

# Full Length Article

# Genetic Divergence for Seedling Traits in Tomato (Solanum lycopersicum)

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## Abstract

Three hundred and eighty genotypes of tomato were investigated for genetic diversity for nine seedling traits and considerable genetic variation was observed for all the traits except pubescence. Only two genotypes (19901 and 6836-9) were glabrous, whereas all others had hair on the hypocotyl. Eight clusters were observed based on *k-means* clustering with average distance ranging from 0.47 (cluster 6) to 0.79 (cluster 8). Some of the discrete traits did not exhibit variation within individual cluster that could be one of the bases for clustering pattern. The scatter diagram partially indicated the clustering pattern and the clusters 3, 4 and 5 intermixed. Sub clustering of individual clusters revealed 5 sub clusters of cluster 1, three of cluster 2 and 5 in each case, six in cluster 3, 4 and 7 and cluster 6 and 8 had 4 each. The cluster 2, 3, 4 and 6 joined at higher genetic linkage with induction of single genotype in the cluster 2, 4 and 6, whereas in cluster 3, two main groups joined at higher distance including one group comprising of the 41 genotypes and the second comprising 19 genotypes, which joined at 80% linkage distance. The data on seedling traits along with other data will be utilized for establishment of core set and the genotypes with maximum genetic distance from individual clusters along with representative samples from low distance groups are likely to be chosen for core set. © 2013 Friends Science Publishers

Keywords: K-means clustering; Seedling vigor; Hairy hypcotyl; Wild germplasm; Tomato

## Introduction

Tomato, a member of Solanaceae family is short-lived perennial usually grown as annual plant almost throughout the world. It is highly self-pollinated plant and may be determinate or indeterminate in growth habit. The cultivated Tomato (Solanum lycopersicum L.) is relatively a new addition to world food crops, but has gained popularity very rapidly and has attained the status of most widely consumed vegetables in world (Ojo et al., 2009). It is believed that tomato is native to South America, the Incas and Aztecs began cultivating tomato plants as early as 700AD (Tam et al., 2007). Genetic evidence shows that the progenitors of tomatoes were herbaceous green plants with small green fruit and a center of diversity in the highlands of Peru (Jenkins, 1948). In Indo-Pak region, tomato is thought to be introduced by British colonists in the beginning of 19th century (Khan, 2009). The large, lumpy tomato, a mutation from a smoother, smaller fruit, originated in Mesoamerica and may be the direct of some modern cultivated ancestor tomatoes (Abdullahi and Choji, 2009). Thousands of tomato cultivars are being grown worldwide for its edible fruit with a world production of 130 million tons (MT), China being the largest producer (34 MT), followed by USA

(12.7 MT) and Pakistan is at the 34<sup>th</sup> position in fresh tomato production with production of 0.47 MT (http://faostat.fao.org).

Tomatoes are rich source of nutrition and contain lycopene, one of the most powerful natural antioxidants (Cohen et al., 2000; Marković, 2010). Assessment of the intra-population genetic variability in tomato has been reported important by Mazzucato et al. (2010). These authors analyzed morphological and molecular descriptors in Italian landraces of tomato. Seedling traits give an indication for plant growth and could also be used as plant descriptors as well as markers. Monogenic traits were the first to be employed for varietal identification and for markers which are still important for most of the crops (Gul et al., 2010; Xu et al., 2010). The seedling qualitative descriptors have been utilized for identification of various crop varieties and as genetic markers for investigation of quantitative traits loci (Basunanda et al., 2010; Ashfaq et al., 2012). The present study was initiated to characterize tomato germplasm for seedling traits, both qualitative and quantitative to investigate the magnitude of diversity among genotypes and clusters. This data will serve the purpose for genotypic identification and later will be utilized for establishing core collection to have the maximum diversity in less number of genotypes.

#### **Materials and Methods**

Three hundred and eighty genotypes of tomato including five commercial cultivars (Tom Round, Roma King, Money Maker, Saryab Long, BARI-5), and four wild species Solanum pimpinellifolium (eight accessions), S. habrochaites (2 accessions), S. pennellii and S. chilense (one accession of each) were investigated for genetic diversity on nine seedling traits i.e., hypocotyl color, hypocotyl color intensity, hypocotyl pubescence, overall leaf color, midrib color, seedling vigor, primary leaf length (mm), primary leaf width (mm) and hypocotyl length (mm) according to the descriptors bv **IPGRI** (http://www.bioversityinternational.org/publications/pubfile. asp?ID PUB=286). All of these genotypes have been maintained in the genebank at three storage conditions for active/short-term, medium-term and long-term/base collection for conservation and future utilization for crop improvement program. The seed was placed in the paper towel till germination at 25°C in the growth chamber and then each genotype was transferred in plastic pots accommodating twenty seedlings with equal plant spacing. The pots were kept under greenhouse conditions with appropriate temperature and irrigated alternate days with the help of sprinkler. Data were recorded when seedlings were three weeks old after transferring in the plastic pots. The data for hypocotyl color intensity, hypocotyl pubescence, overall leaf color, midrib color and seedling vigor were recorded on genotype basis as discrete traits, and thus can be used as plant descriptors representing single value for each genotype, whereas primary leaf length and width (mm) and hypocotyl length (mm) were measured on 10 seedlings sampled at random within each genotype and then averaged for analysis and presentation.

Measureable data for seedling traits (primary leaf length and width, and hypocotyl length) were analyzed for descriptive statistics including means and variance. For easy comparison, the variance was expressed as percent of mean for measureable traits. Other discrete data were classified into groups, whereas all the nine seedling traits were analyzed for genetic diversity according to Nei and Li (1979). The data were analyzed for k-means clustering and then each cluster was presented as dendrogram using computer software STATISTICA Version 6.01 for Windows (http://www.statsoft.com/). The data were standardized prior to cluster analysis due to variation in measuring scales. Based on two Principal Components, the genotypes were plotted on the basis of clusters with the help of SPSS. Version 11.0 for Windows (http://www.spss.com/).

## Results

Table 1 presents the description of all the nine seedling traits and their classification in various categories. One hundred seventy seven genotypes produced full purple hypocotyl, whereas eighty three were green. Others exhibited intermediate level either having one fourth purple color (36 genotypes) or half purple color from the base (84 genotypes). Two genotypes (19901 and 6836-9) were glabrous, whereas all others had hairs on the hypocotyl. In the germplasm under study, 284 genotypes produced good seedling vigor and among these, high yielding cultivars could be selected. The measurable seedling traits showed a normal distribution that could facilitate selection to genetic gain for these traits. The range for three measured traits indicated a considerable variation among the genotypes investigated in the present study (Table 2). Variation expressed as percentage of means indicated that hypocotyls length had the maximum variation that was followed by primary leaf length and primary leaf width.

Eight clusters were observed based on k-means clustering. Data indicated the members of each cluster and average distance (Table 3). Fifty one genotypes were grouped in cluster 1, 48 in cluster 2, 60 in cluster 3, cluster 4 and 6 got 40 each, 52 in cluster 5, 63 in cluster 7 and 26 genotypes were grouped in cluster 8. The average distance for individual clusters ranged from 0.47 (cluster 6) to 0.79 (cluster 8). The cluster with higher genetic distance grouped the genotypes with distinct characteristics. Among discrete traits, hypocotyl pubescence (HP), midrib color (MRC) and seedling vigor (SLV) did not exhibit variation in the cluster 1 and 5, whereas the cluster 2, 3 and 8 were monomorphic for HP. The genotypes in cluster 6 did not reveal variation for HP and MRC, while the members of cluster 7 did not show variation for HP and SLV. Among cultivated varieties, Saryab Long was in cluster 2, Tom Round and BARI 5 were grouped in cluster 3, Roma King was in cluster 6 and Money maker was in the cluster 7, while in wild genotypes, three accessions of S. pimpenellifolium (19888, 19895, 19896) were placed in cluster 2, two (19897, 19903) in cluster 7, whereas cluster 1, 4 and 5 had the accessions 19898, 19889 and 19899, respectively. Two accessions of S. habrochaites were grouped in two clusters, i.e., 19902 in cluster 2 and 19901 in cluster 4. S. chilense (19906) was in the cluster 2 and S. pennelli (19905) in the cluster 4. The average distance for grouping of commercial varieties in different clusters indicated the distinctness of tomato varieties for seedling traits.

