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Foreword

The Tomato Genetics Cooperative, initiated in 1951, is a group of researchers who share and interest in tomato genetics, and who have organized informally for the purpose of exchanging information, germplasm, and genetic stocks. The Report of the Tomato Genetics Cooperative is published annually and contains reports of work in progress by members, announcements and updates on linkage maps and materials available. The research reports include work on diverse topics such as new traits or mutants isolated, new cultivars or germplasm developed, interspecific transfer of traits, studies of gene function or control or tissue culture. Relevant work on the Solanaceous species is encouraged as well.

Paid memberships currently stand at approximately 45 from 13 countries. Requests for membership (per year) at US$10 should be sent to Dr. J.W. Scott, jwsc@ufl.edu. Please send only checks or money orders. Make checks payable to the **University of Florida**. We are sorry but we are **NOT** able to accept cash, wire transfers or credit cards.

Cover: Photo by Randy Gardner of Tasti-Lee^{TM} fruit grown in North Carolina after six days of rain. There was minimal vine cover due to bacterial spot infection, illustrating this varieties tolerance to all types of shoulder cracking. 2011 was a breakout year for Tasti-Lee that is now being sold by name in numerous supermarkets in the eastern US. Feedback from consumers has been outstanding. People can't believe they can get tomatoes with flavor and color this good in a grocery store. Will this be a flash in the pan or a paradigm shift for fresh market tomatoes? See "From the Editor" for more.

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Announcements:

From the editor: I'm baack!! Times have changed and due to a lack of reports to the Tomato Genetics Cooperative, there will no longer be hard copies of the TGC. The plan is to post the most recent volume online without the year delay that we have had in the past. As you see we have only two research reports in this volume along with a stock list from the TGRC. Our costs are fewer since we do not have printing or mailing costs so we will probably maintain our $10 per year membership charge but if we begin to accumulate money we may suspend the charge until we need it again. Members will receive notices about dues in the future.

My apologies if the cover picture of my variety seems pretentious. That was not the intent. The most important features of market tomatoes for decades has been how well they yield and ship with little concern for flavor. It is well known that consumers have been dissatisfied with store bought tomatoes. Tasti-Lee is a shipping tomato that has the potential to give consumers a vote in the process. If the quality can be maintained by the growers, shippers and sellers; consumers might start consuming significantly more tomatoes, and flavor might become a more important part of the breeding process in the future. Since the genetics are complex and the environmental impacts on flavor are profound, tomato breeders will find this an interesting challenge. Thus, I considered the cover to be important for historical context. This may be vision or it may be folly.

My thanks go to Dolly Cummings for her considerable help with all phases of the TGC and to Christine Cooley who helps with the website. Happy Holidays and Happy New Year to all of you!

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Managing Editor

Upcoming Meetings

SOL 2012
9th Solanaceae Conference
From the Bench to Innovative Applications
August 26-30, 2012
University of Neuchâtel, Switzerland
http://www.sol2012.ch

Phytoremediation Comparisons Between *Solanum lycopersicum* Wild-Type and brt Mutant Using Kelthane Miticide

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Introduction

Biotechnological approaches to phytoremediation have, thus far, been the source of little research. There are two goals associated with genetic modification of plants for phytoremediation increasing ability and lowering cost (Singh, et. al., 2007). For increasing phytoremediation of metals, the key is to increase the number of water and nutrient uptake sites on the roots and raise the quantity of metal transporters in the xylem (Singh, et. al., 2007). Tomato plants, known hyperaccumulators of Cadmium, need to gain biomass in order to be effective phytoremediators (Setia, et. al., 2007; Cherian and Oliveria, 2005). Transferring genes or traits from bacteria or animal systems frequently improves remediation potential (Cherian and Oliveria, 2005). This was found to be true in genetic engineering selenium phytoremediators (Terry and Bañuelos, 2000). Terry proposed engineering the Indian mustard plant to overproduce enzymes and introduce additional metabolic pathways to remediate the selenium (Terry and Bañuelos, 2000).

Tomato plants and dicofol miticide (Kelthane) were used to complete this phytoremediation test. Tomato plants are not known for their phytoremediation abilities (Bush, n.d.). Research showed that mutated tomato plants may phytoremediate more effectively than regular tomato plants (Buch, n.d.). This may be due to modified root structure and veins.

A bushy root variety of tomato plant was selected from the University of California Davis Charles M. Rick Tomato Genetics Center for this experiment under the rationale that plants with larger roots could take up more chemical (Chetelat, 2010). Zobel (1971) located this mutation and notes that "The root system is very highly branched…the root system branches profusely within one day after emergence, in contrast to normal roots, which branch only after several days of growth" (Zobel, 1971). Zobel also notes that brt mutated tomato plants germinate more slowly than non-mutated plants (Voland and Zobel, 1988). This mutant also displays increased colonization of fungus on its roots (Zsogon, et. al., 2008). Increased fungus presence could contribute to phytoremediation abilities because of the plant's growing need for nutrients (Zsogon, et. al., 2008). There may be more microbial enzymes in the roots (Benedito, 2010). Over expression of root membrane proteins in Indian mustard plants led to an increase in phytoremediation ability for removal of selenium (Terry and Bañuelos, 2000). Peres (2010) noted that he has observed an increased concentration of Brix (sucrose) on the roots. Zobel (2010) confirms this observation by stating that there is an increase in starch at the base of the roots that could be duplicated by the presence of sucrose. This sucrose is likely located on the microbial chelators, which are

known to deliver nutrients to the plant, while sucrose probably is located on the top of the rizosphere (root shoot) (Gerhardt, et. al., 2009). In a 2010-2011 research project, the experimenter found the location for the bushy root mutant on the twelfth tomato chromosome at 19.8 cM (unit length of chromosome) or 95.8 cM. The gene at this location was TG296, a Lysr transcriptional regulator protein from bacteria that was placed in the castor bean plant before being extracted by Zobel at U.C. Davis (Zobel, 1971; Voland and Zobel, 1988).

Kelthane 50W (or WSP) Agricultural Miticide has been manufactured by Dow AgroSciences Canada Inc., Rohm and Haas Company, and Makhteshim-Agan and is “a miticide that provides a high initial kill and good residual (long lasting effectiveness) (MSDS: Kelthane, 2008; Rossi, 1998). A white to gray powder, it has an odor of fresh cut hay” (MSDS: Kelthane, 2008). Kelthane is composed of about 51 percent dicofol (Kelthane, 2005). Dicofol is “a nonsystematic acaricide (poisonous to mites) used to control mites that damage cotton, fruit trees, and vegetables” (Qiu, et al., 2005). Dicofol is similar in composition to DDT and, therefore, is classified a Persistent Organic Pesticide (Eckley, 2001). DDT is actually an intermediate substance in the forming of dicofol (Sánchez, 2010). These two pesticides are often used interchangeably and results in a dicofol experiment should apply to DDT (Garber and Peck, 2009). The EPA notes several important distinctions between DDT and dicofol, chiefly that dicofol is more water-soluble that DDT (Rossi, 1998). Essentially, all results found for dicofol are worse for DDT and is considered less harmful than DDT (Rossi, 1998).

Phytoremediating dicofol and DDT has been studied on a limited basis and a procedure for the remediation has been developed (Thompson, 2010; Gao, et. al., 2000). The DDT begins to be remediated when it is taken from the soil through the roots of the plant (Gao, et. al., 2000). This uptake is limited by the fact that both DDT and dicofol are hydrophobic and they resist water travel (Gao, et. al., 2000). A concentration gradient is formed near the root epidermis that is semi-permeable and absorbs some of the pesticide, transporting it to the root xylem using transport proteins (Setia, et. al., 2008). Benedito (2010) suggests that there are likely increased transport proteins in the roots of the bushy root mutated tomato plants. This suggestion is confirmed through previous research that points to a transcriptional protein gene modification that would effectively produce more transport proteins to increase the amount of DDT that could be transported from the root epidermis into the xylem. Plant metabolism transforms the DDT and degrades it significantly, first into DDD, a less hazardous pesticide, and then catalyzes the DDD using naturally occurring reagents (Gao, et. al., 2000). DDT can also form DDE through a dehalogenation, removing both halogen and hydrogen from the DDT (Gao, et. al., 2000). However, the remediation procedure in tomato plants could be significantly different than the one described since it occurred in two types of grasses (Gao, et. al., 2000). Frequently, remediated pesticides or metals will be sequestered in the leaf or stem (Setia, et. al., 2008). Either a vacuole will form around the pesticide or it will be sequestered away from any vital cell or plant process (Setia, et. al., 2008).

Similar experiments have been conducted using different plants and different chemicals from this experimenter and others. A phytoremediation experiment in 2005

using rye grass to remove DDT was extremely effective (Greenberg, 2006). In fact, 30% of the DDT was removed within 90 days, but it is noted that there is know way to know "whether DDT is being degraded in the soil or in the plants," an important consideration (Greenberg, 2006). Initially, phytoremediation of DDT was deemed impossible, but was proven possible in 1977 (Russell, 2005). Chu (2006) performed a hydroponic experiment using DDT, PCBs and remediated both with rye grass (Chu, et. al., 2006). Though this test used an extremely small (ng) sample of DDT, it was remediated at a fairly fast rate and the half life determined to be only two or three days for such a small amount of DDT added (Chu, et. al., 2006).

The hypothesis for this experiment focused on the ability of the mutated tomato plants to phytoremediate: Tomato plants that have been genetically mutated to increase root length and size will phytoremediate more effectively, with fewer negative health effects when 1.5 g of dicofol is applied than wild-type tomato plants that have not been mutated.

Materials and Methods

Sixty 5 inch diameter biodegradable (Jiffy Pots) plant pots were used in this experiment. They were purchased with two 5/16 inch holes for drainage. These holes were covered with a piece of duct tape to prevent pesticide leakage and evaporation of the pesticide. There were ten samples in each of six test groups and controls. Group A contained neither dicofol nor plants. Group B contained wild-type tomato plants without dicofol. Group C contained bushy root mutant plants without dicofol. Group D contained dicofol, but no plants. Group E contained dicofol and wild-type tomato plants. Finally, Group F contained dicofol and bushy root mutant tomato plants.

Scotts Premium Topsoil that contained organic materials and peat moss was autoclaved. Miracle Grow Water Soluble Fertilizer was prepared and added to each pot of soil every ten to fifteen days. All test groups were watered with 50 ml of tap water three days a week or as needed.

Seeds used for this test included tomato seeds and mustard seeds (for bioassay). S. lycopersicum brt bushy root mutant tomato plants (LA2816) were obtained from the C.M. Rick Tomato Genetics Resource Center and the University of California Davis. These seeds were acid treated in 1 percent HCL. The wild-type tomatoes were Better Boy Hybrids from Burpee (Lot 1). Southern Giant Curled Mustard from Wetsel Incorporated (Lot 1185) was used for the bioassay. All tomato seeds were prepared before being transplanted into their soil pots. Forty of the 50 mutant seeds (quantity was limited) and 40 wild-type seeds were placed in 2.7 percent sodium hypochlorite (half-strength bleach) in a 500 ml beaker for 30 minutes. Seeds were then rinsed and placed in plant trays lined with five layers of paper towel that was moistened and covered with five additional layers. Plant trays containing the seeds were placed in a warm dark location until germination. Seeds were then transplanted into soil pots, with two seeds per pot, planted ¼ inch below the soil.

Two different pesticides were obtained for this experiment from Dr. R. Allen Straw at Virginia Tech. Six lbs of Kelthane 50 Agricultural Miticide (Lot L2603), manufactured by Rohm and Haas Company with 50 percent dicofol and 50 percent inert ingredients was actually used in the test. Five lbs of Thionex 50 W (Endosulfan) was also obtained as an alternative to dicofol. The Thionex contained 50 percent endosulfan and 50 percent inert ingredients and was manufactured by Makhteshim Agan of North America, Incorporated (Lot GM809016).

Pesticide (Kelthane 50) was applied at two different times for phytoremediation opportunity. In powder form, 0.5 g of Kelthane was added to each test pot. After one month, an additional 1 g of Kelthane was added aqueously. These two applications simulated a large presence of dicofol initially and then additional dicofol being dumped at the remediation site. Thirty grams of Kelthane were added to 300 ml distilled water. The solution was heated and 2 ml of acetone forced the solution to combine. The acetone evaporated and 10 ml of solution was added to each of the pots receiving pesticide. A pipette pump was used to apply the solution and it was placed under the top layer of soil near the roots to minimize evaporation of the pesticide.

Leaf area, chlorophyll concentration at A_{663} and A_{645}, Brix concentration, wet root mass, and dry plant mass were measured as health indicators.

The soil was analyzed to see how much of the pesticide exists when compared to the control with just the miticide. The method of bioassay was used because it was deemed reliable from previous testing.

To prepare the bioassay, a baseline test was conducted. Pots of soil were prepared as described above. This means that 3230 g of soil (170 g per pot) were autoclaved. Nineteen pots were used. Each pot was given varying amounts of Kelthane, from 0 grams to 1.8 grams, increasing by 0.10 grams. The pesticide was weighed and mixed in powder form into each sample of soil for one minute. Forty mustard seeds were added to each pot. Mustard seeds were chosen because they have been known to be effective indicators of DDT (extremely similar to dicofol) (Orcutt, 2010). The number of plants that germinated was measured for twelve days. The results were compiled and averaged and one equation for each day that was representative of the data was found to allow for estimation of the amount of dicofol in soil with relation to the number of seeds that germinated. Similar testing was repeated with the pots that had unknown amounts of Kelthane. Germination of mustard seeds was recorded and using the equations found above, an average estimated amount of dicofol remaining in the soil was obtained. A different standard equation was used for each day of germination. If the logistic curve did not fit the number of seeds germinated, results were extrapolated. For example, if the lower bound for the equation was ten plants and one pot had four plants, the pot would be recorded as having the maximum (1.5 g) of Kelthane. After recording the daily amount of Kelthane remaining, the pots that had no Kelthane were used to standardize the data. A difference was taken between the germination of the pots with no Kelthane and those with Kelthane to obtain an accurate amount of Kelthane remaining. These results were averaged and t-tests tests were run.

Results and Discussion

The hypothesis that bushy root mutated tomato plants would remove more Kelthane than wild-type tomato plants, but have more negative health effects, was not supported. In fact, the exact opposite result occurred. Bioassay results showed that autoclaved soil alone removed 0.384 grams of Kelthane, while the mutated plants removed 0.537 grams, and the wild-type removed 1.140 grams out of the total 1.50 grams added. Wild-type plants removed significantly more than mutated plants and mutated plants removed more than soil alone, but not to a significant degree.

In terms of health, the mutant plants seemed to fair best. Mutant plants had a significantly greater percent increase in leaf area, 123% for those with Kelthane added, when compared to a -5.16% increase for wild-type plants undergoing phytoremediation. Plants that were not phytoremediating increased leaf area at a steadier 41-61% rate. Percent change in plant height showed a similar that mutant plants grew taller without Kelthane (275 to 166%), while wild-type plants were significantly taller when phytoremediating (279 to 234%). Though not significant, mutant plants had more chlorophyll (0.458 without Kelthane and 0.182 g with Kelthane) when compared to wild-type plants (0.203 and 0.177 g). Mutant plants also had the highest Brix concentrations (121 and 3.61%), though the wild-type without Kelthane was significantly higher in Brix than the wild-type with Kelthane (39.1 and -5.63%). With plant dry mass, the mutant with no Kelthane had the highest mass (0.232 g) followed by the mutant with Kelthane (0.101 g). Finally, the mutant plants had the highest root masses (2.02 and 1.59 g) when compared to the wild-type plants (0.777 and 1.28 g).

Conclusions

This experiment represents a much more comprehensive look at the phytoremediation of Kelthane when compared to three previous years of research. The amount of time that the plants grew was extended by a factor of eight and the amount of Kelthane was raised to more typical levels. Bioassay testing was also much improved, with additional precision.

Mutated tomato plants were healthier, sometimes statistically so, when compared to wild-type plants and test groups without Kelthane were healthier than those undergoing phytoremediation. Russell (2005) supports this conclusion and notes that plants must have phytotoxicity, or ability to withstand the presence of dicofol, a factor that wild-type tomatoes typically do not have. Weaver (2010) warns that tomato plants are usually fairly phytotoxic and are used as bioindicators meaning that their health will be adversely affected by the presence of pesticides like Kelthane.

