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Mapping QTL Underlying Fruit Quality Traits In An F_1 Strawberry Population

Rashed Alarfaj[a,b*], Mohamed El-Soda[c*], Laima Antanaviciute[d], Robert Vickerstaff[d], Paul Hand[e], Richard J. Harrison[d], Carol Wagstaff[b]

[a] *Food Sector, Saudi Food and Drug Authority, Saudi Arabia*
[b] *Department of Food and Nutritional Sciences, University of Reading, UK*
[c] *Department of Genetics, Faculty of Agriculture, Cairo University, 12613, Egypt*
[d] *Department of Genetics, Genomics and Breeding, NIAB EMR, UK*
[e] *Department of Crop and Environment Sciences, Harper-Adams University, UK*
[*] *These authors contributed equally to this work.*
Correspondence: raarfaj@sfda.gov.sa

Understanding how strawberry nutritional and quality traits are genetically regulated and correlated is an essential step towards improving marker-assisted breeding programmes in this crop. A first step to achieve this goal was to construct a Single Nucleotide Polymorphism (SNP)-based genetic map of 140 F_1 individuals of a cross between the two octoploid parents 'Redgauntlet' and 'Hapil'. The map consisted of 3933 SNPs distributed over 28 linkage groups, representing the seven homoeologous groups expected in *Fragaria* (2n = 8x = 56), and covered a total length of 2624.7 cM with an average resolution of 0.7 cM/SNP. Two overlapping subsets of F_1 individuals were evaluated in the field and glasshouse at East Malling Research and the University of Reading, respectively. Negative correlation was observed between Pelargonidin and the three traits L*, a* and b*, whereas positive correlations were observed within L*, a* and b*, and between Ellagic acid, Pelargonidin, and Cyanidin at both trial locations. QTL mapping revealed 29 significant QTL associated with the measured traits and mapped over 16 linkage groups. Two QTL for fruit Fresh Weight (FW) were co-located between day 1 and day 4 of shelf life, accounting for over 62 % of the variation. These data will enhance our understanding of the genetic basis and correlation of strawberry quality traits and provide the basis for refining QTL that underpin the genetic regulation of these quality traits.

Key words: Strawberry, *Rosaceae* family, F_1 strawberry population, shelf life, QTL, SNP.

Abbreviations: **FW**, Fresh Weight; **TSS**, Total Soluble Solids; **TA**, Titratable Acidity; **QTL**, Quantitative Trait Loci; **SNP**, Single Nucleotide Polymorphism.

1. Introduction

Strawberry belongs to the *Rosaceae* family, which contains morphologically diverse flowering plants consisting of more than 3,000 species from approximately 100 genera (Cabrera *et al.,* 2009; Jung *et al.,* 2012; Shulaev *et al.,* 2008). Although the taxonomic structure of the *Rosaceae* family is still controversial, it is divided into four subfamilies based on chromosome number: Rosoideae, Amygdaloideae (Prunoideae), Spiraeoideae and Maloideae (Pomoideae) (Shulaev *et al.,* 2008). Economically, *Rosaceae* is the third most important plant family in temperate regions after the Poaceae (grass family) and Fabaceae (legume family) (Dirlewanger *et al.,* 2002). Strawberries are one of the most highly valued fruits due to their abundance of vitamins, minerals, anthocyanin, flavonoids, and phenolic acids (Ayala-Zavala *et al.,* 2004; Halbwirth *et al.,* 2006) that give rise to appearance, nutritional and organoleptic qualities that appeal to human consumers. Epidemiological studies indicated that consuming food containing micronutrients and phytochemical compounds found in strawberry is linked with decreased risk of developing non-communicable diseases such as cancers, heart diseases, neurodegenerative diseases, attenuate cognitive decline and neuronal dysfunction (Aune *et al.,* 2017; Spencer, 2009; Vauzour *et al.,* 2008).