Maximum genetic distance (1.61) was observed between cluster 6 and 8, whereas a minimum distance (0.79)was observed in two cases *i.e.*, between cluster 2 and 4, and cluster 3 and 5 (Table 4). The clusters thus observed through *k-means* clustering were plotted for the first two principal components contributing 44% of variation against *x-y* coordinated (Fig. 1). More than half of the genotypes in cluster 6 and 7 were at the peripheral boundaries of the graph and only cluster 8 was clearly grouped in the upper right box indicating both the factors with positive axes. The genotypes observed on the graph were categorized and the clustering pattern was presented in the Fig. 1 for understanding and easy interpretation, because due to large

Traits	Notation	Classes	Frequency	Percentage
Discrete Traits			* *	
Hypocotyl color	НС			
		Green	83	21.8
		One fourth purple from base	36	9.5
		Half purple from base	84	22.1
		Purple	177	46.6
Hypocotyl color intensity	HCI	Low	122	32.1
51		Intermediate	176	46.3
		High	82	21.6
Hypocotyl pubescence	HP	8		
51 5 I		Present	378	99.5
		Absent	2	0.5
Overall leaf color	OLC			
		Low	28	7.4
		Intermediate	207	54.5
		Dark	145	38.2
Midrib color	MRC			
		Green	244	64.2
		Purple	136	35.8
Seedling vigor	SLV	-		
		good	284	74.7
		weak	96	25.3
Measureable Traits				
Primary leaf length (mm)	PLL			
		Up to 18.0	24	6.3
		18.1 - 24.0	153	40.3
		24.1 - 30.0	142	37.4
		30.1 - 36.0	57	15.0
		36.1 - 42.0	4	1.1
Primary leaf width(mm)	PLW			
		$\leq 4.0$	6	1.6
		4.1 - 6.0	112	29.5
		6.1 - 8.0	232	61.1
		8.1 - 10.0	28	7.4
		10.1 - 12.0	2	0.5
Hypocotyl length (mm)	HL			
		$\leq 20.0$	36	9.5
		20.1 - 40.0	292	76.8
		40.1 - 60.0	47	12.4
		60.1 - 80.0	3	0.8
		80.1 - 100.0	2	0.5

Та	able	1:	Cl	assif	icatior	۱of	seedling	traits in	n 380	genotypes	s of tomato
			-							B	

*HC*: Hypocotyl color, *HCI*: Hypocotyl color intensity, *HP*: Hypocotyl pubescence, *OLC*: Overall leaf color, *MRC*: Midrib color, *SLV*: Seedling vigor, *PLL*: Primary leaf length (mm), *PLW*: Primary leaf width (mm), *HL*: Hypocotyl length (mm)

<b>Table 2.</b> Dasie statistics for second guards in 500 genotypes of tom	Table 2:	Basic statistics	s for seedlin	g traits in 380	genotypes of toma
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Growth parameters	Mean±SE	Standard Deviation	Variance % of means	Range
Primary leaf length (mm)	25.0±0.2	4.8	90.9	12.0-42.4
Primary leaf width (mm)	6.6±0.1	1.1	18.6	3.0-12.0
Hypocotyl length (mm)	30.3±0.5	10.4	357.4	1.2-96.0

number of genotypes (380 in this case), the graph was intermingled. With the intermixing of clusters 3, 4 and 5, all the eight clusters were further analyzed individually keeping same axis values for distance for easy comparison to present in the dendrogram (Fig. 2). The dendrograms grouped varying numbers of genotypes as presented in Table 3. Sub clustering was observed at 50% inter-cluster dissimilarity and cluster 1 was divided into 5 sub clusters, cluster 2 and 5 into three sub-clusters each, six sub clusters were observed in each of the cluster 3, 4 and 7 and cluster 6 and 8 were divided into four sub clusters in each case. Among all the clusters, cluster 2, 3, 4 and 6 joined at higher genetic linkage. Single genotype 19896 (*S. pimpinellifolium*) was joined at higher distance in the cluster 2, 1803083 in cluster 4 and LO5860 in cluster 6, whereas in cluster 3, two main groups joined at higher distance. One group comprising of the genotypes, viz., 10576, Tom Round, Avinash, 17889, 17870, LO5596, 6836-2, 6863-10, 6836-8, 6836-4, 19294, LO5633, 10573, 10587, LO5632, LO5840, Nozami, 17885 and 6234 joined with other group of genotypes, viz., LO6029, LO5839, LO6021, LO2401, NGB2407, CN1516, CLN2768A, PL12583157AL, 17882, 19291, CN112,