The major finding from this experiment was that more effective phytoremediation occurred in wild-type tomato plants when compared to mutated tomato plants. “The root system is very highly branched…the root system branches profusely within one day after emergence, in contrast to normal roots, which branch only after several days of growth” (Zobel, 1971). This phenomenon may have actually hurt phytoremediation ability since the root branching causes stringier and less developed roots. Zobel also

notes that brt mutated tomato plants germinate more slowly than non-mutated plants (Voland and Zobel, 1988). The increased Brix concentration found in mutated plants seems to have contributed to plant health, but may have made enzyme transport more difficult (Peres, 2010). Relationships between the number of microbial enzymes and their effect on phytoremediation are currently being investigated (Benedito, 2011). Research to better explain the reason that wild-type plants are more effective phytoremediators of Kelthane is still ongoing.

Acknowledgements

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A collection of polymorphic markers useful for fine-mapping the *Ty-3* locus from *Solanum chilense* accession LA2779

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Introduction

To date, five begomovirus-resistance loci/regions (*Ty-1* through *Ty-5*) have been identified and are available to breeders for development of resistant cultivars (Zamir et al., 1994; Hanson et al., 2006; Ji et al., 2007a; Ji et al., 2009; Anbinder et al., 2009). The *Ty-3* locus from the *Solanum chilense* accession LA2779 was mapped to an approximately 27 cM introgression on chromosome 6 (Ji et al., 2007) and provides resistance to Tomato Yellow Leaf Curl Virus (TYLCV) as well as several other begomoviruses. Molecular markers linked to linked to *Ty-3* are available (Ji et al., 2007a, b), but the development of newer markers that are more tightly-lined to the gene has been limited. The *Ty-3* region has recently been more precisely mapped to the interval between 18 and 25 cM (Scott et al., 2009), but fine-mapping efforts have been limited by suppression of recombination within the homeologous region, and especially by insufficient marker coverage throughout the introgressed region.

Toward fine-mapping of the *Ty-3* locus, Fla. 8680 (which contains the ~27 cM LA2779 introgression) and the susceptible breeding line Fla. 7776 were used to develop a large, segregation population. In spring 2009, approximately 10,500 plants were screened using molecular markers located at the distal ends of the *Ty-3* introgression. Recombinant individuals were selected and subjected to further screens using a collection of previously-available and newly-developed markers. Herein, we provide details on this collection of markers that is useful for fine-mapping the *Ty-3* locus.

Materials and Methods

DNA was extracted from young leaves of individual plants according to the protocol of Fulton et al. (1995) and adjusted to approximately 50 ng/µl concentration. PCR-based markers were used for all screens, and reactions were performed in 10 µL volumes containing 0.4 µM of each primer, 0.8 mM dNTPs, 2.5 mM of $MgCl_2$, 1 µl of 10X buffer, 0.25 units of *Taq* polymerase (New England Biolabs, Ipswich, MA) and 2 ul of dna. PCR was performed in an Eppendorf Master Cycler Pro 384 at the following parameters: denaturation at 94°C for 5 min; then 35 cycles at 94°C for 30 sec, annealing for 30 sec, and extension at 72°C for 30 sec; followed by a final extension at 72°C for 10 min. Restriction enzymes were purchased from New England Biolabs and digestions were performed according to the respective protocols.

Twenty-three new markers polymorphic between the two parents were developed primarily from Bacterial Artificial Chromosome (BACs) and Fosmid (FOS) sequences corresponding to the *Ty-3* region between 18 and 25 cM. These markers, along with previously available markers, were used to determine introgression sizes in recombinant individuals. Primers, PCR parameters and detection methods of each these markers are presented in Table 1.

Table 1. Sequence-characterized amplified region (SCAR) and cleaved amplified polymorphic sequence (CAPS) markers within the *Ty-3* region of tomato chromosome 6 and polymorphic between Fla. 7776 and Fla. 8680.

Marker Name	Marker type	Forward Primer	Reverse Primer	Annealing Temp	Restriction Enzyme	Approx. Amplicon Size(s)
Mi23[1]	CAPS	TGG AAA AAT GTT GAA TTT CTT TTG	GCA TAC TAT ATG GCT TGT TTA CCC	55	BstN I	380
C2_At2g39690[2]	CAPS	TGGTCTTGAATATCCAGAACCTAATG	AATTCTGAAGCATAAGGTTGAACCTC	55	Hinfl	1100
SL10401[3]	CAPS	GGGAGACTCATCCTGATTGC	ATTTGTTCCTCCCAATGCTG	62	Mse I	1090
C2_At4g01900[2]	CAPS	TCACTTTCAAAATCCAATTTCTCC	TGGGCGCCAAAACCACGAAC	55	Hinfl	1500
C2_At5g61510[2]	CAPS	AGTTCCTACTGCGCCGCTGCTTC	AGCATGAACAAGTACTGTGTGCCCACG	55	Hinfl	450
TG231[2]	CAPS	CCATCCTGATTGAAGGGAAACAAGC	CTAGATGAAATGTACCATGCTGCCC	55	TaqI	523
T1456[2]	CAPS	TAGCTTCTGCCATTGATTTGAGC	TGAGAGGGAAGTATCTGTATGCCC	56	RsaI	650
TG97[2]	CAPS	CACCACATAATTGAGAAGGACAACAC	CATCATTGCTATTGAAGTCATCCG	55	Tsp509I	450
T0892[4]	CAPS	TGGCTCTTCGGACTTTAGTGA	AGCACCTTCTGCGTTCATCT	55	DdeI	1300
C2_At3g10920[2]	CAPS	TGGCTTGGTGTGGACAAAGAGC	TGCAAGTAGTATGCGTGTTCCC	55	DpnII	600
U231369[2]	CAPS	AGGGACTAAAACTTGGTGTCTATTCTG	AGCGAACCTGGCCGAACTTGAC	55	RsaI	250
T1563[2]	CAPS	ACTTCACCTACAAATCCTTCCAGA	GCCCTTCCCAATCCAGCAGT	55	TaqI	1650
T0774_UF	CAPS	TTGAGCTCACGTGACGTTGACAAG	AGAACAAGACCCGGAACCGACTTA	56	Hinc II	428
SL_2.40ch06_30.280	SCAR	GAAAGTCTACTACAGGGTCGAAGC	GAGGCCATAGGTTCATAGCAAG	55	n/a	400/500
SL_2.40ch06_30.696	CAPS	TCTGAATGCAGGGTAATCATGT	TGATTTCAGGCCTCATAGAACC	62	Msp I	610
SL_EcoRI0039C03_SP6_241466	CAPS	GAGGTAAGACTATGTAAGGTGTTGTCA	TCAAGGTCGATGACTATGGAAA	56	Rsa I	620
LE_HBa0161K22_SP6_201727	CAPS	AGCTCTTCCAGGAGCAGTTTG	CCCTCCAAATAGTTTCACAAATACG	58	Mse I	530
SL_FOS0169A13_pIBR_529681	CAPS	AGCTATCAGCTGCCAGAGACAT	CACCATCATTGTATCCAGAGAGC	56	Mse I	420
SL_EcoRI0066C10_SP6_338406	CAPS	GAGGATGAGAAGACTTGTGTTTCC	GTGCTTATCCTTGTAGATCTATTCCTG	58	Hha I	500
SL_2.40ch6_30.891	CAPS	CCGAAGGTGATAACCACGAC	GCGACCCTAACCAACAATAAAC	56	BstN I	600
LE_HBa0045I03_T7_121529	CAPS	ATCAAGTATGCGCCCACGTA	TTGAACGAGTTAGGCAAACAGTAAG	56	Dde I	300
LE_HBa0135O04_T7_61735	CAPS	TAAGGCATGTCATACCAGAAGG	TTGATCATGTAGGGAGATGCTG	55	Dpn II	520
SL_EcoRI0020O03_T7_228586[4]	CAPS	GTGTTTCTACCAGTGACATGTGTAT	ACCCACAATACCACAACGTAT	55	HpyCH4 IV	330
cLEG-31-P16[2]	CAPS	ATGGTGACTAAGGTGGATGAGCCT	TGAGTGCCAACCGATAATGCTACC	55	HaeIII	580
LE_HBa0142H09_SP6_199845	CAPS	TTTAGTCCTGCCAAAGAGAAGC	CATTCTAGTGAGCCACTACATAACAGA	55	Hinf I	580
SL_FOS0262B11_pIBF_601148[4]	CAPS	TTTCTGCTTTCCGTGTAATCCT	TTCTCACCACCCAATTAAGTCC	55	BstN I	310
SL_2.40ch06_31.040	CAPS	TTCCTCCAAGTCATCCACCTAC	GAGTCGTTTATTCGTGCAGATG	56	HpyCH4 IV	610
SL_MboI0074O20_SP6_287184	CAPS	CTCATTCTCCGCAGAAACATT	CGCGTAGTGGACATAATGAGAA	55	HpyCH4 IV	200
SL_FOS0245D20_pIBR_588207	CAPS	CAGAATCAGGTGCAATGAAATG	GATGGAGACTTGTTGGTATTAGCC	56	Hpy188 I	300
SL_2.40ch06_31.097	SCAR	TTGTGGGTCCTCATAGGGTAAG	AGGCTGCAACCTTAGAATTTCC	55	n/a	540/630
SL_MboI0046E04_T7_224344[4]	CAPS	TTGAATGAGAGACCAACAAGGA	CTTGCAAGTTCCTGCAGATGT	55	BstU I	310
LE_HBa0117N23_T7_40221	CAPS	GAAAGCGATCCTATCTCGAGTG	TCATCCTGAACACTGGGTGAC	55	Taq I	300
SL_MboI0142A14_SP6_363278	CAPS	CACAAAGCGAGATGACTGAAGA	TAAAGCAGCAAGTTTCCTCACA	60	Dpn II	500
SL_FOS0009D21_pIBR_458577	CAPS	CACCCTGTTTATATACCGCACA	CTCGACAATCGTGGAATTGTTA	55	Dde I	200
TG590 F3R3	CAPS	CAGCAGGAGGTGATGGAATACTCA	ACAAGTGAGAGGAAGACCAGTACC	55	Nhe I	780
Spr2F2R2	CAPS	TTCTTCCGTTTCTGTTTCCGCCAC	CAAGTGTTGTAAGCCCTCCTCTCA	55	TaqI	450
cLET-1-I13	SCAR	TGCTTCATCACCAGCCTTATG	CATCATCTTCGCCTTCCT	50	none	890/?
P6-25[5]	CAPS	GGTAGTGGAAATGATGCTGCTC	GCTCTGCCTATTGTCCCATATATAACC	55	Taq I	290
SL2.40ch06_31.660	CAPS	GAGTTGGATCGGTTTCAAGAAC	GAGAGGAGCAACACCCATTAGT	62	HpyCH4 IV	610
C2_At3g11210[2]	CAPS	AGGCCTGTATAGAGCTATGCAAAGAG	AATTCTGTTGCCATTGATTTCCAGTG	55	Hinfl	750
SL_2.40ch06_31.770	CAPS	AGAACGAGTAAACCAATAGCTG	GGAGCATAATTCTTGTTCCA	55	Dde I	600
T0507[2]	CAPS	CCT TTT ATC TCC TCC GGT GT	TCT GTC CAC TCA CAT GGA TCA	55	DraI	800
SL_2.40ch06_31.928	CAPS	CTTCTACTGTGGCCCTCTTCAG	ATCCAATTCTGCATGCCTTACT	55	Dde I	610
C2_At5g41480[2]	CAPS	TATTCGTGCTGGTCTGGAGAGTGC	ATGATCCTTGTCATTCGCCATAGC	55	DdeI	350
T1079[2]	CAPS	CAACCCAGAAAGGGAAGAAGAC	TGCTGATAACGGAAGAACT	55	taq I	750
TG118L[6]	CAPS	GGAAGTAGATGTGTCAACCTTAAG	CTGGGTGAACCCAAACGTTGTGCT	55	Taq I	620
T1098F2R2[6]	CAPS	GTTAGTTCCTTCTGAGAAGATGGCTG	CAGGATGACTGTATAGTCTGTAGACATTG	55	Rsa I	450
T0834F1aR1[7]	CAPS	CTGTTAATTGGGACCCCATCAGAAGCAGG	GGAAGGTGATGCTGCAATCCTTCAGATAACC	55	Hinf I	610

Table 1 Footnotes

1 Marker obtained from Seah et al. (2007)
2 Marker obtained from Sol Genomics Network (http://solgenomics.net)
3 Marker obtained from van Deynze et al. (2007)
4 Preferential annealing of primers
5 Marker obtained from Ji et al. (2007b)
6 Marker obtained from Doug Maxwell (http://www.plantpath.wisc.edu/GeminivirusResistantTomatoes/Markers.htm)
7 Marker obtained from Martin and Maxwell (2006)

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Revised List of Monogenic Stocks

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The following catalogue lists 1,036 monogenic stocks (at 630 loci), including morphological mutants, allozyme markers, disease resistance genes and other types of genic stocks maintained by the TGRC at UC-Davis. This is a revision of the previous list, issued in 2008 (TGC 58). Our list of available wild species stocks was last updated in 2010 (TGC 60), and miscellaneous genetic stocks in 2009 (TGC 59). Certain obsolete or inactive items have been deleted, newly acquired stocks have been added, inaccuracies corrected, and gene symbols revised to reflect allele tests or other information. This stock list includes only accessions we consider to be the primary sources for individual mutations: usually the original stock in which the mutation was first described, as well as any nearly isogenic lines into which it has been bred. Most mutant stocks are homozygous and true-breeding. However, seed of the male-steriles, homozygous-inviable mutants, and other stocks that are difficult or impossible to maintain as homozygotes, must be propagated via heterozygotes. In these cases, seed are provided in the form of segregating F_2 or BC populations. Note: some accessions may be temporarily unavailable during seed regeneration.

The following monogenic stocks were acquired since the last edition of this list: *Cnr* (*Colorless non-ripening*) in cv. Moneymaker, donated by Andrew Thompson; new alleles of *gf* (*green flesh*) from Cornelius Barry; nearly isogenic stocks of *sun* (*Sun1642 fruit shape*) from Esther van der Knaap; and breeding lines with the resistance factors *Sw-7* (*Spotted wilt resistance-7*), and *Ty-3,* and *-4* (*TYLCV resistance-3, -4*) from Jay Scott.

Documented cases of allelism between mutants are incorporated into this list, and gene symbols revised accordingly. Lippman et al. (2008, PLoS Biology 6: 2424-2435) reported that the mutant *mult* (*multiflora*) is allelic to *s* (*compound inflorescence*), thus *mult* is listed herein as s^{mult}.

Additional information on individual stocks, including phenotypes, references, images, chromosomal locations, etc., can be obtained through our website (http://tgrc.ucdavis.edu). We ask that users report any problems they detect in our lines, such as aberrant segregation, incorrect phenotypes, unexpected variability, etc. TGC members are also encouraged to submit stocks of verified monogenic mutants to the TGRC for maintenance and distribution.

Table 1. List of monogenic stocks. For each locus, stocks containing the original mutant allele are listed first, followed by any additional alleles at the same locus ('prov' indicates a provisional allele). Older gene symbols for each allele are listed under 'Synonyms' ('^' indicates a superscript). Each mutant is assigned to one or more phenotypic categories, listed under 'Class' (see Table 2 for definitions, '*' indicates the primary category). Background genotypes of each stock are listed under 'Back' (see Table 3 for full names). The origin of each mutation is specified as either spontaneous ('SPON'), or induced by chemical treatment ('CHEM') or irradiation ('RAD'). 'Iso' indicates whether the nonmutant control is available as an isogenic ('IL') or nearly isogenic ('NIL') line, or is nonisogenic ('NON'). Accession numbers are listed under 'Acc #'.