Fresh strawberries are extremely perishable, have a short shelf life, and are susceptible to mechanical injuries and physiological decay due to loss of tissue integrity, sensitivity to fungal diseases, and having a large surface area lacking an outer protective rind. Therefore, selecting for improved post-harvest quality traits, otherwise known as consumer quality traits, is becoming an important consideration for breeders (Lerceteau-Kohler *et al.,* 2012; Sargent *et al.,* 2009; Zorrilla-Fontanesi *et al.,* 2012). Post-harvest quality traits such as colour, firmness, flavour, e.g. Total Soluble Solids (TSS) and Titratable Acidity (TA), and phenolic compounds, are complex traits that are normally controlled by several genetic loci and are also influenced by pre-harvest and post-harvest environmental factors, such as temperature, light, moisture, and soil quality (Crespo *et al.,* 2010; El Hadi *et al.,* 2013; Forney *et al.,* 2000; Hakala *et al.,* 2002; Hancock, 1999; Soria *et al.,* 2008; Wang and Lewers, 2007). Therefore, maintaining high nutritional values in the berry fruit whilst maintaining high fruit quality requires an understanding of the genetic and environmental effects on each trait, and how different traits are associated with each other. Mapping traits on the linkage map using a Quantitative Trait Loci (QTL) approach is the first step to identify the underlying gene(s) and to explore their effects and interactions (Hossain *et al.,* 2019; Vallarino *et al.,* 2019; Verma *et al.,* 2017). Strawberry is a highly heterozygous species, further complicated by the octoploid nature of each parental genome, therefore an F_1 population and a two-way pseudo-testcross were used to generate a genetic linkage map (Gaston *et al.,* 2013; Grattapaglia and Sederoff, 1994; Zorrilla-Fontanesi *et al.,* 2012). Selection of parents showing divergence in the traits of interest is recommended to produce an informative mapping population. In this case the Redgauntlet (Rg) x Hapil (H) mapping population was used in a heterozygous cross that segregated for fruit quality, disease resistance, and postharvest traits (Sargent *et al.,* 2009). This population was phenotyped and QTL were reported for powdery mildew disease severity (Cockerton *et al.,* 2018), *Verticillium dahliae* resistance (Antanaviciute *et al.,* 2015), and root architecture, AMF association and low phosphate tolerance (Cockerton *et al.,* 2020).

The aim of the present study was to use a Single Nucleotide Polymorphism (SNP)-based genetic map for the Rg x Hapil mapping population to map QTL associated with morphological and

physiological traits associated with fruit quality collected at two contrasting environments within the UK.

2. Materials and methods

2.1 Plant material and growth conditions

Two subsets consisting of 63 and 76 lines, with 25 overlapping lines, of an F_1 octoploid strawberry mapping population derived from crossing Redgauntlet and Hapil (Sargent *et al*. (2009) were grown under field conditions at East Malling Research in 2013 (Cockerton *et al.,* 2018) and under glasshouse conditions at University of Reading (UoR), Whiteknights campus in 2014. Details of the respective latitude, longitude, elevation, and temperature are given in Table 1.

The cultivation at EMR, reported previously by Antanaviciute et al. (2015), was conducted as follow; cloning of runners from mother plants was carried in the autumn, then the propagation in 9 cm square pots was carried from July onwards, then planted in the field in a randomized block design in late Autumn (September–October). At the UoR, clonal propagation of the F1 population was carried out in the autumn in 9 cm square pots using runners from mother plants kept in an unheated polytunnel. In the spring, four replicates of the 147 seedlings and parental lines 'Redgauntlet' and 'Hapil' were planted in 0.5 m peat-based grow bags (Bulrush Horticulture Ltd., UK) in each of two complete randomised blocks, where each block contained two replicate plants per genotype, and each block had two beds and three rows per bed, in an experimental glasshouse. The glasshouse was set to heat at if the temperature dropped below 5 °C and to vent if the temperature exceeded 20 °C. The plants were grown in natural light. Plants were watered and provided with a commercial nutrition solution containing calcium nitrate, potassium nitrate, potassium sulphate, magnesium nitrate, mono potassium phosphate, iron-EDTA, manganese sulphate, copper sulphate, zinc sulphate, sodium molybdate, and solubor using a drip irrigation system with three drippers per bag. Crop protection to prevent powdery mildew, botrytis, and aphids was applied as per standard commercial practice.

2.2 SNP-base map construction

DNA was isolated from two leaf discs taken from new, fully expanded strawberry leaves of 140 Rg × H individuals and parental genotypes using the Qiagen DNeasy plant miniprep kit (Qiagen Ltd., Manchester, UK). SNP identification and map construction was carried out according to Cockerton et al. (2018) and SNPs are as identified in Cockerton et al. (2020).