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usingle         instance         instance         instance           1         51         17862, 17873, 17875, 17883, 17887, 17888, 17890, 17902, 17903, 17904, 17906, 17900, 17903, 12985, 0.60         HP, MRC,           1         51         17862, 17875, 17883, 17887, 17888, 17890, 17902, 17903, 17904, 17906, 17904, 17905, 0125-206, SLV         SLV           1         S1         17862, 17873, 17875, 17883, 17889, 955, 03-30-11-240, CH134, CL5615-9014, 1-0.3, CL555, 01, 12526, CLN2764, CLN2764, CLN27764, CLN2776, CLN2776, CLN2764, CLN27776, CLN27764, CLN27776, D0536, 17800, 19901, 19901, 19901, 19901, 19901, 19280, 17880, 17880, 17880, 17880, 17880, 17870, 17882, 17880, 17880, 17870, 17882, 17885, 17889, 0.63         HP           19296, 10601, 100797, 10583, 10581, 10592, 10592, 10593, 10580, 10584, 10594, 10524, 10622, 106021, 106022, 106129, 11693, 10893, 19901, 19901, 19901, 1901, 12166295GL, PL12583157AL, PL26299560AL, PL40695276AL, PL474505GL, 70m Round         40         6233, 17863, 17863, 17864, 17844, 19290, 1927, 1988, 19890, 19893, 19901, 19906, 10584, 1, 12166295GL, PL12583157AL, PL26299560AL, PL2023, 101364, 10584, 1, 12166295GL, PL12583157AL, PL26299560AL, PL20232, 106134, 101923, 101936, 101941, 10196, 102589, 102734, 10573, 10581, 10581, 10581, 10581, 10581, 10581, 10581, 10581, 101753, 10581, 105821, 105971	Cluster	Frequency	Genotypes	Average	Traits	with
<ul> <li>1908. 23666A, 2366C, 2277B, 098-C39-20-11/240, CH154, CL5615-3014-L03, CL5915-206, Mol V, CLN 2413), CLN 3615-9304-1, CLN 3022F-10-32-2, CLN1462A, CLN2460P, CLN355A, CLN2402D, CLN2070A, CLN2448, CLN2498, CLN2498, CLN2460P, CLN2413D, CLN2413J, CLN2413R, CLN2498, CLN2498, CLN2766C, CLN2400B, CLN2413D, CLN2413J, CLN2413R, CLN2498, CLN2498D, CLN276A, CLN276A, CLN2777C, CLN2777F, CLN2776F, CLN2726F, CLN276A, C</li></ul>	1	51	17862 17873 17875 17883 17887 17888 17890 17902 17903 17904 17906 17909 19898	distance	no var HP	iation MRC
<ul> <li>CLN 2413J, CLN 5615-39D4-I, CLN 2027-10.32-2, CLN1462A, CLN1466P, CLN2543J, CLN2026, CLN2070, CLN2261, (CLN264), CLN2366, CLN2460B, CLN2413D, CLN2413J, CLN2413R, CLN248A, CLN2498, CLN2498D, CLN276A, CLN276A, CLN2777C, CLN2777F, CLN2777G, CLN2777H, CLN2027-21-0-16, CLNS915-20404, LR99, PT4664B, PT4719A, Waler</li> <li>48 6232, 10580, 10585, 10588, 17859, 17860, 17865, 17872, 17874, 17878, 17880, 17881, 19288, 19295, 0.69 HP</li> <li>19296, 19887, 19888, 19895, 19896, 19900, 19902, 19904, 19906, 19907, 19913, CH-151, CN1498, CN302, DR 4, FLA7654, FLA748 e5, 3-1-11, FLA496-116-10, FLA553-1-10, LOX46, LO8686, L02649, L04034, L05936, LRB10, NGB1910-2, NGB15858-1, NGB2408-2, NGB5021-2, PL12902658AL, PL1200367AL, PL2913756AL, Punjab Chuhana, Suryab Long</li> <li>60 6234, 10576, 10579, 10583, 10587, 10589, 10592, 17856, 17888, 17880, 17882, 17889, 0.63 HP</li> <li>17900, 19291, 19294, 19891, 6834-2, 68364, 6836-, LO866, R686-10, LN2768A, CN1768, LN2768A, CN112, CN1516, L00760, L02663, L05596, L05632, L05633, L05893, L05840, L02641, L02401, L02540, L02650, L02650, L02653, L05632, L05633, L05849, L05848, L05995, L06021, L06022, L06029, LRB11, LRB6, LRB7, NGB2407, Nozami, PL2166295GL, PL1283157AL, PL26299560AL, PL4095276AL, PL64744505GL, Tom Round</li> <li>4 40 6235, 1786, 178861, 17877, 19899, 15876095, Madona, 6836-7, CN100, 056 HP, MRC, S1002777A, LP157, 10578, 10581, 10582, 17867, 17877, 19899, 15876095, Madona, 6836-7, CN100, 056 HP, MRC, CN123, CN126, CN1632, CN18078, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>5 5 2 6233, 10574, L0573, 10578, 10581, 10582, 17867, 17877, 19899, 15876095, Madona, 6836-7, CN100, 056 HP, MRC, CN123, CN126, CN1632, CN18078, CN1857, CN342, CN612, CN74, CN89, CN87, CN89, SLV</li> <li>6 40 6237, 10584, 105841, FL0175, 10578, 10581, L0121, CN120, CN89, CN89, SLV</li> <li>7 63 (6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 047 HP, MRC</li> <li>7 63 (6237, 10584, 19894, 19812, L05873, L05860,</li></ul>	-	51	19908, 23666A, 2366C, 2777B, 99S-C-39-20-11-240, CH154, CL5615-93014-1-0-3, CL5915-206	, 0.00	SLV	unce,
<ul> <li>CLN 2010B, CLN 2010B, CLN 2041, CLN 2264J, CLN 2264J, CLN 2408C, CLN 2413D, CLN 2413J, CLN 2414J, CLN 241J, CLN 241JJ, CLN 241JJ, CLN</li></ul>			CLN 2413J, CLN 5615-93D4-1, CLN 3022F-10-32-2, CLN1462A, CLN1466P, CLN1555A	,		
<ul> <li>CLN2777G, CLN2777H, CLN3022-P2-10-16, CLN5915-204D4, LRB9, PT4664B, PT4719A, Waher</li> <li>48 6232, 10580, 10585, 10588, 17859, 17860, 17865, 17872, 17874, 17878, 17880, 17880, 17881, 19288, 19259, 0.69</li> <li>HP 19296, 19877, 19888, 19895, 19896, 19900, 19902, 19904, 19906, 19907, 19913, CH-151, CN1498, CN302, DR 4, FLA4564, FLL4478-63-1-11, FLA496-11-6-1-0, FLA653-3-1-0, LO0746, LO0868, LO2649, LO4034, LO5936, LRB10, NGB11910-2, NGB15858-1, NGB2408-2, NGB5021-2, PL12902658AL, PL1290367AL, PL2913765AL, Punjab Chubara, Saryab Long</li> <li>60 6234, 10573, 10575, 10579, 10583, 10587, 10589, 10592, 17585, 17888, 17870, 17882, 17885, 17889, 0.63</li> <li>HP 17900, 19291, 19294, 19891, 6836-2, 6836-4, 6836-8, 6863-10, Avinash, BARL5, CLN2768A, CN112, CN1516, LO0760, LO0790, LO0520, LO5632, LO5589, LO533, LO5839, LO5840, LO2848, LO5995, LO6021, LO6250, LO566, LO5556, LO5532, LO5539, LO5840, LO5848, LO5995, LO6021, LO6250, LO2666, LO5559, LO5632, LO5896, LO5840, LO5848, LO5995, LO5605, NGB11900-2, NGB1769-2, PL11878384AL, PL1286295GL, PL12533157AL, PL2629550AL, PL40095276AL, PL64744505C, Tom Round</li> <li>40 6235, 17860, 17864, 17884, 19290, 19297, 19889, 19890, 19893, 19901, 1990, 59910, 6836-9, 0.77</li> <li>AARI local, CN11862, CN18862, CN7232, H 24, LO1923, LO1936, LO1941, LO1996, LO2559, LO2738, LO2739, LO2738, LO2739, LO2738, LO27430, NGB11900-2, NGB17692, PL11878384AL, PL12858695GL, PL21206290AL, PL23847885AL, PL27020663AL, PL28155660AL, PL4520267AL, PL45202777AL, PL4730599CL PJ890760AL, PL28155760AL, PL2847467, CN10, 0.56</li> <li>HP, MRC, CN1836, CN1632, CN18078, CN1855, CN132, CN120, CN412, CN30, CN87, CN89, SLV</li> <li>G233, 10574, 10575, 10578, 10581, 10582, 10583, ALA, PL12902396GL, PL2347466AL, PL2943865AL, PL39128540, PL39128540, PL19027003L, PL2943856AL, PL2943856AL, PL3912854, PL3912854, PL195025004L, PL2943865AL, PL3912854, PL39024, LO0920, L23844, PL29204359, LO5731, LO592, LO3735, LO5920, LO592, LO374, CN855, CN87, CN89, SN89, LO2734, LO2924, LO203</li></ul>			CLN2026D, CLN2070A, CLN2264I, CLN2264J, CLN2366C, CLN2400B, CLN2413D, CLN2413J, CLN2413R, CLN2418A, CLN2498D, CLN2762A, CLN2764A, CLN2777C, CLN2777F	,		
<ol> <li>48 6232, 10580, 10585, 10588, 17859, 17860, 17805, 17872, 17874, 17878, 17880, 17811, 19288, 19295, 0.09</li> <li>HP 19296, 19887, 19888, 19895, 19896, 19900, 19902, 19904, 19906, 19907, 19913, CH-151, CN1498, CN302, DR 4, FLA456-4, FLA478-6-31-11, FLA496-11-6-1-0, FLA653-3-1-0, LO0746, LO0868, LO2649, LO4034, LO5936, LR810, NGB11910-2, NGB15858-1, NGB2408-2, NGB5021-2, PL129025581A, PL12903376A, LP20137576A, LP20137576A, LP20137576A, CN112, CN1516, LO0760, LO0769, LO0790, LO0853, LO1891, LO1902, LO1921, LO2064, LO2401, LO2540, LO2660, LO2663, LO5596, LO5652, LO5633, LO5839, LO5849, LO5848, LO5995, LO021, LO022, LO029, LR811, LR86, LR87, NGB2407, Nozami, PL2166259GL, PL12583157AL, PL26299560AL, PL4095276AL, PL64744505CL, Ton Round</li> <li>4 40 6235, 17863, 17860, 17876, 17884, 17870, 19899, 1989, 19901, 19905, 19910, 6836-9, 0.77 - AARI local, CN1506, CN18862, CN7232, H 24, LO1923, LO1936, LO1941, LO1996, LO2559, LO2738, LO2739, LO2739, LO553, LO5605, NGB17900-2, NCB1769-2, PL1157834AL, PL42858095CL, PL2102269AL, PL2584785AL, PL22702663AL, PL28155566AL, PL4520277AL, PL6473099CL, PL2880766AL</li> <li>5 52 6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56</li> <li>HP, MRC, CN126, CN1632, CN18078, CN1855, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, FLA47-63-1-11, HGB15846-1, LO2017, LO5829, LD5205, LO5905, LO5902, NGB11704-2, NGB15704-1, PL3202777AL, PL64736090CL, PL28757256A, PL10263970AL, PL2943865AL, PL2943865AL, PL2943865AL, PL2943865AL, PL39051075AL, PL647456902CL, PL28438446AA, PL2943865AL, PL2943865AL, PL27043966L, PL64756902CL, PL64756902CL, PL64756902CL, PL64756902CL, PL64756902CL, PL64756902CL, PL64756903CL, PL27043096, LP2770561AL, PL647369992, PL7270561AL, PL647369992, PL1755501GL, PL647369992, PL72745270AL, PL2948865AL, PL2943865AL, PL2943865AL, PL29743965AL, PL2943865AL, PL29743965AL, PL29743965AL, PL2943865AL, PL29743965AL, PL2943865AL, PL29743966CL, PL64756902CL, PL64756902CL, PL64756902CL, PL64756903CA, PL64756903CA,</li></ol>			CLN2777G, CLN2777H, CLN3022-F2-10-16, CLN5915-204D4, LRB9, PT4664B, PT4719A, Walter			
<ul> <li>19296, 1988, 1988, 19895, 19896, 19900, 19902, 19906, 19907, 19913, CH-151, CN1498, CN302, DR 4, ELA456-4, ELA478-6-31-11, ELA496-11-6-1-0, FLA653-3-1-0, L00746, L00868, L02649, L04034, L05936, LRB10, NGB11910-2, NGB15838-1, NGB2408-2, NGB5021-2, PL12902658A1, PL12903367A1, PL29133765AL, Punjab Chuhara, Saryab Long</li> <li>60 6234, 10573, 10576, 10579, 10583, 10587, 10589, 10592, 17856, 17858, 17870, 17882, 17889, 0.63</li> <li>HP 17900, 19291, 19294, 19891, 636-2, 6836-4, 6836-8, 6863-10, Avinash, BARL5, CLN2768A, CN112, CN1516, L00760, L00769, L00790, L00853, L01891, L01921, L01921, L02064, L02401, L02540, L02560, L02663, L05596, L05632, L05633, L05839, L05848, L05595, L02010, L00225, L00022, L020029, LRB11, LRB6, LRB7, NGB2407, Nozami, PL12166295GL, PL12583157AL, PL26299560AL, PL40695276AL, PL4474505GL, Tom Round</li> <li>4 40 6235, 17869, 17876, 17884, 19230, 19297, 19889, 19890, 19991, 19901, 19905, 19910, 6836-9, 0.77</li> <li>AARI local, CN1506, CN18862, CN7232, PL 43, L01923, L01936, L01941, L01956, L02559, L02738, L02739, L05595, L05605, NGB11900-2, NGB7769-2, PL11878384AL, PL12886956GL, PL2102690AL, PL25847885AL, PL27020663AL, PL281555605A, Madona, 6836-7, CN100, 0.56</li> <li>HP, MRC, CN123, CN126, CN1632, CN18078, CN1885, CN1887, CN842, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-3-1-11, HGB1584-61, L02017, L05822, L05905, L05926, L05992, NGB11704-2, NGB15851-1, NGB2048, NGB200, PL1756384AL, PL12403596GL, PL12782570AL, PL3859209AL, PL12912858AL, PL127037256AB, PL190629700GL, PL12782570AL, PL3859209AL, PL12912858AL, PL1578257256AB, PL190629700GL, PL12782570AL, PL3859209AL, PL12912858AL, PL27093596AL, PL2943865AL, PL4943865AL, PL390970AL, PL12912858AL, PL22090205GL, L05927, L05936, L05927, NGB11704-2, NGB18109-1, PL10983344AL, PL12782059AL, PL1290468AL, PL12914258AL, PL15799368AL, PL390970AL, PL1591885AL, PL2209046AAL, PL12914258AL, PL15799368AL, PL4657752</li></ul>	2	48	6232, 10580, 10585, 10588, 17859, 17860, 17865, 17872, 17874, 17878, 17880, 17881, 19288, 19295	, 0.69	HP	