Gene	Allele	Locus name	Synonyms	Class	Origin	Back	Iso	Acc #
a	--	*anthocyaninless*	*a1*	A*	SPON	X	NON	LA0291
a	--	*anthocyaninless*	*a1*	A*	SPON	AC	NIL	LA3263
a	*prov2*	*anthocyaninless*	*a*	A*	CHEM	VF36	IL	3-414
a	*prov3*	*anthocyaninless*	*a*	A*	CHEM	VF36	IL	3-415
aa	--	*anthocyanin absent*		A*	SPON	MD	IL	LA1194
aa	--	*anthocyanin absent*		A*	SPON	AC	NIL	LA3617
Abg	--	*Aubergine*		P*	SPON	X	NON	LA3668
Abg	--	*Aubergine*		P*	SPON	X	NON	LA4425
abi	--	*aborted inflorescence*		M*	CHEM	CSM	NON	3-803
Aco-1	*1*	*Aconitase-1*		V*	SPON	pen	NON	LA0716
Aco-1	*3*	*Aconitase-1*		V*	SPON	pim	NON	LA2903
Aco-2	*2*	*Aconitase-2*		V*	SPON	chm	NON	LA1028
acr	--	*acroxantha*	*acr1*	D*JK	RAD	CR	IL	LA0933
ad	--	*Alternaria alternata resistance*		Q*	SPON	X	NON	LA1783
Adh-1	*1*	*Alcohol dehydrogenase-1*		V*	SPON	VCH	NON	LA1221
Adh-1	*2*	*Alcohol dehydrogenase-1*		V*	SPON	par	NON	LA0247
Adh-1	*n*	*Alcohol dehydrogenase-1*		V*	CHEM	MM	IL	LA3150
Adh-2	*1*	*Alcohol dehydrogenase-2*		V*	SPON	hir	NON	LA1777
adp	--	*adpressa*		K*J	RAD	CR	IL	LA0661
adp	--	*adpressa*		K*J	RAD	AC	NIL	LA3763
adu	--	*adusta*	*adu1*	H*K	RAD	CR	IL	LA0934
ae	--	*entirely anthocyaninless*	*a332*	A*	RAD	KK	IL	LA1048
ae	--	*entirely anthocyaninless*	*a332*	A*	RAD	CG	NIL	LA3018
ae	--	*entirely anthocyaninless*	*a332*	A*	RAD	AC	NIL	LA3612
ae	*2*	*entirely anthocyaninless*		A*	CHEM	UC82	IL	3-706
ae	*afr*	*entirely anthocyaninless*	*afr, ap*	A*	RAD	CT	IL	LA2442
ae	*prov3*	*entirely anthocyaninless*	*ae*	A*	CHEM	VCH	IL	3-620
aeg	--	*aegrota*		H*	RAD	CR	IL	LA0537
aer	--	*aerial roots*		R*	SPON	X	NON	LA3205
aer-2	--	*aerial roots-2*		R*	SPON	X	NON	LA2464A
af	--	*anthocyanin free*	*a325*	A*I	RAD	RCH	IL	LA1049
af	--	*anthocyanin free*	*a325*	A*I	RAD	AC	NIL	LA3610
afe	--	*afertilis*	*afe1*	N*CJK	RAD	RR	IL	LA0935
afl	--	*albifolium*	*af*	B*G	SPON	XLP	IL	2-367
afl	--	*albifolium*	*af*	B*G	SPON	AC	NIL	LA3572
Aft	--	*Anthocyanin fruit*	*Af*	P*	SPON	X	NON	LA1996
ag	--	*anthocyanin gainer*		A*	SPON	GS5	NON	LA0177
ag	--	*anthocyanin gainer*		A*	SPON	AC	NIL	LA3163
ag	*2*	*anthocyanin gainer*		A*	SPON	AC	NIL	LA3164
ag	*2*	*anthocyanin gainer*		A*	SPON	che	NON	LA0422
ag	*k*	*anthocyanin gainer*		A*	SPON	T5	IL	LA3149
ag	*s*	*anthocyanin gainer*		A*	SPON	X	NON	LA4425
ag-2	--	*anthocyanin gainer-2*		A*	SPON	AC	NIL	LA3711
ah	--	*Hoffman's anthocyaninless*	*ao, a337*	A*	SPON	OGA	IL	LA0260
ah	*prov3*	*Hoffman's*	*ah*	A*	CHEM	VCH	IL	3-607

Gene	Allele	Locus name	Synonyms	Class	Origin	Back	Iso	Acc #
		anthocyaninless						
ah	*prov4*	*Hoffman's anthocyaninless*	*ah*	A*	CHEM	VCH	IL	3-628
ah	*prov5*	*Hoffman's anthocyaninless*	*ah*	A*	CHEM	VCH	IL	3-629
ah	*prov6*	*Hoffman's anthocyaninless*	*ah*	A*	SPON	PSN	IL	LA0352
ai	--	*incomplete anthocyanin*	*a342*	A*	RAD	KK	IL	LA1484
ai	--	*incomplete anthocyanin*	*a342*	A*	RAD	AC	NIL	LA3611
ai	*2*	*incomplete anthocyanin*	*am, a340*	A*	RAD	KK	IL	LA1485
al	--	*anthocyanin loser*	*a2*	A*	SPON	AC	NIL	LA3576
alb	--	*albescent*		G*C	SPON	AC	NIL	LA3729
alb	*prov2*	*albescent*	*alb*	G*C	CHEM	VCH	IL	3-625
alc	--	*alcobaca*		P*	SPON	X	NON	LA2529
alc	--	*alcobaca*		P*	SPON	RU	NIL	LA3134
alu	--	*alutacea*	*alu1*	C*K	RAD	CR	IL	LA0838
an	--	*anantha*	*an^1, an^2, ca*	L*N	RAD	CR	IL	LA0536
ap	--	*apetalous*		L*N	SPON	ESC	IL	2-009
ap	--	*apetalous*		L*N	SPON	AC	NIL	LA3673
apl	--	*applanata*		J*K	RAD	LU	IL	LA0662
apn	--	*albo-punctata*		G*BJK	CHEM	VF36	IL	3-105
Aps-1	*1*	*Acid phosphatase-1*		V*	SPON	VCH	NIL	LA1221
Aps-1	*n*	*Acid phosphatase-1*		V*	SPON	pim	NON	LA1810
Aps-2	*1*	*Acid phosphatase-2*		V*	SPON	SM	NON	LA0180
Aps-2	*1*	*Acid phosphatase-2*		V*	SPON	chm	NON	LA1306
Aps-2	*2*	*Acid phosphatase-2*		V*	SPON	che	NON	LA1815
Aps-2	*3*	*Acid phosphatase-2*		V*	SPON	par	NON	LA1325
Aps-2	*n*	*Acid phosphatase-2*		V*	SPON	che	NON	LA1450
are	--	*anthocyanin reduced*		A*	CHEM	VF36	NON	3-073
as	--	*asynaptic*	*as1, a*	N*			NON	LA4461
as-5	--	*asynaptic-5*	*as5, a-5*	N*			NON	LA4462
as-7	--	*asynaptic-7*	*as^b*	N*			NON	LA4463
Asc	--	*Alternaria stem canker resistance*		Q*	SPON	X	NON	LA3528
at	--	*apricot*		P*L	SPON	X	NON	LA0215
at	--	*apricot*		P*L	SPON	RU	NIL	LA2998
at	--	*apricot*		P*L	SPON	AC	NIL	LA3535
atn	--	*attenuata*	*at*	E*AJK	RAD	RR	IL	LA0587
atn	--	*attenuata*	*at*	E*AJK	RAD	AC	NIL	LA3829
atv	--	*atroviolacium*		A*	SPON	VF36	NON	LA0797
atv	--	*atroviolacium*		A*	SPON	AC	NIL	LA3736
au	--	*aurea*		C*B	RAD	AC	NIL	LA3280
au	*(1s)*	*aurea*	*au^2, au, brac*	C*B	RAD	CR	IL	LA0538
au	*6*	*aurea*	*yg^6, yg-6, au^yg-6, yo*	C*B	SPON	RCH	IL	LA1486
au	*6*	*aurea*	*yg^6, yg-6,*	C*B	SPON	AC	NIL	LA2929

Gene	Allele	Locus name	Synonyms	Class	Origin	Back	Iso	Acc #
			au^yg-6, yo					
au	*tl*	*aurea*		C*B	SPON	VF145	IL	2-655A
au	*w*	*aurea*	*w616*	C*B	CHEM	MM	IL	LA2837
aus	--	*austera*		J*KT	RAD	LU	IL	LA2023
aut	--	*aureata*		C*F	SPON	X	NON	LA1067
aut	--	*aureata*		C*F	SPON	AC	NIL	LA3166
auv	--	*aureate virescent*		F*C	CHEM	VF36	IL	3-075
avi	--	*albovirens*	*avi1*	C*BGN	RAD	CR	IL	LA0936
aw	--	*without anthocyanin*	*aba, ab, a179*	A*	SPON	X	NON	LA0271
aw	--	*without anthocyanin*	*aba, ab, a179*	A*	SPON	AC	NIL	LA3281
aw	*prov3*	*without anthocyanin*	*aw*	A*	CHEM	VF36	IL	3-121
aw	*prov4*	*without anthocyanin*	*aw*	A*	CHEM	VCH	NON	3-603
aw	*prov5*	*without anthocyanin*	*aw*	A*	CHEM	VCH	NON	3-627
B	--	*Beta-carotene*		P*	SPON	RU	NIL	LA3000
B	--	*Beta-carotene*		P*	SPON	X	NON	LA2374
B	--	*Beta-carotene*		P*	SPON	E6203	NIL	LA3898
B	--	*Beta-carotene*		P*	SPON	O8245	NON	LA3899
B	*c*	*Beta-carotene*	*og^c,Crn,Cr,crn-2,cr-2*	P*L	SPON	PCV	NON	LA0806
B	*c*	*Beta-carotene*	*og^c,Crn,Cr,crn-2,cr-2*	P*L	SPON	AC	NIL	LA3179
B	*og*	*Beta-carotene*	*og*	L*P	SPON	PSN	NIL	LA0348
B	*og*	*Beta-carotene*	*og*	L*P	SPON	X	NON	LA0500
B	*og*	*Beta-carotene*	*og*	L*P	SPON	X	NON	LA4025
B	*og*	*Beta-carotene*	*og*	L*P	SPON	X	NON	LA4026
bc	--	*bicolor*	*bi*	U*JKT	RAD	CR	IL	LA0588
Bco	--	*Brilliant corolla*		L*	SPON	VF36	NON	LA4261
bi	--	*bifurcate inflorescence*		M*	SPON	X	NON	LA1786
bip	--	*bipinnata*		J*	RAD	LU	IL	LA0663
bip	--	*bipinnata*		J*	RAD	AC	NIL	LA3765
bip	*prov2*	*bipinnata*	*bip*	J*	CHEM	VCH	IL	3-602
bk	--	*beaked*		O*	SPON	X	NON	LA0330
Bk-2	--	*Beaked-2*		O*	SPON	X	NON	LA1787
bks	--	*black seed*	*bks1-1*	S*A	RAD	X	NON	LA4290
bks	*2*	*black seed*	*bks1-2*	S*A	RAD	X	NON	LA4291
bl	--	*blind*		K*	SPON	X	NON	LA0059
bl	--	*blind*		K*	SPON	AC	NIL	LA3745
bl	*2*	*blind*	*to^2*	K*	RAD	LU	IL	LA0980
bl	*to*	*blind*	*to*	K*JLO	RAD	CR	IL	LA0709
bls	--	*baby lea syndrome*	*alm*	A*K	SPON	X	NON	LA1004
bls	--	*baby lea syndrome*	*alm*	A*K	SPON	AC	NIL	LA3167
bls	*prov2*	*baby lea syndrome*	*bls*	A*K	CHEM	VCH	IL	3-610
Bnag-1	*1*	*Beta-N-acetyl-D-glucosaminidase-1*		V*	SPON	pen	NON	LA0716
br	--	*brachytic*		K*	SPON	X	NON	LA2069

Gene	Allele	Locus name	Synonyms	Class	Origin	Back	Iso	Acc #
brt	--	*bushy root*		R*	CHEM	X	NON	LA2816
brt-2	--	*bushy root-2*		R*	SPON	X	NON	LA3206
bs	--	*brown seed*		S*	CHEM	AC	NIL	LA2935
bs-2	--	*brown seed-2*		S*	SPON	PLB	IL	LA1788
bs-4	--	*brown seed-4*		S*	RAD	MM	IL	LA1998
btl	--	*brittle stem*		J*Y	SPON	X	NON	LA1999
bu	--	*bushy*	*fru*	K*JM	RAD	X	NON	LA0897
bu	--	*bushy*	*fru*	K*JM	RAD	AC	NIL	LA2918
bu	*ab*	*bushy*	*fru^ab*	K*JM	RAD	RR	IL	LA0549
bu	*cin*	*bushy*	*cin*	K*JM	SPON	HSD	IL	LA1437
bu	*cin-2*	*bushy*	*cin-2*	K*JM	SPON	HSD	IL	LA2450
bu	*hem*	*bushy*	*fru^hem*	K*JM	RAD	CR	IL	LA0604
bul	--	*bullata*		C*JK	RAD	CR	IL	LA0589
buo	--	*bullosa*	*buo1*	J*O	RAD	pim	IL	LA2000
c	--	*potato leaf*		J*	SPON	AC	NIL	LA3168
c	*int*	*potato leaf*	*int*	J*	RAD	CR	IL	LA0611
c	*int*	*potato leaf*	*int*	J*	RAD	AC	NIL	LA3728A
c	*prov2*	*potato leaf*	*c*	J*	CHEM	MM	IL	3-345
c	*prov3*	*potato leaf*	*c*	J*	CHEM	X	IL	3-604
c	*prov4*	*potato leaf*	*c*	J*	CHEM	VCH	IL	3-609
c	*prov5*	*potato leaf*	*c*	J*	CHEM	VCH	IL	3-626
c	*prov6*	*potato leaf*	*c*	J*	CHEM	VCH	IL	3-631
car	--	*carinata*		J*DLO	RAD	CR	IL	LA0539
car-2	--	*carinata-2*	*car2*	J*K	RAD	pim	IL	LA2001
cb	--	*cabbage*		J*K		AC	NIL	LA3819
cb-2	--	*cabbage leaf-2*		J*K	RAD	X	NON	LA2002
cb-2	--	*cabbage leaf-2*		J*K	RAD	AC	NIL	LA3169
ccf	--	*cactiflora*		N*LO	CHEM	CSM	IL	3-805
Cf-1	--	*Cladosporium fulvum resistance-1*	*Cf, Cf1, Cfsc*	Q*	SPON	X	NON	LA2443
Cf-1	*3*	*Cladosporium fulvum resistance-1*	*Cf-5, Cf5*	Q*	SPON	X	NON	LA2447
Cf-1	*3*	*Cladosporium fulvum resistance-1*	*Cf-5, Cf5*	Q*	SPON	MM	NIL	LA3046
Cf-2	--	*Cladosporium fulvum resistance-2*	*Cf2, Cfp1*	Q*	SPON	X	NON	LA2444
Cf-2	--	*Cladosporium fulvum resistance-2*	*Cf2, Cfp1*	Q*	SPON	MM	NIL	LA3043
Cf-3	--	*Cladosporium fulvum resistance-3*	*Cf3, Cfp2*	Q*	SPON	X	NON	LA2445
Cf-3	--	*Cladosporium fulvum resistance-3*	*Cf3, Cfp2*	Q*	SPON	MM	NIL	LA3044
Cf-4	--	*Cladosporium fulvum resistance-4*	*Cf-8, Cf4, Cf-1^2*	Q*	SPON	X	NON	LA2446
Cf-4	--	*Cladosporium fulvum resistance-4*	*Cf-8, Cf4, Cf-1^2*	Q*	SPON	MM	NIL	LA3045
Cf-4	--	*Cladosporium fulvum resistance-4*	*Cf-8, Cf4, Cf-1^2*	Q*	SPON	AC	NIL	LA3267

