SNPs Associated with ASR Resistance (i.e. each dot equals 1 SNP that associates with ASR resistance)