<ul> <li>CN302, DR 4, PLA4364, LC353-11, PLA4364, LC35-11, PLA4364, LC353-51-10, DL0146, LC0465, LC3649, LC4304, LC5936, LKB10, NGB15858-1, NGB2508-2, NGB5021-2, PL12902658AL, PL1230367AL, PL29133765AL, Punjab Chuhana, Saryab Long</li> <li>60 6234, 10573, 10576, 10579, 10589, 10589, 10589, 1756, 17858, 17870, 17882, 17885, 17885, 1788, 164, LC2401, LC2540, LC2660, LC0663, LC3569, LC05632, LC05633, LC0583, LC1891, LC1902, LC1021, LC2064, LC2401, LC2540, LC260, LC2663, LC5596, LC5632, LC5633, LC5839, LC5848, LC5995, LC6021, LC6022, LC6029, LRB11, LRB6, LRB7, NGB207, Nozami, PL12166295GL, PL12583157AL, PL26299560AL, PL404505GL, Tom Round</li> <li>4 40 6235, 17863, 17876, 17876, 17884, 19290, 19297, 19889, 19890, 19893, 19901, 19905, 19910, 6836-9, 0.77 - AARI local, CN1506, CN18862, CN7232, H 24, LC1923, LC1936, LC1944, LC12401, LC2549, LC559, LC2573, LC2737, LC2737, LC5053, LC5053, NC6190-2, NCB1769-2, PL11878384AL, PL285865GL, PL21206269AL, PL25847885AL, PL27020663AL, PL2815556AL, PL45202678AL, PL45202777AL, PL64730599GL, PL9809766AL</li> <li>5 2 6233, 10574, 10575, 10578, 10581, 10582, L7864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 CN123, CN126, CN1632, CN1835, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-3-1-1, HGB15846-1, L02017, L05822, L05905, L05926, L0592, NGB11704-2, NGB15851-1, NGB2048, NGB2050, PL11756384AL, PL2847466AL, PL2943865AL, PL24559269AL, PL3959260, PL4755601GL, PL4745690GL, PL6474590GL, PL647455601GL, PL475601GL, PL475601GL, PL475601GL, PL474509070AL, PL12912888AL, PL128057265A, PL19629700GL, PL25847466AL, PL2943865AL, PL345556, L01231, L01715, 0.47 HP, MRC</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 0.47 HP, MRC</li> <li>6 40 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6886 - 0.68 HP, SLV</li> <li>3, 6836-5, 6836-6, 1982-01072AL, PL20846AA, L, PL12912858AL, PL1259265AL, PL2770361A1, PL40695276AL, P150531784AL, PL6092005GL, LP17</li></ul>			19296, 19887, 19888, 19895, 19896, 19900, 19902, 19904, 19906, 19907, 19913, CH-151, CN1498	,		
<ul> <li>PL12902658AL, PL12903367AL, PL29133765AL, Punjab Chuhara, Saryab Long</li> <li>60</li> <li>6234, 10573, 10576, 10579, 10583, 10589, 10592, 17856, 17858, 17870, 17882, 17885, 17889, 0.63</li> <li>HP</li> <li>179000, 19291, 19294, 19891, 6836-2, 6836-4, 6836-8, 6853-10, Avinash, BARL5, CLN2768A, CN112, CN1516, L00760, L00769, L00790, L000853, L01891, L01902, L01921, L02064, L02401, L02540, L02560, L02663, L05596, L05632, L055632, L05503, L05894, L05840, L05848, L05995, L06021, L06022, L06029, L0811, LRB6, LKB7, NGB2407, Nozami, PL12166295GL, PL12583157AL, PL26299560AL, PL40695276AL, PL46744505GL, Tom Round</li> <li>6235, 17863, 17869, 17876, 17884, 19290, 19297, 19889, 19800, 19893, 19901, 19905, 19910, 6836-9, 0.77</li> <li>AARI local, CN1506, CN18862, CN7232, H 24, L01933, L01936, L01941, L01996, L02559, L02738, L02739, L05595, L05605, NGB11900-2, NGB7769-2, PL121878384AL, PL12858695GL, PL21206269AL, PL25847885AL, PL27020663AL</li> <li>52</li> <li>6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56</li> <li>KIA47-6-3-1-11, HGB15846-1, L02017, L05822, L05905, L05996, L05992, NGB11704-2, NGB15851-1, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL12782570AL, PL4259269AL, PL12912858AL, PL15357256AB, PL10629700CL, PL25847466AL, PL2943865AL, PL34113498GL, PL39051075AL, PL64744791GL, PL64748699GL, PL64755601GL, PL64755602GL, PL12912858AL, PL12580472AL, PL12904285AL, PL12782570AL, PL5900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL29703908GL, PL59507070AL, PL15919885AL, PL2681072AL, PL27040861AL, PL27043905GL, PL27270361AL, PL40695276AL, P15031784AL, PL6092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TV52</li> <li>6 638, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19901, Peto-86-China, 6836-0.68</li> <li>HP, SLV 3, 6835-6, 6836-6, 698-C-39-20-11, Arka Abha, CH8 CLN 1134G, CLN 2001A, CLN 2071A, CLN 2076A, CLN 2365, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN 20</li></ul>			CN302, DK 4, FLA450-4, FLA4/8-0-3-1-11, FLA496-11-0-1-0, FLA053-3-1-0, LO0/40, LO0808 LO2649 LO4034 LO5936 LRB10 NGB11910-2 NGB15858-1 NGB2408-2 NGB5021-2	,		
<ul> <li>60 6234, 10573, 10576, 10579, 10583, 10587, 10589, 10592, 17886, 17882, 17885, 17889, 0.63 HP</li> <li>17900, 19291, 19294, 19891, 6836-2, 6836-4, 6836-36, 6863-10, Avinash, BARI-5, CLN2768A, CN112, CN1516, LO0760, LO0769, LO0853, LO1891, LO1902, LO1921, LO2064, LO2401, LO2540, LO2560, LO2603, LO5596, LO5632, LO5633, LO5839, LO5840, LO5848, LO5995, LO6021, LO6022, LO811, LRB6, LRB7, NGB2407, Norzami, PL12166295GL, PL12583157AL, PL26299560AL, PL40695276AL, PL64744505GL, Tom Round</li> <li>4 40 6235, 17863, 17869, 17876, 17884, 19290, 19297, 19889, 19890, 19893, 19901, 19905, 19910, 6836-9, 0.77 - AARI local, CN1506, CN18862, CN7232, H 24, LO1933, LO1936, LO1941, LO1906, LO2559, LO2738, LO2739, LO5595, LO5605, NGB11900-2, NGB770-2, PL11878384AL, PL12858095GL, PL21206269AL, PL25847885AL, PL27020663AL, PL2815556AL, PL45202777AL, PL6473059GL, PL9809766AL</li> <li>5 52 6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 CN123, CN126, CN1632, CN18078, CN1855, CN1837, CN342, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-3-1-11, HGB15846-1, LO2017, LO5822, LO5905, LO5905, LO5992, NGB11704-2, NGB15851-1, NGB2048, NGB2030, PL11756384AL, PL12403596GL, PL12782570AL, PL12925870AL, PL1291285478, LPL57255AB, PL196279700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL1291205576AL, PL0592700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL12912059AL, PL129025970AJ, PL1290258468AL, PL12914258AL, PL15790368AL, PL34113498GL, PL129129590, LPL059070AJ, PL12905468AL, PL27043096GL, P12720361AI, PL4755601GL, PL64755601GL, PL057576AL, P1059370AJ, LP12090468AL, PL27043096GL, P127270361AI, PL4065, TY52</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, LO1231, L01715, 0.47 HP, MRC L0378, L01917, L02598, L03873, L05800, L06017, NGB15845-1, NGB15847-1, NGB15847-1, NGB16841-1, PL107834904L, PL127805903AL, PL27040861AL, PL27043096GL, P127270361AI, PL40695276AL, P150531784AL, PL27603970AJ, PL2090468AL, PL3914258AL, PL15790368AL, PL</li></ul>			PL12902658AL, PL12903367AL, PL29133765AL, Punjab Chuhara, Saryab Long			
<ul> <li>17900, 19291, 19294, 19891, 6836-2, 6836-4, 6836-8, 6863-0, Avinash, BARL5, CLN2768A, CN112, CN1516, L00760, L00769, L00790, L00833, L01891, L01902, L01921, L02064, L02401, L02540, L02560, L02663, L05596, L05632, L05633, L05839, L05840, L05848, L05995, L06021, L06022, L06029, LRB11, LRB6, LRB7, NGB2407, Nozami, PL12166295GL, PL12583157AL, PL26299560AL, PL40695276AL, PL64744505GL, Tom Round</li> <li>4</li> <li>40</li> <li>6235, 17863, 17869, 17876, 17884, 19290, 19297, 19889, 19890, 19893, 19901, 19905, 19910, 6836-9, 0.77 AARI local, CN1806, CN18862, CN7232, H 24, L01923, L01936, L01941, L01996, L02559, L02738, L02793, L02579, L05595, L05605, NGB11900-2, NGB7769-2, PL11878384AL, PL12885895GL, PL21206269AL, PL25847885AL, PL27020663AL, PL28155566AL, PL45202678AL, PL45202777AL, PL6473059GL, PL809766AL</li> <li>5</li> <li>52</li> <li>6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 HP, MRC, CN123, CN126, CN1632, CN18078, CN1855, CN1857, CN342, CN42, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-31-11, HGB15846-1, L02017, L05822, L05905, L05926, L05992, NGB11704-2, NGB15851-11, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL12782570AL, PL2859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL3495602GL, T5020</li> <li>6</li> <li>40</li> <li>6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 0.47 L01878, L01917, L02598, L03873, L05860, L06017, NGB15447-1, NGB18109-1, PL10983484AL, PL12782059AL, PL1290468AL, PL12914258AL, PL15799368AL, PL40695276AL, PL50531784AL, PL2681072AL, PL27040861AL, PL2043096GL, P127270361AL, PL40695276AL, P150531784AL, PL2681072AL, PL27040861AL, PL2043096GL, P127270361AL, PL40695276AL, P150531784AL, PL2681072AL, PL27040861AL, PL2043096GL, P127270361AL, PL40695276AL, P150531784AL, PL2681072AL, PL27040861AL, PL2914258AL, R0ma King, T 4065, TY52</li> <li>7</li> <li>63</li> <li>6238, 17857, 17868, 17871, 17899, 19321, 19897,</li></ul>	3	60	6234, 10573, 10576, 10579, 10583, 10587, 10589, 10592, 17856, 17858, 17870, 17882, 17885, 17889	, 0.63	HP	
<ul> <li>CN112, CN1516, L00760, L00769, L00789, L007837, L01891, L01902, L01921, L02064, L02401, L02540, L02560, L02653, L05632, L05633, L05839, L05840, L058448, L05995, L06021, L06022, L06029, LRB11, LRB6, LRB7, NGB2407, Nozami, PL12166295GL, PL12583157AL, PL26299560AL, PL40695276AL, PL4691744505GL, Tom Round</li> <li>4 40</li> <li>6235, 17863, 17869, 17876, 17884, 19290, 19297, 19889, 19890, 19893, 19901, 19905, 19910, 6836-9, 0.77 - AARI local, CN1506, CN18862, CN7232, H 24, L01923, L01936, L01941, L01996, L02559, L02738, L027739, L05595, L05605, NGB11900-2, NGB7769-2, PL11878384AL, PL12858695GL, PL21206269AL, PL25847885AL, PL27020663AL, PL28155566AL, PL45202678AL, PL45202777AL, PL64730599GL, PL9809766AL</li> <li>5 c2 6233, 10574, 10575, 10578, L0581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 HP, MRC, CN123, CN126, CN1632, CN1807, CN1855, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, FLA47-6-3-1-11, HGB15846-1, L02017, L05822, L05905, L05922, NGB11704-2, NGB15851-1, NGB208, NGB210, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL2859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL2859269AL, PL129122588AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL284756001GL, PL647556001GL, PL647556001GL, PL647566012GL, T5020</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 0.47 HP, MRC L01878, L01917, L02598, L03873, L05860, L06017, NGB15845-1, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL12904868AL, PL12914258AL, PL15799368AL, PL15909700AL, PL5919285AL, PL2681072AL, PL27040861AL, PL2743096GL, PL27720361A1, PL40695276AL, PI50531784AL, PL2681072AL, PL27040861AL, PL278257AL, Roma King, T 4065, TY52</li> <li>7 63 6238, 17887, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836-0.68 HP, SLV 3, 8636-5, 636-6, 998-C-39-20-11, Ark a bha, CH 68, CLN 1314G, CLN 2001A, CLN 20716, CLN 2076K, CLN 22766, L02777K, CLN2777F, CLN2777E,</li></ul>			17900, 19291, 19294, 19891, 6836-2, 6836-4, 6836-8, 6863-10, Avinash, BARI-5, CLN2768A	,		