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Cf-6	--	*Cladosporium fulvum resistance-6*		Q*	SPON	X	NON	LA2448
Cf-7	--	*Cladosporium fulvum resistance-7*		Q*	SPON	X	NON	LA2449
Cf-9	--	*Cladosporium fulvum resistance-9*		Q*	SPON	MM	NIL	LA3047
cfa	--	*conferta*	*cfa1*	K*		LU	NON	LA0832
cg	--	*congesta*	*cg1*	K*J	RAD	RR	IL	LA0831
ch	--	*chartreuse*		L*	SPON	PSN	IL	2-253
ch	--	*chartreuse*		L*	SPON	AC	NIL	LA3720
ci	--	*cincta*	*ci1*	K*	RAD	CR	IL	LA0938
cit	--	*citriformis*		O*JK	RAD	RR	IL	LA2024
cjf	--	*conjunctiflora*		L*N	SPON	PTN	IL	LA1056
ck	--	*corky fruit*		O*	SPON	X	NON	LA2003
cl-2	--	*cleistogamous-2*	*cl2*	L*N	SPON	SM	IL	2-185
cla	--	*clara*		C*A	RAD	LU	IL	LA0540
clau	--	*clausa*	*ff, vc*	J*LO	RAD	LU	IL	LA0591
clau	--	*clausa*	*ff, vc*	J*LO	RAD	X	NON	LA0719
clau	--	*clausa*	*ff, vc*	J*LO	RAD	AC	NIL	LA3583
clau	*ff*	*clausa*		J*LO	SPON	VFSM	IL	2-505
clau	*ics*	*clausa*	*ics*	J*	SPON	PTN	IL	LA1054
clau	*ics*	*clausa*	*ics*	J*	SPON	AC	NIL	LA3713
clau	*prov2*	*clausa*	*clau*	J*LO	SPON	X	IL	LA0509
clau	*vc*	*clausa*		J*LO	SPON	X	NON	LA0896
cls	--	*clarescens*		C*K	RAD	RR	IL	LA2025
clt	--	*coalita*		J*	RAD	LU	IL	LA2026
cm	--	*curly mottled*		G*JNO	SPON	PCV	NON	LA0272
cm	--	*curly mottled*		G*JNO	SPON	AC	NIL	LA2919
cma	--	*commutata*		K*DHJ	RAD	RR	IL	LA2027
Cmr	--	*Cucumber mosaic resistance*		Q*	SPON	X	NON	LA3912
cn	--	*cana*	*ca*	D*K	RAD	RR	IL	LA0590
Cnr	--	*Colorless nonripening*		P*	SPON	AC	NIL	LA4459
co	--	*cochlearis*		J*D	RAD	CR	IL	LA0592
coa	--	*corrotundata*	*coa1*	J*KLT	RAD	CR	IL	LA0940
com	--	*complicata*		K*J	RAD	CR	IL	LA0664
com	*in*	*complicata*	*in*	K*DJ	RAD	CR	IL	LA0610
com	*in*	*complicata*	*in*	K*DJ	RAD	AC	NIL	LA3715
con	--	*convalescens*		E*FK	RAD	CR	IL	LA0541
con	--	*convalescens*		E*FK	RAD	AC	NIL	LA3671
cor	--	*coriacea*		K*J	RAD	CR	IL	LA0666
cor	--	*coriacea*		K*J	RAD	AC	NIL	LA3743
cpa	--	*composita*	*cpa1*	M*K	RAD	RR	IL	LA0833
cpt	--	*compact*		K*EJ	SPON	XLP	IL	2-377
cpt	--	*compact*		K*EJ	SPON	AC	NIL	LA3723
Cri	--	*Crispa*		H*JU	RAD	CR	IL	LA0667
Crk	--	*Crinkled*		J*T	SPON	X	NON	LA1050
crt	--	*cottony-root*		R*	SPON	RCH	NON	LA2802
cru	--	*corrupta*	*cru1*	K*J		LU	IL	LA0941
cry1	--	*cryptochrome 1*		AE*	RAD	MM	IL	LA4359

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cta	--	*contaminata*	*cta1*	K*HJN	RAD	RR	IL	LA0939
ctr	*1*	*citrate concentration*		V*	SPON	pim	NON	LA2904
ctt	--	*contracta*		K*J	RAD	LU	IL	LA2028
Cu	--	*Curl*		J*KT	SPON	STD	IL	LA0325
Cu	--	*Curl*		J*KT	SPON	AC	NIL	LA3740
cu-2	--	*curl-2*	*cu2*	J*	RAD	CT	IL	LA2004
cu-3	--	*curl-3*		J*KT	SPON	pim	NON	LA2398
cul	--	*culcitula*		K*U	RAD	RR	IL	LA2029
cur	--	*curvifolia*		J*EK	RAD	RR	IL	LA0668
cv	--	*curvata*	*cu*	K*JT	RAD	LU	IL	LA0593
cv	*2*	*curvata*	*acu*	K*JT	RAD	CR	IL	LA0660
cva	--	*conversa*		K*D	RAD	CR	IL	LA0665
cvl	--	*convoluta*	*cvl1*	K*J	RAD	RR	IL	LA0830
Cvx	--	*Convexa*		J*	SPON	X	NON	LA1151
d	--	*dwarf*		K*JT	SPON	STN	NIL	LA0313
d	--	*dwarf*		K*JT	SPON	FB	NIL	LA3022
d	--	*dwarf*		K*JT	SPON	GRD	NIL	LA3031
d	*b*	*dwarf*		K*JTL	SPON	RR	IL	LA3865
d	*cr*	*dwarf*	*rob^crisp*	K*JT	RAD	CR	IL	LA0570
d	*im*	*dwarf*	*rob^imm*	K*JT	RAD	CR	IL	LA0571
d	*prov2*	*dwarf*	*d*	K*JT	CHEM	VCH	IL	3-623
d	*provcr -2*	*dwarf*	*d^cr*	K*JT	CHEM	VF36	IL	3-420
d	*provcr -3*	*dwarf*	*d^cr*	K*JT	CHEM	VF36	IL	3-422
d	*x*	*dwarf*		K*JT	SPON	SPZ	IL	LA0160
d	*x*	*dwarf*		K*JT	SPON	PCV	NON	LA1052
d	*x*	*dwarf*		K*JT	SPON	AC	NIL	LA3615
d	*x*	*dwarf*		K*JT	SPON	VAN	NIL	LA3902
d-2	--	*dwarf-2*	*rob2, rob II, d2*	K*N	RAD	RR	IL	LA0625
dc	--	*decomposita*	*dc1*	J*	RAD	RR	IL	LA0819
dd	--	*double dwarf*	*d^xx*	K*J	SPON	X	NON	LA0810
de	--	*declinata*		K*JU	RAD	RR	IL	LA0594
de	--	*declinata*		K*JU	RAD	AC	NIL	LA3742
deb	--	*debilis*		H*BCJ	RAD	CR	IL	LA0542
deb	--	*debilis*		H*BCJ	RAD	AC	NIL	LA3727
dec	--	*decumbens*		K*R	RAD	LU	IL	LA0669
def	--	*deformis*		J*LN	RAD	RR	IL	LA0543
def	--	*deformis*		J*LN	RAD	AC	NIL	LA3749
def	*2*	*deformis*	*vit*	J*	RAD	CR	IL	LA0634
def-2	--	*deformis*		J*LN	RAD	AC	NIL	LA2920
Del	--	*Delta*		P*	SPON	AC	NIL	LA2921
Del	--	*Delta*		P*	SPON	RU	NIL	LA2996A
Del	--	*Delta*		P*	SPON	M82	NON	LA4099
deli	--	*deliquescens*		K*CJ	RAD	RR	IL	LA0595

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dep	--	*deprimata*		T*J	RAD	CR	IL	LA0544
depa	--	*depauperata*		K*CJ	RAD	RR	IL	LA0596
depa	--	*depauperata*		K*CJ	RAD	AC	NIL	LA3725
det	--	*detrimentosa*		C*KF	RAD	RR	IL	LA0670
det	*2*	*detrimentosa*		C*KF	RAD	RR	IL	LA0820
Df	--	*Defoliator*		Y*H	SPON	par	NON	LA0247
dgt	--	*diageotropica*	*lz-3*	K*R	SPON	VFN8	IL	LA1093
dgt	*dp*	*diageotropica*	*dp*	J*KT	RAD	CT	IL	LA2526
Dia-2	*1*	*Diaphorase-2*		V*	SPON	pen	NON	LA0716
Dia-2	*2*	*Diaphorase-2*		V*	SPON	VF36	NIL	LA4232
Dia-3	*1*	*Diaphorase-3*		V*	SPON	X	NON	LA3345
Dia-3	*1*	*Diaphorase-3*		V*	SPON	VF36	NIL	LA4269
Dia-4	*1*	*Diaphorase-4*		V*	SPON	VF36	NIL	LA4284
dil	--	*diluta*		D*JK	RAD	CR	IL	LA0545
dil	--	*diluta*		D*JK	RAD	AC	NIL	LA3728
dim	--	*diminuta*		A*DK	RAD	LU	IL	LA0597
dim-2	--	*diminuta-2*	*dim2*	A*K	RAD	AC	NIL	LA3170
dis	--	*discolor*		D*F	RAD	CR	IL	LA0598
div	--	*divaricata*		C*AJK	RAD	CR	NON	LA0671
div	--	*divaricata*		C*AJK	RAD	AC	NIL	LA3818
dl	--	*dialytic*		I*LN	SPON	SM	IL	2-069
dl	--	*dialytic*		I*LN	SPON	AC	NIL	LA3724
dl	*S*	*dialytic*	*Dl^s*	L*N	SPON	VF36	NIL	LA3906
dlb	--	*dilabens*	*dlb1*	C*JK	RAD	CR	IL	LA0829
dm	--	*dwarf modifier*	*d2*	K*	SPON	X	NON	LA0014
dmd	--	*dimidiata*		K*JU	RAD	LU	IL	LA2033
dmt	--	*diminutiva*		K*	CHEM	VF36	IL	3-007
dps	--	*diospyros*		P*	SPON	X	NON	LA1016
dpy	--	*dumpy*		K*J	SPON	X	NON	LA0811
dpy	--	*dumpy*		K*J	SPON	AC	NIL	LA3171
dpy	*prov2*	*dumpy*	*dpy*	K*J	CHEM	VCH	IL	3-630
dpy	*prov3*	*dumpy*	*dpy*	K*J	SPON	ANU	IL	LA1053
drt	--	*dwarf root*		R*	CHEM	X	NON	LA3207
ds	--	*dwarf sterile*		N*K	SPON	EPK	IL	2-247
ds	--	*dwarf sterile*		N*K	SPON	AC	NIL	LA3767
dt	--	*dilatata*	*dt1*	C*JK	RAD	CR	IL	LA0828
dtt	--	*detorta*		J*K	RAD	LU	IL	LA2030
du	--	*dupla*		J*KU	RAD	LU	IL	LA2034
dv	--	*dwarf virescent*		F*D	SPON	X	NON	LA0155
e	--	*entire*	*b*	J*	SPON	AC	NIL	LA2922
e	*prov3*	*entire*	*e*	J*	CHEM	VCH	IL	3-616
e-2	--	*entire-2*		J*	CHEM		NON	3-705
ec	--	*exserted carpels*		O*		X	NON	LA4340
eca	--	*echinata*		K*	RAD	RR	IL	LA2035
el	--	*elongated*	*e*	O*	SPON	AC	NIL	LA3738
ele	--	*elegans*		E*JK	RAD	CR	IL	LA0546

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ele	--	*elegans*		E*JK	RAD	AC	NIL	LA3825
ele	*2*	*elegans*	*ang*	E*JK	RAD	CR	IL	LA0586
elu	--	*eluta*		E*K	RAD	LU	IL	LA0547
em	--	*emortua*	*em1*	H*K	RAD	RR	IL	LA0827
em	--	*emortua*	*em1*	H*K	RAD	AC	NIL	LA3817
en	--	*ensiform*		J*	SPON	X	NON	LA1787
ep	--	*easy peeling*		O*	RAD	MM	IL	LA1158
ep	--	*easy peeling*		O*	RAD	AC	NIL	LA3616
Epi	--	*Epinastic*		J*K	SPON	VFN8	IL	LA2089
er	--	*erecta*		K*JT	RAD	CR	IL	LA0600
era	--	*eramosa*	*era1*	B*JK	RAD	CR	IL	LA0850
Est-1	*1*	*Esterase-1*		V*	SPON	pimp	NON	LA1338
Est-1	*1*	*Esterase-1*		V*	SPON	cer	IL	LA2415
Est-1	*2*	*Esterase-1*		V*	SPON	pim	NON	LA1260
Est-1	*3*	*Esterase-1*		V*	SPON	pim	NON	LA1820
Est-1	*4*	*Esterase-1*		V*	SPON	par	NON	LA1326
Est-1	*5*	*Esterase-1*		V*	SPON	pen	NON	LA0716
Est-1	*n*	*Esterase-1*		V*	SPON	pim	NON	LA1817
Est-2	*1*	*Esterase-2*		V*	SPON	pen	NON	LA0716
Est-3	*1*	*Esterase-3*		V*	SPON	par	NON	LA0247
Est-4	*1*	*Esterase-4*		V*	SPON	par	NON	LA1319
Est-4	*2*	*Esterase-4*		V*	SPON	pim	NON	LA2423
Est-4	*3*	*Esterase-4*		V*		X	NON	LA0410
Est-4	*4*	*Esterase-4*		V*	SPON	PCV	NON	LA2425
Est-4	*5*	*Esterase-4*		V*	SPON	pim	NON	LA2426
Est-4	*6*	*Esterase-4*		V*	SPON	cer	NON	LA1338
Est-4	*7*	*Esterase-4*		V*	SPON	cer	NON	LA1386
Est-4	*8*	*Esterase-4*		V*	SPON	pim	NON	LA2429
Est-5	*1*	*Esterase-5*		V*	SPON	pen	NON	LA0716
Est-6	*1*	*Esterase-6*		V*	SPON	pen	NON	LA0716
Est-7	*1*	*Esterase-7*		V*	SPON	par	NON	LA1319
Est-7	*2*	*Esterase-7*		V*	SPON	pen	NON	LA0716
Est-8	*1*	*Esterase-8*		V*	SPON	pen	NON	LA0716
ete	--	*extenuata*	*ete1*	K*JN	RAD	CR	IL	LA0942
ex	--	*exserted stigma*		L*N	SPON	SM	IL	2-191
exl	--	*exilis*	*ex*	D*JK	RAD	CR	IL	LA0601
exs	--	*excedens*	*exs1*	K*J	RAD	CR	IL	LA0852
f	--	*fasciated fruit*		O*L	SPON	ESC	NON	LA0517
f	*D*	*fasciated fruit*		O*L	SPON	PCV	NON	LA0767
fa	--	*falsiflora*	*fa1*	M*N	RAD	RR	IL	LA0854
fcf	--	*fucatifolia*	*fcf1*	D*CK	RAD	CR	IL	LA0945
fd	--	*flecked dwarf*		G*DK	RAD	BK	NON	LA0873
fd	--	*flecked dwarf*		G*DK	RAD	AC	NIL	LA3750
Fdh-1	*1*	*Formate dehydrogenase-1*		V*	SPON	pen	NON	LA0716
Fdh-1	*2*	*Formate dehydrogenase-1*		V*	SPON	VF36	NIL	LA4238
fe	--	*fertilis*		J*LO	RAD	LU	IL	LA0672