2.3 Post-harvest management for plant phenotyping and chemotyping

Six fully-ripe fruits per genotype were harvested from three blocks grown at EMR, while twelve fruits were harvested from two blocks grown at the UoR. Fruits were delivered immediately to the laboratory in the School of Chemistry, Food and Pharmacy, UoR, Whiteknights campus at ambient temperature on the day of harvest (day 0). Fruits were placed into clear plastic egg boxes to avoid bruising and to allow the analysis of individual fruit, then stored overnight at 4 °C in the dark before subsequent analysis on day 1, day 4 and day 7 of post-harvest storage at 4 °C. Post-harvest quality assessment was conducted on fresh fruits including fresh weight (FW) and colour using non-destructive methods allowing repeat measurements of the same fruit (n=4 from the EMR trial and n=9 from the UoR trial). Then, one experimental rep of each block were used to measure firmness in order to allow repeating the measurements over post-harvest storage. The fruits from

each block for each genotype were subsequently combined, giving one sample per genotype per block, and blended prior to storage at -80 °C for further chemical analysis.

2.4 Measuring total soluble solids and titratable acidity, and HPLC analysis

One experimental rep of each block was prepared by blending the two fruits, which were stored at -80 °C prior to further chemical analysis. On the day of HPLC analysis each experimental replicate was defrosted and brought to ambient temperature prior to measuring two aliquots for TSS (Total Soluble Solids) and TA Titratable Acidity) (two technical reps). One extract was prepared from each experimental rep for HPLC analysis. Polyphenol standards were supplied as follows: Ellagic acid, (+)-Catechin, Kaempferol, Quercetin, Pelargonidin chloride and Cyanidin chloride by Sigma (North Dorset, UK). HPLC-grade methanol and water were purchased from J. T. Baker (Deventer, The Netherlands). Formic acid was obtained from Merck (Darmstadt, Germany). The glassware was cleaned before use by repeatedly washing with chromic and concentrated sulfuric acid hot mixture and purified water and finally dried at 150° C.

2.5 Assessment of postharvest fruit quality

2.5.1 Fresh weight (FW)

Fresh weight of samples was measured on day 1, day 4 and day 7 to evaluate the water loss from the fruits using a digital electrical balance (Analytical Products Ltd, UK). Repeat measurements were taken for each single fruit (n=4 from the EMR trial and n=9 from the UoR trial).

2.5.2 Colour measurement

Three measurements were taken on day 1, day 4 and day 7 using a sph850 spectrophotometer (ColorLite GmbH, Katlenburg-Lindau, Germany) around the circumference of each fruit and a single mean set of values was calculated from three replicate measurements of each fruit. The measurements included three parameters L* (lightness), a* (red tone), b* (yellow tone) which were each separately subjected to subsequent QTL analysis. Repeat measurements were taken for each single fruit (n=4 from the EMR trial and n=9 from the UoR trial).

2.5.3 Firmness

Three measurements of each fruit were taken on day 1, day 4 and day 7 using a handheld Digital Fruit and Vegetable Ripeness/Hardness Tester fitted with 3.5 mm diameter plunger tip (HFH81, Omega Engineering Limited, Manchester, UK) of each fruit and a single mean set of values was calculated. A puncture test was performed on the fruit cheek, approximately between the calyx and blossom end, by holding the fruit against a hard surface before forcing the plunger tip into the fruit at a uniform speed so that the depth of penetration was consistently to the subscribed line on the tip.

2.5.4 Total Soluble Solids (TSS)

TSS is a refractometric index that indicates the proportion (%) of dissolved solids in a solution (Beckles, 2012). The TSS was determined for day 1, day 4 and day 7 samples through a digital, hand held refractometer (Atago, Japan). A drop of strawberry puree was placed on the hand refractometer with results expressed as °Brix.

2.5.5 Titratable Acidity (TA)

TA was quantified for day 1, day 4 and day 7 samples by diluting each 3 ml of strawberry liquid in 50 ml distilled water and then titrating with NaOH (0.1M), using 0.1 % phenolphthalein (ph-th) in ethanol:water 50:50 (v/v) as an indicator. Results were converted to percent citric acid equivalents using the following equation: [(ml NaOH × 0.1N × 0.064 / 3 ml of strawberry puree) × 100].