<ul> <li>LOS995, LOG021, LOG022, LOG029, LRB11, LRB6, LRB7, NGB2407, Nozami, PL12166295GL, PL12583157AL, PL26299560AL, PL40695276AL, PL64744505GL, Tom Round</li> <li>4</li> <li>40</li> <li>6235, 17863, 17869, 17876, 17884, 19200, 19297, 19889, 19893, 19901, 19905, 19910, 6836-9, 0.77 AARI local, CN1506, CN18862, CN7232, H 24, L01923, L01936, L01941, L01996, L02559, L02738, L02739, L05595, L05605, NGB11900-2, NGB7769-2, PL1878384AL, PL12858695GL, PL21206269AL, PL25847885AL, PL27020663AL, PL28155566AL, PL45202678AL, PL45202777AL, PL64730599GL, PL9809766AL</li> <li>5</li> <li>52</li> <li>6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56</li> <li>HP, MRC, CN123, CN126, CN1632, CN18078, CN1855, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-31-11, HGB15846-1, L02017, L05822, L05905, L05926, L05992, NGB11704-2, NGB15851-1, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL12782570AL, PL12859269AL, PL12912858AL, PL1537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL24113498GL, PL39051075AL, PL64744791GL, PL64748699GL, PL64755601GL, PL64756602GL, T5020</li> <li>6</li> <li>40</li> <li>6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 0.47</li> <li>HP, MRC L01878, L01917, L02598, L03873, L05860, L06017, NGB13643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL12904868AL, PL12914258AL, PL15799368AL, PL1590970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL2914258AL, PL15799368AL, PL1590970AL, PL5051784AL, PL60092005GL, PL9758704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7</li> <li>63</li> <li>6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836-0.68</li> <li>HP, SLV</li> <li>3, 6836-5, 633-6, 998-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2011A, CLN 20716, CLN 2123C, CLN 2123D, CLN 2123E, CLN 22777, CLN 2366 B, CLN 2400A, CLN 2585A, CLN 2365A, CLN 2400B, CLN 2413D, CLN 2418, A, C</li></ul>			CN112, CN1516, L00/60, L00/69, L00/90, L00853, L01891, L01902, L01921, L02064, L02401 L02540 L02560 L02663 L05596 L05632 L05633 L05839 L05840 L05848	,		
<ul> <li>PL12583157AL, PL26299560AL, PL40695276AL, PL64744505GL, Tom Round</li> <li>44</li> <li>40</li> <li>6235, 17863, 17869, 17876, 17884, 19290, 19297, 19889, 19890, 18903, 19901, 19905, 19910, 6836-9, 0.77</li> <li>AARI local, CN1506, CN18662, CN7232, H 24, L01923, L01936, L01941, L01996, L02559, L02738, L02739, L05595, L05605, NGB11900-2, NGB7769-2, PL11878384AL, PL12858695GL, PL21206269AL, PL25847885AL, PL27020663AL, PL28155566AL, PL45202678AL, PL45202777AL, PL64730599GL, PL9809766AL</li> <li>52</li> <li>6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56</li> <li>HP, MRC, CN123, CN126, CN1632, CN18078, CN1855, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-3-1-11, HGB15846-1, L02017, L05822, L05905, L05926, L05992, NGB11704-2, NGB15851-11, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL25870AL, PL1289269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL39051075AL, PL64744791GL, PL64748699CL, PL64755601GL, PL4756002GL, T5020</li> <li>6</li> <li>40</li> <li>6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 0.47</li> <li>HP, MRC L01878, L01917, L02598, L03873, L05860, L06017, NGB15845-1, NGB15847-1, NGB15847-1, NGB18109-1, PL10983484AL, PL127093050GL, PL2194258AL, PL15799368AL, PL15990576AL, PL509307AL, PL15991585AL, PL2004861AL, PL2043096GL, PL27270361A1, PL40695276AL, PL50531784AL, PL2681072AL, PL27040861AL, PL2914258AL, PL1579368AL, PL15990575AL, R060351784AL, PL27040861AL, PL27043096GL, P127270361A1, PL40695276AL, PI50531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7</li> <li>63</li> <li>6238, 17857, 17868, 17871, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836-0.68</li> <li>HP, SLV 3, 6836-5, 6836-6, GLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2056A, CLN2255A, CLN2255D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, L00024H</li></ul>			LO5995, LO6021, LO6022, LO6029, LRB11, LRB6, LRB7, NGB2407, Nozami, PL12166295GL	,		
<ul> <li>40 6235, 17863, 17869, 17876, 17884, 19290, 19297, 19889, 19890, 19893, 19901, 19905, 19910, 6836-9, 0.77 AARI local, CN1506, CN18862, CN7232, H 24, L01923, L01936, L01941, L01996, L02559, L02738, L02739, L05595, L05605, NGB11900-2, NGB7769-2, PL11878384AL, PL12856695GL, PL21206269AL, PL25847885AL, PL27020663AL, PL28155566AL, PL45202678AL, PL45202777AL, PL64730599GL, PL9809766AL</li> <li>52 6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56</li> <li>HP, MRC, CN123, CN126, CN1632, CN18078, CN1855, CN1857, CN342, CN612, CN74, CN85, CN89, SLV FLA47-6-3-1-11, HGB15846-1, L02017, L05822, L05905, L05992, NGB11704-2, NGB15851-1, NGB2048, NGB2050, PL1756384AL, PL12403596GL, PL12782570AL, PL12859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL39051075AL, PL64744791GL, PL64748699GL, PL64755601GL, PL64756602GL, T5020</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 0.47 HP, MRC L01878, L01917, L02598, L03873, L05860, L06017, NGB13643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL1098384AL, PL12782059AL, PL290486AL, PL27043096GL, PL277270361A1, PL40695276AL, PL50531784AL, PL2681072AL, PL27040861AL, PL27043096GL, P1277270361A1, PL40695276AL, PL50531784AL, PL2681072AL, PL27040861AL, PL27043096GL, P127270361A1, PL40695276AL, PL50531784AL, PL2681072AL, PL27040861AL, PL27043096GL, P127270361A1, PL40695276AL, PL50531784AL, PL2681072AL, PL27043086AL, PL2914258AL, R015799368AL, PL15900970AL, PL15919885AL, PL2681072AL, PL27043096GL, P127270361A1, PL40695276AL, PL50531784AL, PL268072AL, PL2704306, CLN2077C, CLN2366, CLN2285D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, L00244, L00818, L01788, L04020, L05833, L05861, L05877, L05913, L8816, LRB17, Money Maker, Nagina, NGB1213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li></ul>			PL12583157AL, PL26299560AL, PL40695276AL, PL64744505GL, Tom Round			
<ul> <li>AART IGGAI, CN1306, CN18302, CN1232, H 24, D01936, D01941, D01941, D01956, D02539, D02739, L05595, L05605, NGB11000-2, NGB7160-2, PL11878384AL, PL12828695GL, PL21206269AL, PL45202777AL, PL64730599GL, PL9809766AL</li> <li>52 6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 HP, MRC, CN123, CN126, CN1632, CN1832, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, SLV FLA47-6-3-1-11, HGB15846-1, L02017, L05822, L05905, L05992, NGB11704-2, NGB15851-1, NGB2094A, PL12912858A, PL15537256AB, PL19629700GL, PL25847466AL, PL2782570AL, PL12782570AL, PL39504AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL39051075AL, PL64744791GL, PL64744766AL, PL2943865AL, PL395051075AL, PL64744791GL, PL647447056002GL, 75020</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, L01231, L01715, 0.47 HP, MRC L01878, L01917, L02598, L03873, L05860, L06017, NGB15643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL12908468AL, PL12914258AL, PL1579368AL, PL15900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL27043096GL, P127270361A1, PL40695276AL, P150531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7 63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836-0.68 HP, SLV 3, 6836-5, 6836-6, 098-C-39-20-11, Arka Abha, CH 68, CLN 3146, CLN 2001A, CLN 2026M, CLN 2136, CLN 2400B, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2132C, CLN 2400B, CLN 2418, A, CLN1621L, CLN2001A, CLN2026M, CLN2132C, CLN 2400B, CLN 2418, A, CLN1621L, CLN2001A, CLN2026M, CLN22385, D, CLN2777B, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, L00244, L00818, L01788, L00420, L05833, L05861, L05877, L05871, L05871, L05824, L06814, FLA 496-11-61-0, L00854, L009814, L01733 L019627 L02299 L05571, L05835 L05861-1, Bio Blitz, CLN3022F-183-11, 0.79 HP</li> </ul>	4	40	6235, 17863, 17869, 17876, 17884, 19290, 19297, 19889, 19890, 19893, 19901, 19905, 19910, 6836-9	, 0.77	-	
<ul> <li>PL2106269AL, PL2584788SAL, PL27020663AL, PL28155566AL, PL45202678AL, PL45202777AL, PL64730599CL, PL9809766AL</li> <li>6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 HP, MRC, CN123, CN126, CN1632, CN18078, CN1855, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-3-1-11, HGB15846-1, LO2017, LO5822, LO5905, LO5926, LO5992, NGB11704-2, NGB15851-1, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL12782570AL, PL12859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL3859269AL, PL2912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL64756602GL, T5020</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, LO1231, LO1715, 0.47 HP, MRC L01878, L01971, L02598, L03873, L05860, L06017, NGB13643-3, NGB15845-1, NGB15845-1, NGB18109-1, PL10983484AL, PL12782059AL, PL27040861AL, PL27040306GL, PL27270361A1, PL40695276AL, PL50598, L03873, L05860, L06017, NGB13643-3, NGB15845-1, NGB15845-1, NGB18109-1, PL10983484AL, PL2782059AL, PL27040861AL, PL27040306GL, PL27270361A1, PL40695276AL, PL50531784AL, PL2681072AL, PL27040861AL, PL27040306GL, PL27270361A1, PL40695276AL, P150531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7 63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 998-C-39-20-11, Arka Abha, CH 86, CLN 1314G, CLN 2001A, CLN 2017L, CLN 2123C, CLN 2366A, CLN 24040B, CLN 2413B, CLN 2418, A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, L00244, L00818, L01788, L04020, L05833, L05861, L05877, L05913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TB 111, TMV F1</li></ul>			AARI 100al, CN1500, CN18802, CN7252, H 24, L01925, L01950, L01941, L01990, L02559 L02738 L02739 L05595 L05605 NGB11900-2 NGB7769-2 PL11878384AL PL12858695GL	,		