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fgv	--	*fimbriate gold virescent*		F*CJ	SPON	VF36	IL	LA1143
fir	--	*firma*		K*JM	RAD	CR	IL	LA0602
fl	--	*fleshy calyx*		O*	SPON	X	NON	LA2372
fla	--	*flavescens*		D*JK	RAD	LU	IL	LA0548
fla	--	*flavescens*		D*JK	RAD	AC	NIL	LA3565
flav	--	*flavida*		C*	RAD	LU	IL	LA0603
flc	--	*flacca*		W*HJY	RAD	RR	IL	LA0673
flc	--	*flacca*		W*HJY	RAD	AC	NIL	LA3613
fld	--	*flaccida*	*fld1*	K*HJT	RAD	RR	IL	LA0943
fle	--	*flexifolia*	*fle1*	A*J	RAD	AC	NIL	LA3764
fli	--	*filiform inflorescence*		M*LN	SPON	X	NON	LA1790
fn	--	*finely-netted*		D*	RAD	PSP	IL	LA2005
fr	--	*frugalis*		K*JT	RAD	CR	IL	LA0674
frg	--	*fragilis*	*frg1*	D*CJK	RAD	CR	IL	LA0864
fri	*1*	*far red light insensitive*	*phyA*	AY*	CHEM	MM	IL	LA3809
fri	*1*	*far red light insensitive*	*phyA*	AY*	CHEM	MM	IL	LA4356
Frl	--	*FORL resistance*	*Fr1, Fr-1*	Q*	SPON	AC	NIL	LA3273
Frs	--	*Frosty spot*	*Nec*	H*	SPON	X	NON	LA2070
frt	--	*fracta*		K*JT	RAD	LU	IL	LA2038
fsc	--	*fuscatinervis*	*dkv*	E*	SPON	VF145	IL	LA0872
ft	--	*fruiting temperature*		O*	SPON	X	NON	LA2006
fu	--	*fusiformis*		C*JK	RAD	CR	IL	LA0605
fu	--	*fusiformis*		C*JK	RAD	AC	NIL	LA3070
fua	--	*fucata*	*fua1*	E*K	RAD	CR	IL	LA0944
fug	--	*fulgida*	*fug1*	E*BK	RAD	RR	IL	LA0946
ful	--	*fulgens*		E*	RAD	CR	IL	LA0550
ful	*2*	*fulgens*	*ful1^2*	E*	RAD	RR	IL	LA0843
ful-3	--	*fulgens-3*		E*	SPON	VF36	IL	LA1495
fus	--	*fulgescens*		E*	RAD	LU	IL	LA2039
Fw	--	*Furrowed*		J*KN	SPON	PSN	IL	LA0192
Fw	--	*Furrowed*		J*KN	SPON	AC	NIL	LA3300
fx	--	*flexa*		K*	RAD	LU	IL	LA2037
fy	--	*field yellow*		E*	SPON	VF36	IL	2-565
fy	--	*field yellow*		E*	SPON	AC	NIL	LA3295
ga	--	*galbina*	*ga1*	D*BE	RAD	CR	IL	LA0836
ga	--	*galbina*	*ga1*	D*BE	RAD	AC	NIL	LA3828
gas	--	*gamosepala*	*gas1*	D*JL	RAD	RR	IL	LA0947
gbl	--	*globula*		K*JU	RAD	LU	IL	LA2032
Ge	*c*	*Gamete eliminator*		N*	SPON	CR	NON	LA0533
Ge	*p*	*Gamete eliminator*		N*	SPON	PSN	NON	LA0012
gf	--	*green flesh*		P*	SPON	PCV	NON	LA2071
gf	--	*green flesh*		P*	SPON	RU	NIL	LA2999
gf	--	*green flesh*		P*	SPON	AC	NIL	LA3534
gf	*2*	*green flesh*		P*	SPON	BP	NON	LA4449
gf	*3*	*green flesh*		P*	SPON	PR	NON	LA4450
gf	*4*	*green flesh*		P*	SPON	BC	NON	LA4451

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gf	*5*	*green flesh*		P*	SPON	NYG	NON	LA4452
gfl	--	*globular flower*		L*	SPON	X	NON	LA2984
gh	--	*ghost*	*ab*	B*G	SPON	SM	IL	LA0295
gh-2	--	*ghost-2*		C*G	CHEM	SX	IL	LA2007
gi	--	*gibberosa*		J*K	RAD	RR	IL	LA2040
gib-1	--	*gibberellin deficient-1*		K*Y	CHEM	MM	IL	LA2893
gib-2	--	*gibberellin deficient-2*		K*Y	CHEM	MM	IL	LA2894
gib-3	--	*gibberellin-deficient-3*		K*Y	CHEM	MM	IL	LA2895
gib-3	*x*	*gibberellin-deficient-3*		K*Y	CHEM	X	NON	LA2993
gl	--	*glauca*		J*F	RAD	CR	IL	LA0675
glau	--	*glaucescens*		E*JK	RAD	CR	IL	LA0606
glb	--	*globularis*		K*CJ	RAD	RR	IL	LA0677
glc	--	*glaucophylla*		D*JK	RAD	RR	IL	LA0676
glf	--	*globiformis*	*glf1*	K*M	RAD	CR	IL	LA0948
glg	--	*galapagos light green*		D*	SPON	X	NON	LA1059
glm	--	*glomerata*		K*	RAD	LU	IL	LA2031
glo	--	*globosa*		K*	RAD	CR	IL	LA0551
glo	*2*	*globosa*	*inx, intro*	K*	RAD	LU	IL	LA0612
glo	*2*	*globosa*	*inx, intro*	K*	RAD	AC	NIL	LA3618
glu	--	*glutinosa*	*glu1*	O*P	RAD	RR	IL	LA0842
gm	--	*gamosepalous*		L*	RAD	SX	IL	LA2008
Got-1	*1*	*Glutamate oxaloacetate transaminase-1*		V*	SPON	pim	NON	LA1670
Got-2	*1*	*Glutamate oxaloacetate transaminase-2*		V*	SPON	pim	NON	LA1825
Got-2	*2*	*Glutamate oxaloacetate transaminase-2*		V*	SPON	che	NON	LA1450
Got-2	*4*	*Glutamate oxaloacetate transaminase-2*		V*	SPON	pim	NON	LA1828
Got-2	*n*	*Glutamate oxaloacetate transaminase-2*		V*	SPON	pim	NON	LA1613
Got-2	*n*	*Glutamate oxaloacetate transaminase-2*		V*	SPON	pim	NON	LA1659
Got-3	*2*	*Glutamate oxaloacetate transaminase-3*		V*	SPON	pim	NON	LA1831
Got-3	*3*	*Glutamate oxaloacetate transaminase-3*		V*	SPON	par	NON	LA1321
Got-3	*n*	*Glutamate oxaloacetate transaminase-3*		V*	SPON	che	NON	LA1464
Got-4	*1*	*Glutamate oxaloacetate transaminase-4*		V*	SPON	par	NON	LA1306
Got-4	*1*	*Glutamate oxaloacetate transaminase-4*		V*	SPON	par	NON	LA1326
Got-4	*2*	*Glutamate oxaloacetate transaminase-4*		V*	SPON	pim	NON	LA1835
Got-4	*n*	*Glutamate oxaloacetate transaminase-4*		V*	SPON	cer	NON	LA1833
Gp	--	*Gamete promoter*		N*	SPON	AC	NIL	LA3273
gq	--	*grotesque*		L*O	SPON	X	NON	LA0137
Gr	--	*Green ripe*	*gr*	P*	SPON	X	NON	LA2453
Gr	*Nr-2*	*Green ripe*		P*	SPON	X	NON	LA2455
gra	--	*gracilis*		K*J	RAD	CR	IL	LA0607
grc	--	*gracillama*	*grc1*	E*JK	RAD	RR	IL	LA0950
grf	--	*grandifructa*	*grf1*	K*O	RAD	LU	IL	LA0951
grl	--	*gracilenta*	*grl1*	E*JK	RAD	RR	IL	LA0949
grn	--	*granulosa*		I*	CHEM	CSM	IL	3-804
gro	--	*grossa*		J*DK	RAD	LU	IL	LA2041
gs	--	*green stripe*		P*	SPON	GSM	IL	LA0212
gs	--	*green stripe*		P*	SPON	AC	NIL	LA3530

Gene	Allele	Locus name	Synonyms	Class	Origin	Back	Iso	Acc #
h	--	*hairs absent*	*H*	I*	SPON	X	NON	LA0154
h	--	*hairs absent*	*H*	I*	SPON	AC	NIL	LA3172
he	--	*heteroidea*		D*JK	RAD	CR	IL	LA0679
Hero	--	*Heterodera rostochiensis resistance*		Q*	SPON	X	NON	LA1792
hg	--	*heterogemma*	*hg1*	K*M	RAD	CR	IL	LA0837
hi	--	*hilara*		K*DJT	RAD	CR	IL	LA0952
hl	--	*hairless*		I*X	SPON	AC	NIL	LA3556
hl	*2*	*hairless*	*cal, cal1*	I*X	RAD	CR	IL	LA0937
hl	*prov3*	*hairless*	*hl*	I*X	CHEM	VCH	IL	3-095
hl	*prov4*	*hairless*	*hl*	I*X	CHEM	VCH	IL	3-126
hl	*prov5*	*hairless*	*hl*	I*X	CHEM	VCH	IL	3-605
hl-2	--	*hairless-2*	*hl^prov6*	I*X	CHEM	VF36	NON	3-417
hp-1	--	*high pigment-1*	*hp, hp1, hp2, bs, dr*	P*TA	SPON	X	NON	LA0279
hp-1	--	*high pigment-1*	*hp, hp1, hp2, bs, dr*	P*TA	SPON	RU	NIL	LA3004
hp-1	--	*high pigment-1*	*hp, hp1, hp2, bs, dr*	P*TA	SPON	AC	NIL	LA3538
hp-1	*w*	*high pigment-1*		P*TA	CHEM	GT	IL	LA4012
hp-2	--	*high pigment-2*	*hp*	P*TA	CHEM	SM	NIL	LA3006
hp-2	--	*high pigment-2*	*hp*	P*TA	CHEM	MM	NON	LA4013
hp-2	*dg*	*high pigment-2*	*dg*	P*AT	SPON	MP	IL	LA2451
hp-2	*dg*	*high pigment-2*	*dg*	P*AT	SPON	MP	NIL	LA3005
hp-2	*j*	*high pigment-2*	*hp*	P*T	SOMA	MM	NON	LA4014
hp-3	*prov7*	*high pigment-3*	*ah*	A*	CHEM	MM	IL	3-343
Hr	--	*Hirsute*		I*	SPON	X	IL	LA0895
Hrt	--	*Hirtum*		I*	SPON	X	NON	LA0501
ht	--	*hastate*		J*L	SPON	SM	IL	2-295
hy	--	*homogeneous yellow*		E*	SPON	AC	NIL	LA3308
hy	--	*homogeneous yellow*		E*	SPON	cer	NON	LA1142
I	--	*Immunity to Fusarium wilt*		Q*	SPON	VD	NIL	LA3025
I	--	*Immunity to Fusarium wilt*		Q*	SPON	GRD	NIL	LA3042
I-3	--	*Immunity to Fusarium wilt-3*		Q*	SPON	X	NON	LA4025
I-3	--	*Immunity to Fusarium wilt-3*		Q*	SPON	X	NON	LA4026
ic	--	*inclinata*		J*CK	RAD	RR	IL	LA0682
ica	--	*icana*		B*JK	RAD	RR	IL	LA2042
icn	--	*incana*		B*F	SPON	X	NON	LA1009
icn	--	*incana*		B*F	SPON	AC	NIL	LA3173
id	--	*indehiscens*		L*JO	RAD	RR	IL	LA0684
ida	--	*inordinata*		K*JT	RAD	RR	IL	LA2043
Idh-1	*1*	*Isocitrate dehydrogenase-1*		V*	SPON	hir	NON	LA2906
ig	--	*ignava*		D*K	RAD	CR	IL	LA0608
ig	--	*ignava*		D*K	RAD	AC	NIL	LA3752
im	--	*impatiens*	*im1*	K*UW	RAD	RR	IL	LA0863
imb	--	*imbecilla*		E*DK	SPON	CR	IL	LA0552
imb	--	*imbecilla*		E*DK	SPON	AC	NIL	LA3566

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imp	*dia*	*impedita*		E*K	SPON	CR	IL	LA0680
imp	*eg*	*impedita*		E*K	SPON	CR	IL	LA0681
ina	--	*inflexa*	*ina1*	K*	RAD	LU	IL	LA0840
ina	--	*inflexa*	*ina1*	K*	RAD	AC	NIL	LA3732
inc	--	*incurva*		K*J	RAD	CR	IL	LA0609
inc	--	*incurva*		K*J	RAD	AC	NIL	LA3730
inf	--	*informa*		J*K	RAD	CR	IL	LA0553
inf	--	*informa*		J*K	RAD	AC	NIL	LA3726
ini	--	*inquieta*	*ini1*	I*DJK	RAD	RR	IL	LA0953
ino	--	*involuta*	*ino1*	K*	RAD	CR	IL	LA0954
ins	--	*inconstans*	*ins1*	K*	RAD	RR	IL	LA0841
inv	--	*invalida*		F*EJK	RAD	CR	IL	LA0554
inv	--	*invalida*		F*EJK	RAD	AC	NIL	LA3439
Ip	--	*Intense pigment*		P*	SPON	VF145	NIL	LA1500
Ip	--	*Intense pigment*		P*	SPON	VF145	NIL	LA1563
irr	--	*irregularis*		J*CT	RAD	CR	IL	LA0613
irr	--	*irregularis*		J*CT	RAD	AC	NIL	LA3747
ita	--	*inquinata*	*ita1*	H*G	RAD	RR	IL	LA0839
j	--	*jointless*	*lf*	M*	SPON	FB	NIL	LA3023
j	--	*jointless*	*lf*	M*	SPON	GRD	NIL	LA3033
j-2	--	*jointless-2*	*j2*	M*	SPON	PSN	NON	LA0315
j-2	--	*jointless-2*	*j2*	M*	SPON	O8245	NON	LA3899
j-2	*in*	*jointless-2*	*j2^in*	M*	SPON	X	NON	LA0756
Jau	--	*Jaundiced*		E*	SPON	AC	NIL	LA3174
jug	--	*jugata*		K*LO	RAD	CR	IL	LA0555
jug	*2*	*jugata*	*jug1^2*	K*LO	RAD	LU	IL	LA0834
l	--	*lutescent*	*g*	C*	SPON	AC	NIL	LA3717
l	*2*	*lutescent*	*rub*	C*	RAD	LU	IL	LA0572
l	*prov3*	*lutescent*	*l*	C*	SPON	ROMA	IL	2-491
l	*prov4*	*lutescent*	*l*	C*	SPON	EPK	NIL	LA3009
l-2	--	*lutescent-2*	*l-3, l2*	C*Y	SPON	LRD	IL	LA0643
l-2	--	*lutescent-2*	*l-3, l2*	C*Y	SPON	AC	NIL	LA3581
La	--	*Lanceolate*		J*	SPON	PCV	NON	LA0335
lae	--	*laesa*		H*JK	RAD	RR	IL	LA0685
lan	--	*languida*		D*F	RAD	RR	IL	LA2044
lap	--	*lamprochlora*	*lap1*	J*K	RAD	RR	IL	LA0955
lat	--	*lata*		K*	RAD	CR	IL	LA0556
le	--	*lembiformis*	*le1*	K*ACJR	RAD	RR	IL	LA0956
lep	--	*leprosa*	*lep1*	H*K	RAD	RR	IL	LA0957
lg	--	*light-green*	*lme*	D*	SPON	X	NON	LA1156
lg	--	*light-green*	*lme*	D*	SPON	AC	NIL	LA3175
lg-5	--	*light green-5*	*lg5, lm, fy, yt*	D*	SPON	X	NON	LA0757
lg-5	--	*light green-5*	*lg5, lm, fy, yt*	D*	SPON	AC	NIL	LA3176

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li	--	*limbrata*		J*	RAD	LU	IL	LA2045
Ln	--	*Lanata*		I*	CHEM	VF36	IL	3-071
Ln	*G*	*Lanata*		I*	CHEM	FLD	IL	LA3127
lop	--	*longipes*	*lop1*	J*DK	RAD	CR	IL	LA0958
Lpg	--	*Lapageria*		J*LNT	SPON	VF36	IL	2-561
Lpg	--	*Lapageria*		J*LNT	SPON	AC	NIL	LA3739
ls	--	*lateral suppresser*		K*LN	SPON	X	NON	LA2892
ls	--	*lateral suppresser*		K*LN	SPON	AC	NIL	LA3761
ls	--	*lateral suppresser*		K*LN	SPON	AMB	NON	LA0329
ls	*2*	*lateral suppresser*		K*LN		PRI	NIL	LA3901
lt	--	*laeta*	*lt1*	E*DK	RAD	CR	IL	LA0835
ltf	--	*latifolia*		J*	CHEM	VF36	IL	3-035A
lu	--	*luteola*		L*	RAD	LU	IL	LA0686
luc	--	*lucida*		C*F	RAD	CR	IL	LA0557
lur	--	*lurida*	*lur1*	E*D	RAD	RR	IL	LA0959
lut	--	*lutea*		E*F	RAD	CR	IL	LA0558
lut	--	*lutea*		E*F	RAD	AC	NIL	LA3714
Lv	--	*Leveillula taurica resistance*		Q*	SPON	X	NON	LA3118
Lv	--	*Leveillula taurica resistance*		Q*	SPON	X	NON	LA3119
Lx	--	*Lax*		J*	SPON	LK	NON	LA0505
Lx	--	*Lax*		J*	SPON	AC	NIL	LA3177
lyr	--	*lyrate*		J*NO	SPON	PCV	NON	LA0763
lyr	--	*lyrate*		J*NO	SPON	AC	NIL	LA2923
lz	--	*lazy*		K*	RAD	AC	NIL	LA3762
lz-2	--	*lazy-2*		K*	CHEM	SM	NIL	LA2924
lz-2	--	*lazy-2*		K*	CHEM	AC	NIL	LA3710
m	--	*mottled*		G*J	RAD	AC	NIL	LA3568
m-2	--	*mottled-2*	*m2, mo, md*	F*D	RAD	AC	NIL	LA3574
ma	--	*macrocarpa*		J*O	RAD	LU	IL	LA0687
mac	--	*maculata*	*mac1*	H*K	RAD	CR	IL	LA0960
mad	--	*marcida*	*mad1*	T*K	RAD	CR	IL	LA0961
Mae-1	*1*	*Malic enzyme-1*		V*	SPON	VF36	NIL	LA4251
mar	--	*marcescens*		T*K	RAD	LU	NON	LA0688
marm	--	*marmorata*		G*D	RAD	CR	IL	LA0559
marm	*2*	*marmorata*	*marm1^2*	G*D	RAD	CR	IL	LA0844
mc	--	*macrocalyx*		L*M	SPON	X	NON	LA0159
mcn	--	*maculonecrotic*		G*H*CF	CHEM	VF36	IL	3-045
mcr	--	*multicolor*		B*CH	RAD	LU	IL	LA2047
mcs	--	*macrosepala*		L*J	RAD	LU	IL	LA2046
Mdh-1	*1*	*Malate dehydrogenase-1*		V*	SPON	VF36	NIL	LA4243
Mdh-1	*1*	*Malate dehydrogenase-1*		V*	SPON	X	NON	LA3344
Mdh-4	*1*	*Malate dehydrogenase-4*		V*		VF36	NIL	LA4283
Me	--	*Mouse ears*		J*K	SPON	RU	IL	LA0324
Me	--	*Mouse ears*		J*K	SPON	AC	NIL	LA3552
med	--	*mediocris*	*med1*	K*	RAD	CR	IL	LA0962