2.5.6 Extraction of Flavonoids and Acid Hydrolysis for HPLC

Samples for determination of phenolic content by HPLC were extracted as follows: three strawberry fruits of each genotype from each block were blended together with no further addition of liquid. Samples from different blocks were analysed separately. 1 g of strawberry puree was added to 1 ml of 70 % MeOH, prepared by mixing 70 ml of absolute methanol (MeOH) and 30 ml of distilled water. 1 ml from the solution was transferred to screw-cap tubes and then placed in water-bath (80 °C) for 10 minutes. Afterwards, the samples were recovered and then located in speed vacuum (Savant Speed Vac, Thermo Scientific, MA, USA) for 60 minutes to dry them completely. 1.5 ml of 2M hydrochloric acid (HCl) in HPLC grade MeOH, which was made by mixing 16.8 ml of 37 % HCl and 83.2 ml of HPLC grade MeOH, was added to each sample. The samples were then placed in the roller/stirrer for 45 minutes and covered with aluminium foil to prevent the degradation of light-sensitive compounds, including flavonoids. After mixing, these samples were located in a dried heater block (85 °C) for 60 minutes, in order to accelerate the acid hydrolysis process, and then left for 30 minutes to cool. The samples were then transferred into microcentrifuge tubes (1.5 ml) after filtering them through 0.45 µm filters (Sartorius Stedim Biotech GmbH, Goettingen, Germany). Lastly, 100 µl was transferred into amber glass vials and used for high performance liquid chromatography (HPLC).

2.5.7 High Performance Liquid Chromatography (HPLC)

The different components were separated using a Hewlett Packard (Agilent, Bracknell, UK) model 1100 series LC running HP ChemStation software with a Nova Pak C18 column (250 * 4.6; 4 mm) (Waters, Elstree, UK) at 30 °C. 50µl of each sample was injected into the column. The mobile phase consisted of (A) H2O (95 %), methanol (5 %), and containing formic acid (0.1 %) and (B) H2O (50 %), acetonitrile (50 %), and containing formic acid (0.1 %), with a flow rate of 0.7 ml/min. The gradient system was: 95% A (5-5 min), 50% (40 min), 0% (55 min), and 95% (60 min). A UV/vis diode-array detector was used to acquire spectra at different wavelengths: 254, 280, 320, 365, and 520 nm. Flavonoids were identified by matching their retention times and UV diode array spectra with those of standards (Sigma, Gillingham, UK).

2.6 Statistical analysis

Data were Log10-transformed to generate datasets with a normal distribution and then it was statistically analysed using GenStat for windows release 16 (VSN International Ltd., Hemel Hempstead, UK). Mixed linear model (MLM) was applied to the 25 common lines between the two experiments. The model included Environment and genotypes as a fixed effect, and shelf life day as a random effect. MLM was used to test for the significant genotype x environment, genotype x day, and environment x day interactions. Pearson's correlation analyses were conducted using SPSS for windows release 21. Heritability was calculated as the ratio of additive genetic variance (Vg) to total phenotypic variance (Vt), (Vt = Vg + Ve).

2.7 QTL analysis

QTL mapping was performed on the –log10 transformed data using Genetic Analysis of Clonal F_1 and Double cross populations (GACD) software (Zhang *et al.,* 2015). Using the 3933 SNPs, inclusive composite interval mapping (ICIM) was used as an algorithm for mapping the QTLs. Significant QTL with logarithm of odds (LOD) scores ($P \leq 0.05$) was identified based on 1000 permutations. The LOD score was determined separately for each trait and is shown in Table 5. We also calculated a universal LOD score threshold from combining all traits, which was found to be LOD=5.7.

3. Results

3.1 Constructing a SNP-based linkage map of Rg × H population for QTL mapping

A linkage map consisting of 28 linkage groups (LG) representing the whole genome of the Rg × H octoploid strawberry population was constructed using 3,933 SNP markers covering a total length of 2,624.7 centimorgans (cM) with an average distance between SNPs of 0.7 cM (Figure 1; Supplementary Table 1). LG2.1 was the longest at 162.8 cM, whereas, LG5.4 was the shortest at 58.3 cM. In addition, the highest and the least number of SNPs mapped on one linkage group were on LG6.1 and LG5.2 with 272 and 72, respectively. Sixteen gaps (defined as a distance of 10 cM or more without markers) were observed on the consensus map with the longest gap of 31 cM on LG6.3. The second two longest gaps of 24 cM and 20 cM, were observed on LG4.4 and LG7.2 respectively. Two gaps per LG were observed on LG5.2, LG6.2 and LG7.1 and six single gaps per LG were found on LG1.4, LG2.4, LG3.3, LG4.1, LG4.2 and LG7.3 (Table 2).