<ul> <li>PL45202777AL, PL64730599GL, PL9809766AL</li> <li>52</li> <li>6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 HP, MRC, CN123, CN126, CN1632, CN18078, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, SLV</li> <li>FLA47-6-3-1-11, HGB15846-1, LO2017, LO5822, LO5905, LO5926, LO5992, NGB11704-2, NGB15851-1, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL12782570AL, PL12859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL39051075AL, PL647478099GL, PL647466905L, PL64755601GL, PL6475600GL, T5020</li> <li>6</li> <li>40</li> <li>6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, LO1231, LO1715, 0.47 HP, MRC L01878, L01917, L02598, L03873, LO5860, L06017, NGB13643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL129102846AL, PL29124258AL, PL15799368AL, PL15910970AL, PL1591985AL, PL2681072AL, PL2904468AL, PL2914258AL, PL15799368AL, PL15910970AL, PL159198585AL, PL2681072AL, PL27040861AL, PL27043096GL, PL2770361A1, PL40695276AL, P150531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TYS2</li> <li>7</li> <li>63</li> <li>6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836-0.68 HP, SLV 3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN 2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2268A, CLN2268A, CLN2585D, CLN2777A, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, L00818, L01788, L04020, L05833, L05861, L05877, L05913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8</li> <li>26</li> <li>6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Bitz, CLN3022F-183-11, 0.79 HP CLN460E, CLN3022F2-10-55, CLN3022F2-11-16, CN177, CN634, FLA 496-11-6-10, L00854, L00981, L00781,</li></ul>			PL21206269AL, PL25847885AL, PL27020663AL, PL28155566AL, PL45202678AL	,		
<ul> <li>5 52 6233, 10574, 10575, 10578, 10581, 10582, 17864, 17877, 19899, 15876095, Madona, 6836-7, CN100, 0.56 HP, MRC, CN123, CN126, CN1632, CN18078, CN1855, CN1857, CN342, CN612, CN74, CN85, CN87, CN89, FLA47-6-31-11, HGB15846-1, LO2017, LO5822, LO5905, LO5992, LO5992, NGB11704-2, NGB15851-1, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL12782570AL, PL12859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL39051075AL, PL6474791GL, PL6475660JGL, T5020</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, LO1231, LO1715, 0.47 HP, MRC LO1878, LO1917, LO2598, LO3873, LO5860, LO6017, NGB15643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL12908468AL, PL12914258AL, PL15799368AL, PL15919885AL, PL5900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL2704306GL, P12770361A1, PL40695276AL, P150531784AL, PL60092005GL, PL97538704L, PL2970361A1, PL40695276AL, P150531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7 63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001A, CLN 2071C, CLN 2123C, CLN 2123D, CLN 2113D, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN 2123D, CLN2177E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5831, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-11-0555, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-10, LO0854, LO0984, LO0984, LO0783, LO9671, L07871, L05971, L05871, L05974, L06003</li> </ul>			PL45202777AL, PL64730599GL, PL9809766AL			
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<ul> <li>NGB15851-1, NGB2048, NGB2050, PL11756384AL, PL12403596GL, PL12782570AL, PL12859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL, PL34113498GL, PL39051075AL, PL64744791GL, PL64748699GL, PL64755601GL, PL64756602GL, T5020</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, LO1231, LO1715, 0.47 HP, MRC LO1878, LO1917, LO2598, LO3873, LO5860, LO6017, NGB13643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL12908468AL, PL12914258AL, PL15799368AL, PL15900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL27043096GL, P127270361A1, PL406952766AL, PI50531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7 63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 998-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN 2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001 A, CLN2026M, CLN2123C, CLN 2130D, CLN 2413D, CLN 2413 A, CLN1621L, CLN2001 A, CLN2026M, CLN2123C, CLN21777A, CLN2777B, CN1502, DR 2-, DR 3, L00244, L00818, L01788, LO4020, L05833, L05861, L05877, L05913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN1177, CN634, FLA 496-11-6-1-0, L00854, L00784, L00784, L00730</li> </ul>			CN123, CN120, CN1032, CN18078, CN1855, CN1857, CN342, CN012, CN74, CN85, CN87, CN89 FLA47-6-3-1-11 HGB15846-1 LO2017 LO5822 LO5905 LO5926 LO5922 NGB11704-2	,	SLV	
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<ul> <li>PL34113498GL, PL39051075AL, PL64744791GL, PL64748699GL, PL64755601GL, PL64756602GL, T5020</li> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, LO1231, LO1715, 0.47 HP, MRC LO1878, LO1917, LO2598, LO3873, LO5860, LO6017, NGB13643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL12908468AL, PL12914258AL, PL15799368AL, PL15900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL27043096GL, Pl27270361A1, PL40695276AL, Pl50531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7 63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN 2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV FI</li> <li>8 26 6231, 17867, 17879, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO1733 LO1967 LO2299 LO5571 LO5835 LO5847, LO5947 LO6003</li> </ul>			PL12859269AL, PL12912858AL, PL15537256AB, PL19629700GL, PL25847466AL, PL2943865AL	,		
<ul> <li>6 40 6237, 10584, 19894, 19912, 19914, Rio-China, CN1707, CN345, FLA505, LO1231, LO1715, 0.47 HP, MRC LO1878, LO1917, LO2598, LO3873, LO5860, LO6017, NGB13643-3, NGB15845-1, NGB15847-1, NGB18109-1, PL10983484AL, PL12782059AL, PL12908468AL, PL12914258AL, PL15799368AL, PL15900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL270403096GL, Pl27270361A1, PL40695276AL, PI50531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>7 63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN 2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-1, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981, LO1733, LO1674, LO0674, LO0603</li> </ul>			PL34113498GL, PL39051075AL, PL64744791GL, PL64748699GL, PL64755601GL	,		
<ul> <li>Korney K. K.</li></ul>	6	40	PL04/500020L, 15020 6237 10584 19894 19912 19914 Rio-China CN1707 CN345 FLA505 LO1231 LO1715	0.47	HP M	RC
<ul> <li>NGB18109-1, PL10983484AL, PL12782059AL, PL12908468AL, PL12914258AL, PL15799368AL, PL15900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL27043096GL, Pl27270361A1, PL40695276AL, Pl50531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN 2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981, LO1733, LO1967, LO2799 LO5571, LO5835, LO5947, LO6003</li> </ul>	0	10	LO1878, LO1917, LO2598, LO3873, LO5860, LO6017, NGB13643-3, NGB15845-1, NGB15847-1	, 0.17	111,101	ite
<ul> <li>PL15900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL27043096GL, Pl27270361A1, PL40695276AL, Pl50531784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, T 4065, TY52</li> <li>63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN 2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981, LO1733, LO1967, LO2799 LO5571, LO5947, LO6903</li> </ul>			NGB18109-1, PL10983484AL, PL12782059AL, PL12908468AL, PL12914258AL, PL15799368AL	,		
<ul> <li>PL40695276AL, PI50551784AL, PL60092005GL, PL97538704L, PL9978275AL, Roma King, 1 4065, TY52</li> <li>63 6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68 HP, SLV 3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN 2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981 LO1733 LO1967 L02299 L05571 L05835 L05947 L06003</li> </ul>			PL15900970AL, PL15919885AL, PL2681072AL, PL27040861AL, PL27043096GL, Pl27270361A1	,		
7       63       6238, 17857, 17868, 17871, 17895, 17899, 19321, 19897, 19903, 19909, 19911, Peto-86-China, 6836- 0.68       HP, SLV         3       6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN       2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1         8       26       6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79       HP         8       26       6231, 17867, 17879, 19289, 19292, 19293, 19592, 105542, LO5947, LO6003       HP       HP			PL40695270AL, PL50551784AL, PL60092005GL, PL97538704L, PL9978275AL, Koma King, I 4065 TY52			
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<ul> <li>2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M, CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2366 B, CLN2400A, CLN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981, LO1733, LO1967, LO2299, LO5571, LO5835, LO5947, LO6003</li> </ul>			3, 6836-5, 6836-6, 99S-C-39-20-11, Arka Abha, CH 68, CLN 1314G, CLN 2001 A, CLN 2071C, CLN	í.		
<ul> <li>CLIN2125C, CLIN2125D, CLIN2125E, CLIN2277C, CLIN2506 B, CLIN2400A, CLIN2505A, CLIN2585A, CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2, IDR 3, LO0244, LO0818, LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981, LO1733, L01967, L02299, L05571, L05835, L05947, L06003</li> </ul>			2123C, CLN 2366A, CLN 2400B, CLN 2413D, CLN 2418 A, CLN1621L, CLN2001A, CLN2026M	,		
<ul> <li>LO1788, LO4020, LO5833, LO5861, LO5877, LO5913, LRB16, LRB17, Money Maker, Nagina, NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1</li> <li>6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981, LO1733, LO1967, LO2299, LO5571, LO5835, LO5947, LO6003</li> </ul>			CLN2123C, CLN2123D, CLN2123E, CLN2277C, CLN2500 B, CLN2400A, CLN2585A CLN2585D, CLN2777A, CLN2777B, CLN2777E, CN1502, DR 2, DR 2-1, DR 3, L00244, L00818			
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8 26 6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11, 0.79 HP CLN2460E, CLN3022F2-10-55, CLN3022F2-11-16, CN117, CN634, FLA 496-11-6-1-0, LO0854, LO0981 LO1733 LO1967 LO2299 LO5571 LO5835 LO5947 LO6003			NGB12213-1, Pant Bahar, Pusa Ruby, Rio-Early, T-4, TLB 111, TMV F1			
CLN2400E, CLN302272-10-33, CLN302272-11-10, CN117, CN034, FLA 490-11-0-1-0, LO0854, LO0981 LO1733 LO1967 LO2299 LO5571 LO5835 LO5947 LO6003	8	26	6231, 17867, 17879, 19289, 19292, 19293, 19892, 6836-1, 6836-11, Bio Blitz, CLN3022F-183-11.	, 0.79	HP	
100000000000000000000000000000000000000			L00981, L01733, L01967, L02299, L05571, L05835, L05947, L06003			