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mel	--	*melongenoida*	*mel1*	O*K	RAD	LU	IL	LA0963
mgn	--	*marginal necrotic*		H*C	CHEM	VF36	IL	3-025
Mi	--	*Meloidogyne incognita resistance*		Q*	SPON	MM	NIL	LA2819
Mi	--	*Meloidogyne incognita resistance*		Q*	SPON	VFN8	NON	LA1022
Mi-3	--	*Meloidogyne incognita resistance-3*		Q*	SPON	per	NON	LA3858
Mi-9	--	*Meloidogyne incognita resistance-9*		Q*	SPON	Sarc	NON	LA2157
mic	--	*microcarpa*	*mic1*	D*GLO	RAD	CR	IL	LA0845
mn	--	*minuta*	*mi*	K*CJ	RAD	CR	IL	LA0614
mon	--	*monstrosa*		K*J	RAD	CR	IL	LA0615
mon	--	*monstrosa*		K*J	RAD	AC	NIL	LA3826
mor	--	*morata*	*mor1*	E*K	RAD	RR	IL	LA0848
ms-02	--	*male-sterile-2*	*ms2*	N*	SPON	PSN	IL	2-031
ms-03	--	*male-sterile-3*	*ms3*	N*	SPON	SM	IL	2-032
ms-05	--	*male-sterile-5*	*ms5*	N*	SPON	SM	IL	2-039
ms-06	--	*male-sterile-6*	*ms6*	N*	SPON	SM	IL	2-044
ms-07	--	*male-sterile-7*	*ms7*	N*	SPON	SM	IL	2-089
ms-09	--	*male-sterile-9*	*ms9*	N*	SPON	SM	IL	2-121
ms-10	--	*male-sterile-10*	*ms10*	N*	SPON	SM	IL	2-132
ms-10	*35*	*male-sterile-10*	*ms-35, ms35*	N*	SPON	VF11	IL	2-517
ms-10	*36*	*male-sterile-10*	*ms-36*	N*	SPON	VF36	IL	2-635
ms-11	--	*male-sterile-11*	*ms11*	N*	SPON	SM	IL	2-152
ms-12	--	*male-sterile-12*	*ms12*	N*	SPON	SM	IL	2-161
ms-13	--	*male-sterile-13*	*ms13*	N*	SPON	SM	IL	2-165
ms-14	--	*male-sterile-14*	*ms14*	N*	SPON	ERL	IL	2-175
ms-15	--	*male-sterile-15*	*ms15*	N*	SPON	SM	IL	2-193
ms-15	*26*	*male-sterile-15*	*ms26, ms-26*	N*	SPON	VE	IL	2-327
ms-15	*47*	*male-sterile-15*	*ms-47*	N*	SPON	UC82 B	NIL	2-837
ms-16	--	*male-sterile-16*	*ms16*	N*	SPON	PRT	IL	LA0062
ms-17	--	*male-sterile-17*	*ms17*	N*	SPON	ACE	IL	2-225
ms-18	--	*male-sterile-18*	*ms18*	N*	SPON	C255	IL	2-233
ms-23	--	*male-sterile-23*	*ms23*	N*	SPON	EPK	IL	2-273
ms-24	--	*male-sterile-24*	*ms24*	N*	SPON	EPK	IL	2-277
ms-25	--	*male-sterile-25*	*ms25*	N*	SPON	RTVF	IL	2-313
ms-27	--	*male-sterile-27*	*ms27*	N*	SPON	VE	IL	2-331
ms-28	--	*male-sterile-28*	*ms28*	N*	SPON	XLP	IL	2-355
ms-29	--	*male-sterile-29*	*ms29*	N*	SPON	CPC2	IL	2-423
ms-30	--	*male-sterile-30*	*ms30*	N*	SPON	SM	IL	2-455
ms-31	--	*male-sterile-31*	*ms31*	N*	SPON	VF6	IL	2-461
ms-32	--	*male-sterile-32*	*ms32*	N*	SPON	cer	NON	LA0359
ms-32	--	*male-sterile-32*	*ms32*	N*	SPON	MNB	NIL	LA2712
ms-32	--	*male-sterile-32*	*ms32*	N*	SPON	M167	NIL	LA2713
ms-32	--	*male-sterile-32*	*ms32*	N*	SPON	M168	NIL	LA2714
ms-32	--	*male-sterile-32*	*ms32*	N*	SPON	POR	NIL	LA2715

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ms-33	--	*male-sterile-33*	*ms33*	N*	SPON	VF11	IL	2-511
ms-34	--	*male-sterile-34*	*ms34*	N*	SPON	VF11	IL	2-513
ms-38	--	*male-sterile-38*	*ms38*	N*	SPON	VF36	IL	2-539
ms-38	*40*	*male-sterile-38*	*ms-40*	N*	SPON	VF36	IL	2-553
ms-39	--	*male-sterile-39*		N*	SPON	VF36	IL	2-549
ms-44	--	*male-sterile-44*		N*J	CHEM	SM	IL	LA2090
ms-45	--	*male-sterile-45*		N*	SPON	VFN8	IL	2-659
ms-46	--	*male-sterile-46*		N*	SPON	VFN8	IL	2-681
Ms-48	--	*Male-sterile-48*		N*	CHEM	CSM	IL	2-839
Ms-48	--	*Male-sterile-48*		N*	CHEM	VF36	NIL	LA3191
Ms-48	--	*Male-sterile-48*		N*	CHEM	TVD	NIL	LA3192
Ms-48	--	*Male-sterile-48*		N*	CHEM	MR20	NIL	LA3193
Ms-48	--	*Male-sterile-48*		N*	CHEM	T5	NIL	LA3198
Ms-48	--	*Male-sterile-48*		N*	CHEM	VCH	NIL	LA3199
ms-49	--	*male-sterile-49*		N*	SPON	per	NON	LA1161
mt	--	*midget*		K*N	SPON	NRT	NON	LA0282
mta	--	*mutata*	*mta1*	K*EFJ	RAD	RR	IL	LA0965
mts	--	*mortalis*	*mts1*	K*JM	RAD	RR	IL	LA0849
mu	--	*multinervis*		D*J	RAD	CR	IL	LA0690
mu	--	*multinervis*		D*J	RAD	AC	NIL	LA3573
mu	*3*	*multinervis*	*rv-3*	D*J	CHEM	VF36	IL	3-033
mua	--	*multifurcata*	*mua1*	K*M	RAD	CR	IL	LA0851
muf	--	*multifolia*		J*DK	RAD	RR	IL	LA0689
mup	--	*multiplicata*	*mup1*	M*L	RAD	RR	IL	LA0846
mut	--	*mutabilia*	*mut1*	K*DT	RAD	RR	IL	LA0866
muv-2	--	*multivalens-2*	*mus1*	C*FJK	RAD	CR	IL	LA0964
muv-2	--	*multivalens-2*	*mus1*	C*FJK	RAD	AC	NIL	LA3758
mux	--	*multiplex*	*mux1*	L*KM	RAD	CR	IL	LA0847
n	--	*nipple-tip*	*nt*	O*	SPON	X	NON	LA2353
n	--	*nipple-tip*	*nt*	O*	SPON	X	NON	LA2370
na	--	*nana*		K*J	RAD	CR	IL	LA0561
nc	--	*narrow cotyledons*		J*	SPON	AC	NIL	LA3178
nd	--	*netted*	*m-4*	F*	RAD	AC	NIL	LA3584
ndw	--	*necrotic dwarf*		H*JK	SPON	X	NON	LA3142
ndw	--	*necrotic dwarf*		H*JK	SPON	M82	NIL	LA4061
ne	--	*necrotic*		H*	SPON	X	NON	LA2350
ne	--	*necrotic*		H*	SPON	AC	NIL	LA3084
neg	--	*neglecta*		H*DK	RAD	CR	IL	LA0562
neg	--	*neglecta*		H*DK	RAD	AC	NIL	LA3746
neg	*ne-2*	*neglecta*	*ne-2, ne2*	H*DK	RAD	CT	IL	LA2454
neg	*ne-2*	*neglecta*	*ne-2, ne2*	H*DK	RAD	X	NON	LA2489
neg	*ne-2*	*neglecta*	*ne-2, ne2*	H*DK	RAD	AC	NIL	LA3621
nor	--	*non-ripening*		P*	SPON	X	NON	LA1793
nor	--	*non-ripening*		P*	SPON	RU	NIL	LA3013
nor	--	*non-ripening*		P*	SPON	AC	NIL	LA3770
not	--	*notabilis*		W*JY	RAD	LU	IL	LA0617

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not	--	*notabilis*		W*JY	RAD	AC	NIL	LA3614
Nr	--	*Never ripe*		P*	SPON	PSN	IL	LA0162
Nr	--	*Never ripe*		P*	SPON	RU	NIL	LA3001
nv	--	*netted virescent*		E*F	SPON	X	NON	LA0786
o	--	*ovate*		O*	SPON	AC	NIL	LA3543
o	*l*	*ovate*	*ol, O^1*	O*	SPON	X	NON	LA0271
ob	--	*obscura*		T*K	RAD	RR	IL	LA0691
obl	--	*oblate fruit*		O*	RAD	MM	NIL	LA1159
obv	--	*obscuravenosa*		U*X	SPON	M82	NON	LA3475
obv	+	*obscuravenosa*		U*X	SPON	M82	NON	LA4057
oc	--	*ochroleuca*		G*BK	RAD	RR	IL	LA0692
Od	--	*Odorless*		I*	SPON	PCV	NON	LA0292
Ol-4	--	*Oidium neolycopersici resistance-4*				Sarc	NON	LA2172
oli	--	*olivacea*		K*U	RAD	AC	NIL	LA3722
op	--	*opaca*		D*CF	RAD	CR	IL	LA0618
op	--	*opaca*		D*CF	RAD	AC	NIL	LA3567
opa	--	*opacata*	*opa1*	E*K	RAD	CR	IL	LA0966
or	--	*ordinata*		D*F	RAD	RR	IL	LA2048
Ora	--	*Orobanche aegyptica resistance*		Q*	SPON	X	NON	LA2530
os	--	*oligosperma*	*os1*	K*JT	RAD	CR	IL	LA0868
ovi	--	*oviformis*	*ovi1*	J*O	RAD	LU	IL	LA0967
p	--	*peach*		O*I	SPON	X	NON	LA2357
pa-2	--	*parva-2*	*pa1, pa2*	K*J	RAD	CR	IL	LA0970
pal	--	*pallida*		D*L	RAD	CR	IL	LA0563
pap	--	*paupercula*		J*W	RAD	RR	IL	LA2050
pas	--	*pallescens*	*pas1*	D*K	RAD	CR	IL	LA0968
pat	--	*parthenocarpic fruit*		S*	CHEM	ROMA	IL	LA2013
pat-2	--	*parthenocarpic fruit-2*		S*	SPON	X	NON	LA2413
pau	--	*pauper*		K*	RAD	CR	NON	LA0877
pct	--	*polycot*		J*KLMS	SPON	X	NON	LA2896
pcv	--	*polychrome variegated*		G*BDJ	SPON	X	NON	LA1199
pdc	--	*pudica*		K*JT	CHEM	VF36	IL	3-047
pds	--	*phosphorus deficiency syndrome*	*Ph-oid*	A*CY	SPON	X	NON	LA0813
pdw	--	*pale dwarf*		V*	SPON	X	NON	LA2457
pdw	--	*pale dwarf*		V*	SPON	X	NON	LA2490
pe	--	*sticky peel*		O*	SPON	X	NON	LA0759
pen	--	*pendens*		J*C	RAD	CR	IL	LA0694
pen	--	*pendens*		J*C	RAD	AC	NIL	LA3293
per	--	*perviridis*		A*KT	RAD	RR	IL	LA0564
pet	--	*penetrabile*	*pet-2, pet2*	K*J	RAD	CR	IL	LA0971
Pgdh-2	*1*	*6-Phosphogluconate dehydrogenase-2*		V*	SPON	pen	NON	LA0716
Pgdh-3	*1*	*6-Phosphogluconate dehydrogenase-3*		V*	SPON	pen	NON	LA0716
Pgi-1	*1*	*Phosphoglucoisomerase-1*		V*	SPON	pen	NON	LA0716
Pgi-1	*2*	*Phosphoglucoisomerase-1*		V*	SPON	par	NON	LA0735

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Pgm-1	*1*	*Phosphoglucomutase-1*		V*	SPON	hir	NON	LA1295
Pgm-2	*1*	*Phosphoglucomutase-2*		V*	SPON	pen	NON	LA0716
Ph	--	*Phytophthora infestans resistance*	*PiT, TR1*	Q*	SPON	X	NON	LA2009
Ph-2	--	*Phytophthora infestans resistance-2*		Q*	SPON	UC82	NIL	LA3151
Ph-2	--	*Phytophthora infestans resistance-2*		Q*	SPON	MNB	NIL	LA3152
Ph-3	--	*Phytophthora infestans resistance-3*		Q		CLN2 264F	NON	LA4285
Ph-3	--	*Phytophthora infestans resistance-3*		Q		CLN2 264G	NON	LA4286
phyB2	--	*phytochrome B2*		AE*	RAD	MM	IL	LA4358
pi	--	*pistillate*		L*N	SPON	SM	IL	2-137
pi-2	--	*pistillate-2*		N*LM	CHEM	CSM	IL	3-802
pic	--	*picta*		H*C	RAD	CR	IL	LA0620
pl	--	*perlucida*	*pl1*	D*CJ	RAD	CR	IL	LA0867
pl	--	*perlucida*	*pl1*	D*CJ	RAD	AC	NIL	LA3296
pla	--	*plana*		D*CK	RAD	CR	IL	LA0695
pli	--	*plicata*		K*ABJ	RAD	LU	IL	LA0696
pli	--	*plicata*		K*ABJ	RAD	AC	NIL	LA3672
pm	--	*praematura*	*pm1*	Z*CJK	RAD	RR	IL	LA0855
Pn	--	*Punctate*		A*I	SPON	X	NON	LA0812
Pn	--	*Punctate*		A*I	SPON	AC	NIL	LA3089
pol	--	*polylopha*		K*JO	RAD	LU	IL	LA0697
pp	--	*polyphylla*	*pp1*	J*D	RAD	RR	IL	LA0860
ppa	--	*purpurea*		A*	RAD	LU	IL	LA2054
pr	--	*propeller*		J*	RAD	X	NON	LA0326
pr	--	*propeller*		J*	RAD	AC	NIL	LA2925
prc	--	*procumbens*		K*CJ	RAD	CR	IL	LA0698
pre	--	*pressa*		K*J	RAD	RR	IL	LA2053
pro	--	*procera*		J*Z	RAD	CR	IL	LA0565
pro	--	*procera*		J*Z	RAD	AC	NIL	LA3283
prt	--	*protea*	*prt1*	C*JK	RAD	CR	IL	LA0972
prun	--	*prunoidea*		O*J	RAD	LU	IL	LA0566
Prx-1	*1*	*Peroxidase-1*		V*	SPON	pim	NON	LA1597
Prx-1	*2*	*Peroxidase-1*		V*	SPON	pim	NON	LA1838
Prx-1	*3*	*Peroxidase-1*		V*	SPON	pim	NON	LA1839
Prx-1	*4*	*Peroxidase-1*		V*	SPON	chm	NON	LA1028
Prx-1	*5*	*Peroxidase-1*		V*	SPON	pim	NON	LA1841
Prx-1	*n*	*Peroxidase-1*		V*	SPON	pim	NON	LA1836
Prx-2	*1*	*Peroxidase-2*		V*	SPON	cer	NON	LA1843
Prx-2	*3*	*Peroxidase-2*		V*	SPON	pim	NON	LA1845
Prx-2	*n*	*Peroxidase-2*		V*	SPON	pim	NON	LA1842
Prx-3	*1*	*Peroxidase-3*		V*	SPON	pim	NON	LA1847
Prx-3	*2*	*Peroxidase-3*		V*	SPON	pim	NON	LA1848
Prx-3	*a1*	*Peroxidase-3*		V*	SPON	chm	NON	LA1316
Prx-3	*n*	*Peroxidase-3*		V*	SPON	pim	NON	LA1846