3.2 Plant Phenotyping

The parent Hapil showed higher values than the parent Rg for all traits measured at EMR except for TSS/TA %, Elagic acid, Pelargonidin, and Cyanidin (Table 3). For the traits measured at The UoR, TSS/TA %, b* value, FW and firmness values were higher for Hapil than Rg. The two parents showed interaction with the locations (Gene x Environment (GxE) effects) for TSS, TA and a* value. In addition, Elagic acid, Pelargonidin and Cyanidin measured at day 1 showed interaction with the location, however, day 7 data differences were independent of the location.

For the 25 common genotypes between the two experiments, population and parental lines means and range values for quality traits is presented in Table 3. Broad sense heritabilities ranged from 0.25, for L* measured at EMR, to 0.96, for Ellagic acid and Pelargonidin measured at The UoR. MLM revealed significant genotype x environment interactions for a* value (red tone), Cyanidin, Ellagic acid, Pelargonidin, and TSS/TA (Table 4). Only Cyanidin showed significant genotype x day interaction. In addition, Cyanidin and pelargonidin showed significant environment x day interactions.

Correlation analysis of all measured traits at EMR (Figure 2A) and at The UoR (Figure 2B; Supplementary Table 2) showed similar correlation trends at both locations. For example, and in contrast to the negative correlation observed between Pelargonidin and the three traits L*, a* and b*, positive correlations were observed within L*, a* and b* and between Ellagic acid, Pelargonidin, and Cyanidin at both trial locations. In addition, correlations between the two sites were observed in most traits. The highest positive correlations were found for Pelargonidin, regardless of shelf life day.

3.3 QTL analysis

A total of 29 significant QTL, all of which exceeded the universal LOD threshold of 5.7 and of which six had relatively high LOD scores (>10), mapped on 16 LGs were associated with 16 traits measured at EMR (2013) and The UoR (2014) (Figure 3, Table 5). The highest number of QTL observed on the same LGs was three QTLs on each of 2.4, 4.2, and 4.4. Per trait, the highest number of significant QTL was four, mapped for L-1-13, which together explained over 34 % of the variation in this trait across the population. Two QTL were observed for FW measured at UoR (2014) on LGs 4.4 and 7.3 and co-located between days 1 and 4, with over 62 % of the variation in fresh weight captured by these two QTL on each day of shelf life (Figure 3, Table 5). A QTL for L (Lightness) at day 1 from the EMR trial (qL-1-13.RH-ch4.2) was adjacent to the QTL for FW on LG 4.4 (qFW-1-14.RH-ch4.1 and qFW-4-14.RH-ch4.1), and a QTL for Ellagic Acid from UoR trial (qEA-1-14.RH-ch7.1) was found to lie within 10 cM of the FW QTL on LG 7.3 (qFW-1-14.RH-ch7.1 and qFW-4-14.RH-ch7.1). QTL for Pelargonidin for both trials (qPel-1-14.RH-ch2.1 and qPel-7-13.RH-ch2.1) were adjacent to each other on LG 2.2. QTL for L (Lightness) at day 1 from UoR (qL-1-14.RH-ch2.1), Pelargonidin at day 7 from EMR (qPel-7-13.RH-ch2.2) and Cyanidin at day 7 from EMR (qCya-7-13.RH-ch2.1) were all adjacent to each other within the top 7.5 cM of LG 2.4. A two-way ANOVA revealed a non-epistatic interaction at P value = 0.05 between the markers reported in table 5. The highest explained variances for single QTL were 53.3 and 44.6 % observed for Firmness-7-14 and b-7-13, respectively.