PL12166295GL, 17858, PL26299560AL, LO2540, LO0853, LO0769, LRB7, LO1921, LO1891, LO5995, LO0790, LO0760, LO5848, 19891, LO6022, LO2064, 10592, BARI-5, 10589, 17856, 10583, LO1902, PL64744505GL, 17900, LO2663, LO2560, PL40695276AL, LRB11, LRB6, 1057 at 80% linkage distance. The genotypes with maximum genetic distance from individual clusters along with representative samples from low distance groups are likely to be chosen for the establishment of core collection.

## Discussion

The loss of genetic diversity is a major threat for the maintenance and adaptive potential in genetic improvement of crop species (Olivera and Steffenson, 2009). Tomato is

also enlisted among the autogamous crops, which have undergone loss of genetic diversity due to intense natural and artificial selection during domestication (Saavedra *et al.*, 2001; Akhtar *et al.*, 2011). Huge genetic resources of tomato are available in various genebanks and are accessible worldwide for research purposes. Significant improvement in tomato along with basic information has been reported (Kamenetzky *et al.*, 2010). The magnitude of diversity and availability of information on plant descriptors and agronomic data are crucial for crop improvement (Cruz *et al.*, 2010). The first step to deal with any crop germplasm is to evaluate and characterize. We initiated characterization of seedling traits in tomato as a first step in the study.

For seedling traits of qualitative nature, the germplasm possessed almost all the categories reported, elsewhere representing optimum diversity for discrete

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
Cluster 2	1.09						
Cluster 3	0.85	1.12					
Cluster 4	1.18	0.74	0.90				
Cluster 5	0.79	0.85	0.74	0.83			
Cluster 6	1.20	0.85	1.19	0.76	0.85		
Cluster 7	0.85	1.05	0.98	1.25	0.97	1.26	
Cluster 8	1.27	1.56	0.71	1.14	1.24	1.61	1.36

Table 4: Genetic distances between clusters based on *k-means* analyses for seedling traits in 380 genotypes of tomato



**Fig. 1:** Scatter diagram of tomato germpalsm based on nine seedling traits. Eight clusters were constructed on the basis of *k*-means clustering and the graph was plotted depicting individual genotypic position on *x*-*y* coordinates presenting the cluster number

traits in the tomato germplasm conserved in the genebank. Among measureable traits, hypocotyl length exhibited maximum variation. The hypocotyl length determines the plant vigor at later stage and a medium seedling height with stuff growth is likely to produce healthy plants. According to Ellis (1992) seed germination, vigor and size influence crop yield through both indirect and direct effects. Rasmussen and Rasmussen (2000) suggested potential possibilities for successful integrated weed control with the use of high quality seed to a weed harrowing strategy. Similar model can be adopted in tomato, where weeds are serious problem and to avoid chemical weedicides, the genotypes with better seedling vigor and quick growth habit could be selected to cope with weed control strategy.

A considerable variation was observed for most of the seedling traits. Among nine seedling traits, six were of discrete nature and can be incorporated as genotype identification singly or in combination (Smýkal *et al.*, 2008). In the present study, tomato germplasm contained genotypes from various sources and the clustering pattern exhibited the formation of well characterized and coherent groups that indicated the practical value of data sets and analysis (Rodiño *et al.*, 2010). In our study, two genotypes19901 (*S. habrochaites*) and 6836-9 (*S. lycopersicum*) were glabrous and there might be a link

between the morphology and chemical composition of glandular trichomes in these two genotypes. Kang et al. (2010) has already reported that *hl*-mediated changes in tomato leaf surface traits correlate with decreased resistance to insect herbivory. In current study tomato seedlings fell in two categories on basis of purple color distribution in hpocotyl; one with purple colored hypocotyls and one category with green hypocotyls. Hypocotyls with purple color exhibited not only different levels but variation in color intensity was also obvious. Purple color in tomato vegetative tissues is a routine attributed to anthocyanins. Petunidin 3-(p-coumaryl rutinoside)-5-glucoside (Von Wettstein-Knowles, 1968) were extracted from tomato seedlings. These are group of purple, red and blue pigments (Mazza and Miniati, 1993), strong antioxidants and phytonutrients (Ames, 1983; Ames et al., 1993). Different levels of anthocyanins are attributed to various genes. Recessive anthocyanin free gene (af) have also been reported due to which anthocyanins are lacking in vegetative tissues (Burdick, 1958).