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Prx-4	*1*	*Peroxidase-4*		V*	SPON	pim	NON	LA1850
Prx-4	*10*	*Peroxidase-4*		V*	SPON	cer	NON	LA1570
Prx-4	*11*	*Peroxidase-4*		V*	SPON	pim	NON	LA1860
Prx-4	*12*	*Peroxidase-4*		V*	SPON	pim	NON	LA1861
Prx-4	*13*	*Peroxidase-4*		V*	SPON	pim	NON	LA1344
Prx-4	*14*	*Peroxidase-4*		V*	SPON	pim	NON	LA1863
Prx-4	*15*	*Peroxidase-4*		V*	SPON	pim	NON	LA1864
Prx-4	*17*	*Peroxidase-4*		V*	SPON	pim	NON	LA1866
Prx-4	*18*	*Peroxidase-4*		V*	SPON	pim	NON	LA1867
Prx-4	*19*	*Peroxidase-4*		V*	SPON	pim	NON	LA1868
Prx-4	*2*	*Peroxidase-4*		V*	SPON	pim	NON	LA1245
Prx-4	*20*	*Peroxidase-4*		V*	SPON	cer	NON	LA1547
Prx-4	*21*	*Peroxidase-4*		V*	SPON	pim	NON	LA1870
Prx-4	*23*	*Peroxidase-4*		V*	SPON	pim	NON	LA1872
Prx-4	*3*	*Peroxidase-4*		V*	SPON	pim	NON	LA1852
Prx-4	*4*	*Peroxidase-4*		V*	SPON	chm	NON	LA1028
Prx-4	*5*	*Peroxidase-4*		V*	SPON	chm	NON	LA1318
Prx-4	*6*	*Peroxidase-4*		V*	SPON	par	NON	LA0247
Prx-4	*7*	*Peroxidase-4*		V*	SPON	STN	NON	LA1504
Prx-4	*7*	*Peroxidase-4*		V*	SPON	STN	NON	LA1506
Prx-4	*8*	*Peroxidase-4*		V*	SPON	pim	NON	LA0381
Prx-4	*9*	*Peroxidase-4*		V*	SPON	pim	NON	LA1858
Prx-7	*1*	*Peroxidase-7*		V*	SPON	pim	NON	LA1245
Prx-7	*2*	*Peroxidase-7*		V*	SPON	pim	NON	LA1874
Prx-7	*n*	*Peroxidase-7*		V*	SPON	pim	NON	LA1670
ps	--	*positional sterile*	*va*	L*N	SPON	JBR	IL	LA0063
ps	*prov2*	*positional sterile*	*ps*	L*N	SPON	PSN	IL	2-303
ps-2	--	*positional sterile-2*		L*N	SPON	X	NON	LA2010
ps-2	--	*positional sterile-2*		L*N	SPON	VRB	IL	LA3631
ps-2	--	*positional sterile-2*		L*N	SPON	STR24	NON	LA3632
psa	--	*perspicua*		D*J	RAD	LU	IL	LA2051
pst	--	*persistent style*		O*	SPON	ESC	IL	2-005
pt	--	*petite*		D*J	RAD	AC	NIL	LA3768
pta	--	*partiaria*		J*	RAD	RR	IL	LA2049
ptb	--	*protuberant*		O*	SPON	X	NON	LA1017
ptb	--	*protuberant*		O*	SPON	X	NON	LA1018
Pto	--	*Pseudomonas syringae pv tomato resis.*		Q*	SPON	X	NON	LA2396
Pto	--	*Pseudomonas syringae pv tomato resis.*		Q*	SPON	RG	NIL	LA3342
Pto	--	*Pseudomonas syringae pv tomato resis.*		Q*	SPON	MM	NIL	LA3472
Pto	*2*	*Pseudomonas syringae pv tomato resis.*		Q*	SPON	RH13	NON	LA3129
Pto	*Pto-2*	*Pseudomonas syringae pv tomato resis.*	*Pto-2*	Q*	SPON	pim	NON	LA2934
Pts	--	*Petroselinum*		J*	SPON	VF36	NIL	LA2532
pu	--	*pulvinata*	*pul*	K*J	RAD	RR	IL	LA0621
pu	*2*	*pulvinata*	*pu2*	K*J	RAD	CR	IL	LA0973

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pum	--	*pumila*		K*	RAD	CR	IL	LA0567
pum	--	*pumila*		K*	RAD	AC	NIL	LA3741
pun	--	*punctata*	*pun1*	J*DGKT	RAD	RR	IL	LA0974
pur	--	*purilla*		K*C	RAD	CR	NON	LA0568
px	--	*praecox*	*px1*	K*JOZ	RAD	LU	IL	LA0856
py	--	*pyramidalis*		K*CJT	RAD	RR	IL	LA2055
pyl	--	*Pyrenochaeta lycopersici resistance*	*py, py-1*	Q*	SPON	X	NON	LA2531A
r	--	*yellow flesh*		P*	SPON	RU	NIL	LA2997
r	--	*yellow flesh*		P*	SPON	C37	NIL	LA3003
r	--	*yellow flesh*		P*	SPON	AC	NIL	LA3532
r	*(2s)*	*yellow flesh*	*r^3, r-2, r2*	P*	RAD	RR	IL	LA2056
r	*prov4*	*yellow flesh*	*r*	P*	SPON	PSN	IL	2-141
r	*prov5*	*yellow flesh*	*r*	P*	SPON	EPK	IL	LA0353
ra	--	*rava*		D*CIJK	RAD	CR	IL	LA0569
ra	*2*	*rava*	*gri*	D*CIJK	RAD	RR	IL	LA0678
rd	--	*reduced*		K*	SPON	X	NON	LA2459B
re	--	*reptans*		K*	RAD	RR	IL	LA0624
rela	--	*relaxata*		K*D	RAD	CR	IL	LA0622
rela	--	*relaxata*		K*D	RAD	AC	NIL	LA3757
rep	--	*repens*		K*J	RAD	CR	IL	LA0623
rep-2	--	*repens-2*		K*J	RAD	LU	IL	LA2057
res	--	*restricta*	*res1*	C*ADJK	RAD	RR	IL	LA1085
res	--	*restricta*	*res1*	C*ADJK	RAD	AC	NIL	LA3756
Rg-1	--	*Regeneration-1*			SPON	GT	NON	LA4136
ri	--	*ridged*	*rl*	J*R	RAD	X	NON	LA1794
ri	--	*ridged*	*rl*	J*R	RAD	AC	NIL	LA3180
ria	--	*rigidula*	*ria1*	C*JKT	RAD	CR	IL	LA0825
ria	*2*	*rigidula*	*ria1^2*	C*JKT	RAD	LU	IL	LA0975
rig	--	*rigida*		C*K	RAD	CR	IL	LA0699
rig	*2*	*rigida*	*pca, pca1*	C*K	RAD	LU	IL	LA0822
rig-2	--	*rigida-2*		C*K	RAD	AC	NIL	LA3716
rin	--	*ripening inhibitor*		P*	SPON	RU	NIL	LA3012
rin	--	*ripening inhibitor*		P*	SPON	AC	NIL	LA3754
rin	--	*ripening inhibitor*		P*	SPON	X	NON	LA1795
rl	--	*radial cracking resistance*	*ra*	O*	SPON	AC	NIL	LA3092
ro	--	*rosette*		K*	RAD	X	NON	LA0270
roa	--	*rotundata*	*roa1*	J*DK	RAD	CR	IL	LA0976
rot	--	*rotundifolia*		J*K	RAD	RR	IL	LA0700
rot	--	*rotundifolia*		J*K	RAD	AC	NIL	LA3751
Rs	--	*Root suppressed*		R*	RAD	X	NON	LA1796
rt	--	*potato virus Y resistance*		Q*	SPON	SCZ	IL	LA1995
rtd	--	*retarded dwarf*		J*K	SPON	X	NON	LA1058
ru	--	*ruptilis*		J*D	RAD	CR	IL	LA0626
ru	--	*ruptilis*		J*D	RAD	AC	NIL	LA3440
ru	*prov2*	*ruptilis*	*ru*	J*D	CHEM	VF36	IL	3-081

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rust	--	*rustica*		K*J	RAD	LU	IL	LA0573
rust	--	*rustica*		K*J	RAD	AC	NIL	LA3766
rv-2	--	*reticulate virescent-2*		D*C	CHEM	SX	IL	LA2011
rvt	--	*red vascular tissue*		X*	SPON	X	NON	LA1799
s	--	*compound inflorescence*		M*	SPON	X	NON	LA0330
s	--	*compound inflorescence*		M*	SPON	AC	NIL	LA3181
s	*mult*	*compound inflorescence*	*mult*	M*	RAD	CR	IL	LA0560
sa	--	*sphacelata*	*sa1*	H*CK	RAD	CR	IL	LA0865
sar	--	*squarrulosa*	*sar1*	K*	RAD	CR	IL	LA0978
scf	--	*scurfy*		J*	SPON	PCV	NON	LA0767
scl	--	*seasonal chlorotic lethal*		C*	SPON	X	NON	LA1007
sd	--	*sun dwarf*		K*	SPON	X	NON	LA0015
sd	--	*sun dwarf*		K*	SPON	AC	NIL	LA3182
Se	--	*Septoria lycopersici resistance*		Q*	SPON	X	NON	LA1800
sem	--	*semiglobosa*		K*JT	RAD	CR	IL	LA0701
ses	--	*semisterilis*	*ses1*	C*DKN	RAD	LU	IL	LA0826
sf	--	*solanifolia*		J*LO	SPON	PSN	IL	2-311
sf	--	*solanifolia*		J*LO	SPON	AC	NIL	LA3674
sf	*wl*	*solanifolia*	*wl, wr*	J*LO	CHEM	ROMA	IL	LA2012
sfa	--	*sufflaminata*	*sfa1*	C*AEK	RAD	RR	IL	LA0862
sfa	*2*	*sufflaminata*	*par*	C*AEK	RAD	CR	IL	LA0969
sft	--	*single flower truss*		M*	SPON	X	IL	LA2460
sh	--	*sherry*		P*	RAD	CX	IL	LA2644
sha	--	*short anthers*		L*N	CHEM	ROMA	IL	LA2013
si	--	*sinuata*		E*JK	RAD	RR	IL	LA0993
si	--	*sinuata*		E*JK	RAD	AC	NIL	LA3728B
sig-1	--	*signal transduction-1*	*JL1*	Y*	CHEM	CSM	IL	LA3318
sig-2	--	*signal transduction-2*	*JL5*	Y*	CHEM	CSM	IL	LA3319
sit	--	*sitiens*		W*HJKY	RAD	RR	IL	LA0574
Skdh-1	*1*	*Shikimic acid dehydrogenase-1*		V*	SPON	pen	NON	LA0716
sl	--	*stamenless*		L*N	SPON	X	NON	LA0269
sl	--	*stamenless*		L*N	SPON	AC	NIL	LA3816
sl	*cs*	*stamenless*	*cs, sl^5, sl5*	L*N	SPON	ONT	IL	LA1789
sl-2	--	*stamenless-2*	*sl2*	L*N	SPON	X	NON	LA1801
slx	--	*serrate lax leaf*		J*	SPON	PCV	NON	LA0503
Sm	--	*Stemphyllium resistance*		Q*	SPON	MM	NIL	LA2821
Sm	--	*Stemphyllium resistance*		Q*	SPON	X	NON	LA1802
sn	--	*singed*		I*	SPON	CX	IL	LA2015
snt	--	*Snout*	*sn*	O*	SPON	X	NON	LA0499
so	--	*soluta*		J*	RAD	LU	IL	LA2058
sp	--	*self-pruning*		K*	SPON	X	NON	LA0154
sp	--	*self-pruning*		K*	SPON	X	NON	LA0490
sp	--	*self-pruning*		K*	SPON	GRD	NIL	LA3133

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sp	*prov2*	*self-pruning*		K*	RAD	spVCH	IL	LA2705
spa	--	*sparsa*		E*BK	RAD	CR	IL	LA0703
spe	--	*splendida*	*spe1*	C*K	RAD	RR	IL	LA0977
sph	--	*sphaerica*		K*T	RAD	CR	IL	LA0704
sph	--	*sphaerica*		K*T	RAD	AC	NIL	LA3744
Spi	*2*	*Sympodial index*		K*	SPON	pen	NON	LA0716
spl	--	*splendens*	*spl1*	C*DJ	RAD	LU	IL	LA0821
spl	--	*splendens*	*spl1*	C*DJ	RAD	AC	NIL	LA3282
squa	--	*squarrosa*		D*KU	RAD	LU	IL	LA0627
sr	--	*slender stem*	*sm*	J*KU	RAD	CT	IL	LA1803
ss	--	*spongy seed*		S*	RAD	AC	NIL	LA3619
sta	--	*stabilis*		K*	RAD	RR	IL	LA2060
ste	--	*sterilis*		J*DKN	RAD	CR	IL	LA0705
stri	--	*stricta*		J*K	RAD	LU	IL	LA0575
stu	--	*stunted*		J*	SPON	X	NON	LA2461
su	--	*suffulta*		C*JM	RAD	LU	IL	LA0628
su	*2*	*suffulta*	*exa*	C*JM	RAD	RR	IL	LA0853
su	*3*	*suffulta*	*di*	C*J	RAD	CR	IL	LA0599
su	*ni*	*suffulta*	*di^ni, ni*	C*J	RAD	CR	IL	LA0616
sua	--	*suffusa*		D*CK	RAD	RR	IL	LA0707
sub	--	*subtilis*		J*K	RAD	LU	IL	LA0576
suc	--	*succedanea*		C*JK	RAD	CR	IL	LA0706
sucr	--	*sucrose accumulator*	*TIV1*	P*	SPON	H100	NIL	LA4104
suf	--	*sufflava*		D*	RAD	CR	IL	LA0577
suf	--	*sufflava*		D*	RAD	AC	NIL	LA3569
sulf	*vag*	*sulfurea*		G*N	RAD	X	NON	LA4351
sun	--	*Sun1642 fruit shape*		O*	SPON	SUN	NON	LA4432
sun	+	*Sun1642 fruit shape*		O*	SPON	SUN	NIL	LA4433
sup	--	*superba*		K*JT	RAD	RR	IL	LA2061
Sw-5	--	*Spotted wilt resistance-5*		Q*	SPON	X	NON	LA3667
Sw-7	--	*Spotted wilt resistance-7*		Q*	SPON	X	NON	LA4442
sy	--	*sunny*	*ye*	F*CE	RAD	AC	NIL	LA3553
syv	--	*spotted yellow virescent*		F*CG	SPON	PCV	NON	LA1096
t	--	*tangerine*		P*L	SPON	X	NON	LA0030
t	--	*tangerine*		P*L	SPON	RU	NIL	LA3002
t	--	*tangerine*		P*L	SPON	AC	NIL	LA3183
t	*v*	*tangerine*		P*L	RAD	CX	IL	LA0351
ta	--	*tarda*		D*JK	RAD	CR	IL	LA0708
tab	--	*tabescens*		E*HJK	RAD	RR	IL	LA0629
tab	--	*tabescens*		E*HJK	RAD	AC	NIL	LA3734
tc	--	*turbinate corolla*		L*K	CHEM	SM	IL	LA2017
te	--	*terminata*	*te1*	K*LMO	RAD	LU	IL	LA0861
tem	--	*tempestiva*	*tem1*	K*DJ	RAD	CR	IL	LA0979
ten	--	*tenuis*		Y*DK	RAD	CR	IL	LA0578
ten	--	*tenuis*		Y*DK	RAD	AC	NIL	LA3748

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tf	--	*trifoliate*	*ct, tri*	J*KN	SPON	X	NON	LA0512
tf	*2*	*trifoliate*	*tri*	J*KN	RAD	CR	IL	LA0579
ti	--	*tiny plant*		K*	SPON	X	NON	LA1806
tl	--	*thiaminless*		Y*C	SPON	X	NON	LA0758
tl	--	*thiaminless*		Y*C	SPON	AC	NIL	LA3712
Tm	--	*Tobacco mosaic virus resistance*		Q*	SPON	X	NON	LA2369
Tm-2	--	*Tobacco mosaic virus resistance-2*	*Tm2*	Q*	SPON	VD	NIL	LA3027
Tm-2	*a*	*Tobacco mosaic virus resistance-2*	*Tm-2^2*	Q*	SPON	VD	NIL	LA3028
Tm-2	*a*	*Tobacco mosaic virus resistance-2*	*Tm-2^2*	Q*	SPON	MM	NIL	LA3310
Tm-2	*a*	*Tobacco mosaic virus resistance-2*	*Tm-2^2*	Q*	SPON	AC	NIL	LA3769
tmf	--	*terminating flower*		K*M	SPON	X	NON	LA2462
tn	--	*tenera*		K*U	RAD	LU	IL	LA2062
tp	--	*tripinnate leaf*		J*K	RAD	X	IL	LA0895
tp	--	*tripinnate leaf*		J*K	RAD	AC	NIL	LA3184
Tpi-2	*1*	*Triosephosphate isomerase-2*		V*	SPON	pen	NON	LA0716
tr	--	*truncata*	*tr1*	D*CJK	RAD	CR	IL	LA0710
tri	*1*	*temporarily red light insensitive*	*phyB1*	AKY*	CHEM	GT	IL	LA3808
tri	*1*	*temporarily red light insensitive*	*phyB1*	AKY*	CHEM	MM	NIL	LA4357
trs	--	*tristis*		J*	CHEM		NON	3-057
Ty-1	--	*TYLCV resistance-1*		Q*	SPON	X	NIL	LA3473
Ty-3	--	*TYLCV resistance-3*				X	NON	LA4440
Ty-4	--	*TYLCV resistance-4*		Q*	SPON	X	NON	LA4440
u	--	*uniform ripening*	*u1*	P*	SPON	LRD	IL	LA0643
u	--	*uniform ripening*	*u1*	P*	SPON	GRD	NIL	LA3035
u	--	*uniform ripening*	*u1*	P*	SPON	AC	NIL	LA3247
u	*G*	*uniform ripening*		P*	SPON	X	NON	LA1018
ub	--	*umbraculiformis*		J*K	RAD	LU	IL	LA2063
uf	--	*uniflora*		M*	SPON	PTN	IL	LA1200
uf	--	*uniflora*		M*	SPON	AC	NIL	LA2936
ug	--	*uniform gray-green*	*u2*	P*	SPON	OGA	IL	LA0021
ug	--	*uniform gray-green*	*u2*	P*	SPON	AC	NIL	LA3539
ul	--	*upright leaf*		K*	SPON	X	NON	LA2463
um	--	*umbrosa*		K*JRT	RAD	CR	IL	LA0630
um	--	*umbrosa*		K*JRT	RAD	AC	NIL	LA3733
uni	--	*unicaulis*		K*	RAD	CR	IL	LA0580
up	--	*upright pedicel*		L*	SPON	FLD	IL	LA2397
upg	--	*upright growth*		K*	SPON	X	NON	LA2464A
v-2	--	*virescent-2*	*v2*	F*D	SPON	X	NON	LA2465
v-2	--	*virescent-2*	*v2*	F*D	SPON	AC	NIL	LA3185
v-3	--	*virescent-3*	*V3*	F*B	RAD	X	NON	LA2707
va	*dec*	*varia*		F*E	RAD	CR	IL	LA0581

Gene	Allele	Locus name	Synonyms	Class	Origin	Back	Iso	Acc #
va	*dec*	*varia*		F*E	RAD	AC	NIL	LA3669
va	*virg*	*varia*		F*E	RAD	CR	IL	LA0582
var	--	*variabilis*		D*EK	RAD	CR	IL	LA0583
Ve	--	*Verticillium resistance*		Q*	SPON	MM	NIL	LA2818
Ve	--	*Verticillium resistance*		Q*	SPON	GRD	NIL	LA3038
Ve	--	*Verticillium resistance*		Q*	SPON	AC	NIL	LA3277
ven	--	*venosa*		J*BDK	RAD	X	NON	LA0888
ven	--	*venosa*		J*BDK	RAD	AC	NIL	LA3564
ver	--	*versicolor*	*yv-4, ver1*	G*C	RAD	CR	IL	LA0632
ves	--	*versiformis*	*ves1*	J*P		pim	IL	LA0859
ves-2	--	*versiformis-2*	*vf*	C*JK	RAD	LU	IL	LA1078
vg	--	*vegetative*		L*N	SPON	AC	NIL	LA2916
vga	--	*virgulta*	*vga1*	D*EFK	RAD	RR	IL	LA0858
vi	--	*villous*		I*	SPON	X	NON	LA0759
vio	--	*violacea*		D*A	RAD	LU	IL	LA0633
vio	--	*violacea*		D*A	RAD	AC	NIL	LA3734A
vir	--	*viridis*		T*J	RAD	CR	IL	LA0585
vlg	--	*virescent light green*		F*D	CHEM	VF36	IL	3-128
vms	--	*variable male-sterile*		N*L	SPON	SM	IL	2-219
vo	--	*virescent orange*		F*CP	SPON	ROVF	IL	LA1435
vo	--	*virescent orange*		F*CP	SPON	RU	NIL	LA2995
vra	--	*viridula*	*vra1*	D*JK	RAD	CR	IL	LA0857
vt	--	*vieta*		J*CFK	RAD	LU	IL	LA2064
w	--	*wiry*		J*LN	RAD	CX	NON	LA0274
w-3	--	*wiry-3*	*w3, w2*	J*LN	RAD	FEY	NON	LA1498
w-4	--	*wiry-4*	*w4*	J*LN	SPON	PSN	IL	2-237
w-6	--	*wiry-6*		J*	RAD	RR	IL	LA2065
Wa	--	*White anthers*		L*	SPON	VF36	NIL	LA3906
wd	--	*wilty dwarf*		R*K	SPON	SM	IL	2-110
wf	--	*white flower*		L*	RAD	X	NON	LA0023
wf	--	*white flower*		L*	RAD	AC	NIL	LA3575
Wlt	--	*Wilty*		W*	SPON	LGPL	NON	LA3203
Wo	--	*Wooly*		I*	SPON	X	IL	LA0053
Wo	--	*Wooly*		I*	SPON	AC	NIL	LA3186
Wo	*m*	*Wooly*		I*	SPON	RU	IL	LA0258
Wo	*m*	*Wooly*		I*	SPON	AC	NIL	LA3718
Wo	*mz*	*Wooly*		I*	SPON	VF145	IL	LA1908
Wo	*v*	*Wooly*		I*	SPON	RU	IL	LA1531
Wo	*v*	*Wooly*		I*	SPON	AC	NIL	LA3560
wt	--	*wilty*		J*W	SPON	X	NON	LA0030
wv	--	*white virescent*		F*B	SPON	X	NON	LA0659
wv	--	*white virescent*		F*B	SPON	AC	NIL	LA3187
wv-2	--	*white virescent-2*		F*B	SPON	X	NON	LA1150
wv-3	--	*white virescent-3*		F*B	SPON	X	NON	LA1432
x	--	*gametophytic factor*		N*	SPON	X	NON	LA2348
Xa	--	*Xanthophyllic*		C*	SPON	X	NON	LA2470

Gene	Allele	Locus name	Synonyms	Class	Origin	Back	Iso	Acc #
Xa	--	*Xanthophyllic*		C*	SPON	AC	NIL	LA3579
Xa-2	--	*Xanthophyllic-2*	*Xa2, A*	C*	RAD	X	NON	LA2471
Xa-2	--	*Xanthophyllic-2*	*Xa2, A*	C*	RAD	AC	NIL	LA3188
Xa-2	--	*Xanthophyllic-2*	*Xa2, A*	C*	RAD	X	NON	LA4134
Xa-3	--	*Xanthophyllic-3*	*Xa3*	C*	RAD	CR	IL	LA2472
Xa-3	--	*Xanthophyllic-3*	*Xa3*	C*	RAD	AC	NIL	LA3430
xan-2	--	*xantha-2*	*xan2*	C*	RAD	AC	NIL	LA3759
xan-4	--	*xantha-4*	*xan4*	C*	RAD	AC	NIL	LA3760
y	--	*colorless fruit epidermis*		P*	SPON	OGA	NON	LA1088
y	--	*colorless fruit epidermis*		P*	SPON	AC	NIL	LA3189
yg-2	--	*yellow-green-2*	*yc, yg282, yg2*	E*	RAD	KK	IL	LA2469A
yg-2	--	*yellow-green-2*	*yc, yg282, yg2*	E*	RAD	AC	NIL	LA3551
yg-2	*aud*	*yellow-green-2*	*yg-2^r, aud*	E*	SPON	X	NON	LA1008
yg-2	*aud*	*yellow-green-2*	*yg-2^r, aud*	E*	SPON	AC	NIL	LA3165
yg-3	--	*yellow-green-3*	*yg3, yg330, ye*	E*	RAD	KK	NIL	LA2926
yg-4	--	*yellow-green-4*	*yg4, yl, yg333*	E*J	RAD	KK	NIL	LA2927
yg-4	--	*yellow-green-4*	*yg4, yl, yg333*	E*J	RAD	AC	NIL	LA3731
yg-5	--	*yellow-green-5*	*yw, yg388, yg5*	E*	RAD	RCH	NIL	LA2928
yg-5	--	*yellow-green-5*	*yw, yg388, yg5*	E*	RAD	AC	NIL	LA2928A
yg-5	--	*yellow-green-5*	*yw, yg388, yg5*	E*	RAD	AC		LA2928B
yg-9	--	*yellow-green-9*		E*	SPON	C28	IL	LA2708
yv	--	*yellow virescent*		E*	SPON	SM	IL	LA0055
yv	--	*yellow virescent*		E*	SPON	AC	NIL	LA3554
yv	*2*	*yellow virescent*	*vel^2, vel1^2*	E*	RAD	CR	IL	LA0981
yv	*3*	*yellow virescent*	*vel*	E*	RAD	CR	IL	LA0631
yv	*ms*	*yellow virescent*		E*N		X		LA3907
yv-2	--	*yellow virescent-2*		E*	SPON	AC	NIL	LA3190
yv-4	--	*yellow virescent-4*		E*	SPON	AC	NIL	LA3570

Table 2. Definition of phenotypic class symbols listed in Table 1.

Class	Description
A	Anthocyanin modifications: intensification, reduction, elimination
B	Chlorophyll deficiency: white or whitish
C	Chlorophyll deficiency: yellow or yellowish
D	Chlorophyll deficiency: light, grey, or dull green
E	Chlorophyll deficiency: yellow-green
F	Virescent: chlorophyll deficiency localized at growing point
G	Variegation, flecking or striping
H	Leaf necrosis
I	Hair modifications: augmentation, reduction, distortion, elimination
J	Leaf form and size
K	Plant habit and size
L	Flower form and color
M	Inflorescence (exclusive of L)
N	Sterility: any condition leading to partial or complete unfruitfulness
O	Fruit form and surface texture
P	Fruit color and flavor, ripening modification
Q	Disease resistance
R	Root modification
S	Seed
T	Foliage color: dark
U	Foliage color, miscellaneous: olive, brown, blue-green
V	Allozyme variant
W	Overwilting stomatal defect
X	Vascular modification
Y	Nutritional or hormonal disorder
Z	Precocious development

Table 3. Background genotypes listed in Table 1, and corresponding accession numbers

Back	Genotype name	Acc #
A-1	A-1	LA0818
AC	Ailsa Craig	LA2838A
ACE	Ace	LA0516
ALA	Alabama	n/a
AMB	Antimold-B	LA3244
ANU	Anahu	LA3143
BC	Black Cherry	LA4451
BP	Black Plum	LA4449
BK	Budai Korai	n/a
BOD	Break O'Day	LA1499
C255	Cal 255	LA0198
C28	Campbell 28	LA3317
cer	*L. esc*. var. *cerasiforme*	many
CG	Chico Grande	LA3121
che	*L. cheesmanii*	many
chi	*L. chilense*	many
chm	*L. chmielewskii*	many
CR	Condine Red	LA0533
CRGL	Craigella	LA3247
CSM	Castlemart	LA2400
CT	Chatham	n/a
CX	Canary Export	LA3228
E6203	E-6203	LA4024
EPK	Earlipak	LA0266
ERL	Earliana	LA3238
ESC	Early Santa Clara	LA517
FB	Fireball	LA3024
FEY	First Early	n/a
FLD	Flora-Dade	LA3242
GRD	Gardener	LA3030
GSM	Gulf State Market	LA3231
H100	Hunt 100	LA3144
hir	*L. hirsutum*	many
HSD	Homestead 24	LA3237
JBR	John Baer	LA1089
KK	Kokomo	LA3240
LGPL	Large Plum	LA3203
LK	Laketa	LA0505
LRD	Long Red	LA3232
LU	Lukullus	LA0534
lyc	*S. lycopersicoides*	many
M167	Montfavet 167	LA2713
M82	M-82	LA3475
M168	Montfavet 168	LA2714
MD	Marmande	LA1504
MGB	Marglobe	LA0502
MM	Moneymaker	LA2706
MNB	Monalbo	LA2818
MP	Manapal	LA2451
NRT	Norton	n/a
NYG	Nyagous	LA4452
O8245	Ohio 8245	n/a
OGA	Ohio Globe A	LA1088
ONT	Ontario	n/a
par	*L. parviflorum*	many

Back	Genotype name	Acc #
PCV	primitive cultivar	n/a
pen	*L. pennellii*	many
per	*L. peruvianum*	many
pim	*L. pimpinellifolium*	many
PLB	Pieralbo	n/a
POR	Porphyre	LA2715
PR	Paul Robeson	LA4450
PRI	Primabel	LA3903
PRN	Prairiana	LA3236
PRT	Pritchard	LA3233
PSN	Pearson	LA0012
PSP	Prospero	LA3229
PTN	Platense	LA3243
RCH	Red Cherry	LA0337
RG	Rio Grande	LA3343
RH13	Rehovot 13	LA3129
RNH	Rouge Naine Hative	n/a
ROMA	Roma	n/a
ROVF	Roma VF	n/a
RR	Rheinlands Ruhm	LA0535
RSWT	Roumanian Sweet	LA0503
RTVF	Red Top VF	LA0276
RU	Rutgers	LA1090
SCZ	Santa Cruz	LA1021
SM	San Marzano	LA0180
spVCH	VFNT Cherry (sp)	LA2705
SPZ	San Pancrazio	n/a
STD	Stokesdale	LA1091
STN	Stone	LA1506
STR24	Start 24	LA3632
SUN	Sun1642	LA4432
SX	Sioux	LA3234
T338	UC-T338	LA2939
T-5	UC-T5	LA2399
TGR	Targinnie Red	LA3230
TVD	Vendor (Tm-2a)	LA2968
UC82	UC-82B	LA1706
VCH	VFNT Cherry	LA1221
VD	Vendor	LA3122
VE	Van's Early	n/a
VF11	VF-11	LA0744
VF145	VF-145 78-79	LA1222
VF36	VF-36	LA0490
VF6	VF-6	LA0743
VFN8	VFN-8	LA1022
VFSM	VF San Marzano	n/a
VGB	Vagabond	LA3246
VRB	Vrbikanske nizke	LA3630
VTG	Vantage	LA3905
WA	Walter	LA3465
X	unknown or hybrid	n/a
XLP	XL Pearson	n/a

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