In the data analyzed genotypes of wild species were distributed in different clusters along S. lycopersicum. In the cluster 2 a genotype 19896 (S. pimpenellifolium) was seen to join at higher distance. Rick (1976) considered S. pimpenellifolium as either a direct ancestor of cultivated tomato or parallel evolution of both from a green fruited ancestor. Having close relationship and ease of backcrossing with S. lycopersicum it is considered a valuable source of germplasm. Tomato wild germplasm is known to contain various important genes like resistance to insects (Thurau et al., 2010), diseases (Cano et al., 2010) and introgressed successfully into cultivated tomato for improvement in breeding programs (Lin et al., 2010). However, we intend to evaluate further these wild accessions in our studies. Estimation of genetic diversity and relationships between germplasm collections are important for facilitating efficient germplasm collection, evaluation and utilization (Rafalski, 2009). Terzopoulos and Bebeli (2010) reported wide intrapopulation diversity in tomato landraces and suggested modified approach to population characterization than that used for the homogeneous varieties.

In conclusion either used *per se* or as a very interesting genetic resource in breeding programs, investigations on the genetic structure of tomato landraces is of high importance. If the germplasm is characterized/evaluated for various traits, the spectrum of utilization will be enhanced. Further



**Fig. 2:** Dendrograms of individual cluster of tomato germplasm grouped in to eight clusters on the basis of *k-means* clustering and the graph was plotted keeping linkage distance constant and the dotted line has been drawn at 50% dissimilarity. The names of genotypes are also mentioned in the Table 3 for individual clusters

characterization of tomato germplasm is suggested for broadening the use of core collections so as to use crop germplasm more efficiently in minimum time.

#### References

- Abdullahi, M.S. and K.B. Choji, 2009. The origin and benefits of tomato as a home garden and commercial vegetable. *Electr. J. Environ. Agric. Food Chem.*, 8: 1156–1169
- Akhtar, L.H., M.A. Pervez and M. Nasim, 2011. Genetic divergence and inter-relationship studies in chickpea (*Cicer arietinum L.*). *Pak. J. Agric. Sci.*, 48: 35–39
- Ames, B.N., 1983. Dietary carcinogens and anticarcinogens. Science, 221: 1256–1264
- Ames, B.N., M.K. Shingenaga and T.M. Hagen, 1993.Oxidants, antioxidants, and the degenerative diseases of aging. *Proc. Natl. Acad. Sci. USA*, 90: 7915–7922
- Ashfaq, M., A.S. Khan, S.H.U. Khan and R. Ahmad, 2012. Association of various morphological traits with yield and genetic divergence in rice (*Oryza sativa*). Int. J. Agric. Biol., 14: 55–62
- Basunanda, P., M. Radoev, W. Ecke, W. Friedt, H.C. Becker and R.J. Snowdon, 2010. Comparative mapping of quantitative trait loci involved in heterosis for seedling and yield traits in oilseed rape (*Brassica napus* L.). *Theor. Appl. Genet.*, 120: 271–281
- Burdich, A.B., 1958. New mutants. Rep. Tomato Genet. Coop., 8: 9-11
- Cano, E.G., J.N. Castillo, E. Moriones and R.F. Muñoz, 2010. Resistance to *Tomato chlorosis virus* in Wild Tomato Species that Impair Virus Accumulation and Disease Symptom Expression. *Phytopathology*, 100: 582–592
- Cohen, J.H., A.R. Kristal and J.L. Stanford, 2000. Fruit and vegetable intakes and prostate cancer risk. J. Natl. Cancer Inst., 92: 61–68
- Cruz, M.D., C.L. Moura, L.S.A. Gonçalves, C.P. Sudré, R. Rodrigues, A.T.A. Júnior and T.N.S. Pereira, 2010. The Grower's algorithm on the estimate of genetic diversity in chili pepper germoplasm. *Hortic. Bras.*, 28: 155–161
- Ellis, R.H., 1992. Seed and seedling vigor in relation to crop growth and yield. *Plant Growth Regul.*, 11: 249–255
- Gul, R., H.U. Rehman, I.H. Khalil, S.M.A. Shah and A. Ghafoor, 2010. Heterosis for flower and fruit traits in tomato (*Lycopersicon esculentum* Mill.). Afr. J. Biotechnol., 9: 4144–4151
- Jenkins, J.A., 1948. The origin of the cultivated tomato. *Econ. Bot.*, 2: 379–392
- Kamenetzky, L., R. Asís, S. Bassi, F. de Godoy, L. Bermúdez, A.R. Fernie, M.A. Van Sluys, J. Vrebalov, J.J. Giovannoni, M. Rossi and F. Carrari, 2010. Genomic Analysis of wild tomato introgressions determining metabolism- and yield-associated traits. *Plant Physiol.*, 152: 1772–1786
- Kang, J.H., F. Shi, A.D. Jones, M.D. Marks and G.A. Howe, 2010. Distortion of trichome morphology by the *hairless* mutation of tomato affects leaf surface chemistry. J. Exp. Bot., 61: 1053–1064

- Khan, S.A., 2009. Screening of tomato cultivars against root knot nematodes and their biological management. *Ph D Thesis*, p: 152. Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
- Lin, K.H., W.L. Yeh, H.M. Chen and H.F. Lo, 2010. Quantitative trait loci influencing fruit-relate characteristics of tomato grown in hightemperature conditions. *Euphytica*, 174: 119–135
- Marković, K., I.P. Krbavčić, M. Krpan, D. Bicanic and N. Vahčić, 2010. The lycopene content in pulp and peel of five fresh tomato cultivars. *Acta Alimentaria*, 39: 90–98
- Mazzucato, A., N. Ficcadenti, M. Caioni, P. Mosconi, E. Piccinini, V.R.R. Sanampudi, S. Sestili and V. Ferrari, 2010. Genetic diversity and distinctiveness in tomato (*Solanum lycopersicum* L.) landraces: The Italian case study of 'A pera Abruzzese'. *Sci. Hortic.*, 125: 55–62
- Mazza, G. and E. Miniati, 1993. Anthocyanins in Fruits, Vegetables and Grains. CRC Press Boca Raton, Florida, USA
- Nei, M. and W.H. Li, 1979. Mathematical model for studying genetic variation in terms of restriction endonucleases. *Proc. Natl. Acad. Sci.*, USA, 76: 5269–5273
- Ojo M.A., O.A. Ibrahim and U.S. Mohammed, 2009. Profitability and production function of small scale irrigated tomato production in Niger State, Nigeria. *Continental J. Agric. Econ.*, 3: 16–22
- Olivera, P.D. and B.J. Steffenson, 2009. Aegilops sharonensis: Origin, genetics, diversity and potential for wheat improvement. *Botany*, 87: 740–756
- Rafalski, J.A., 2009. Association genetics in crop improvement. Curr. Opin. Plant Biol., 13: 174–180
- Rasmussen, K. and J. Rasmussen, 2000. Barley seed vigor and mechanical weed control. Weed Res., 40: 219–230
- Rick, C.M., 1991. Tomato (family Solanaceae). In: Evolution of Crop Plants, pp: 268–273. Simmonds, N.W. (ed.). Longman Publications
- Rodiño, P.A., M. Santalla, A.M. De Ron and J.J. Drevon, 2010. Coevolution and Migration of Bean and Rhizobia in Europe. Sustain. Agric. Rev., 3: 171–188
- Saavedra, G., W. Spoor and L. Harrier, 2001. Molecular markers and genetic base broadening in *Lycopersicon* spp. Acta Hortic., 546: 503–507
- Smýkal, P., J. Horáček, R. Dostálová and M. Hýbl. 2008. Variety discrimination in pea (*Pisum sativum L.*) by molecular, biochemical and morphological markers. J. Appl. Genet., 49: 155–166
- Tam, S.M., M. Causse, C. Garchery, H. Burck, C. Mhiri and M.A. Grandbastien, 2007. The distribution of copia-type retrotransposons and the evolutionary history of tomato and related wild species. J. Evol. Biol., 20: 1056–1072
- Thurau, T., W. Ye and D. Cai, 2010. Insect and Nematode Resistance. Biotechnol. Agric. For., 64: 177–197
- Terzopoulos, P.J. and P.J. Bebeli, 2010. Phenotypic diversity in Greek tomato(Solanumlycopersicum L.) landraces. Sci. Hortic., 126:138–144
- Von Wettstein-Knowles, P., 1968. Mutations affecting anthocyanin synthesis in the tomato. *Hereditas*, 60: 317–346
- Xu, A., Z. Huang, C. Ma, E. Xiao, G. Tian, X. Zhang, J. Tu, T. Fu and G. Zhang, 2010. Inheritance of seed color and molecular markers linked to the seed color gene in *Brassica juncea*. *Mol. Breed.*, 25: 57–65

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