4. Discussion

4.1 Environmental effects on plant performance

Compared to the research on diploid strawberry which uses F_2 populations (Mahoney *et al.,* 2016; Rousseau-Gueutin *et al.,* 2008) and near isogenic lines population (Urrutia *et al.,* 2015), research on the octoploid strawberry use F_1 populations as a common method to map QTL, where each of the parent lines are derived from two diploid parents (Davik *et al.,* 2015; Gaston *et al.,* 2013; Hancock *et al.,* 2016; Hossain *et al.,* 2019; Rousseau-Gueutin *et al.,* 2008; Vallarino *et al.,* 2019). In the present study, both parents were chosen because they mainly differ in fruit size, taste and flowering time. Rg has bland small fruits and slightly late flowering (June-bearer type), whereas Hapil has large sweet fruits and classified as a mid-season type (also a June-bearer). However, our results showed striking difference between the parental lines for polyphenol content especially with regard to anthocyanins, i.e. pelargonidin and cyanidin. Those differences were affected by the environmental conditions where the two parents and the 25 overlapping lines cultivated in EMR had significantly higher phenolic compounds compared to those cultivated at The UoR. This observation could be explained by the fact that the EMR experiment was an open field trial and that phenolic acids act as antioxidants and herbivory defense molecules in plants exposed to any kind of biotic and abiotic stress factors (Mithöfer and Boland, 2012; Skłodowska *et al.,* 2011; Treutter, 2006).

In contrast, both parents showed higher TSS, TA and TSS/TA at the UoR in comparison to EMR, while the 25 overlapping lines showed divergent trends between the two sites. For example, and in contrast to TA, the majority of the overlapping lines grown at EMR had significantly greater TSS and TSS/TA content compared to those grown at the UoR. Previous studies reported significant site effects when studying sugar and acid content in strawberry (Crespo *et al.,* 2010), TSS and TA content in strawberry (Krüger *et al.,* 2012) and blackcurrant (Zheng *et al.,* 2009), and

the observed effects were also cultivar dependent. It was reported that low light exposure might lead to low TSS content by the reduction of photosynthetic rates which results in less sugar available (Watson *et al.,* 2002). As discussed above, this may explain the higher TSS content in strawberries grown in the open field at EMR compared to those grown in the greenhouse at the UoR as a result of the shading, as well as, the reduced light radiation occurring as a result of the experiment taking place later in the year. Such differences could be attributed to the MLM results which revealed significant genotype x environment interactions (for a* value (red tone), Cyanidin, Ellagic acid, Pelargonidin, and TSS/TA) and significant environment x day interactions (for Cyanidin and pelargonidin). The study by Watson et al. (2002) also reported a considerable reduction in TSS/TA ratio in shaded conditions; in both cases the data indicate that lower light drives metabolism towards acid production and away from sugars.

Overall, the range of values for the majority of the traits measured at both locations was greater than the values for the parents. This suggests the formation of transgressive phenotypes due to combination of alleles from both parents. These complementary gene effects are common in plants (Rieseberg *et al.,* 1999) and provide useful trait variation for use in breeding programmes.

4.2 Constructing a SNP-based linkage map of Rg × H population

Since the first application of the genotyping arrays to the rosaceous species, a number of saturated linkage maps have been developed in strawberry biparental populations such as *Emily* × *Fenella* (Cockerton *et al.,* 2018), *Fragaria* × *ananassa* (Hossain *et al.,* 2019), and Emily x Fenella and Flamenco x Chandler (Cockerton *et al.,* 2019). The Redgauntlet (Rg) × Hapil population was used to generate a dense linkage map. A linkage map of the Redgauntlet (Rg) × Hapil population was created using 3933 SNPs with an average marker density of one marker per 0.7 cM which is similar to the earlier map that was built for the same population using 35154 SNPs (Cockerton *et al.,* 2018).

The length of this map is 2524.7 cM which is comparable to the length of the recent SNP based map presented in the allo-octoploid strawberry *Fragaria* × *ananassa* (Hossain *et al.,* 2019) map comprised of 1268 SNPs spanning a genetic distance of 2581.57 cM. Our map is also comparable to the length of the previous SSR maps, i.e. 210 markers spanning 2,373 cM reported by Spigler *et al.,* 2008, and the 549 markers spanning 2,140 cM (Sargent *et al.,* 2012). It therefore provides good coverage of the genome, which is now estimated to be 805 Mb based on the 'Camrosa' cultivar (Edgar et al., 2019). However, the SSR-based maps already developed for the Rg × Hapil population had poor coverage of some areas of the genome, with fewer than five markers on some linkage groups, a case which was improved in the present SNP-based map. The availability of the high-throughput platform is a valuable tool for genotyping other populations and accessions and to compare the results obtained by QTL and association mapping approaches and will contribute towards the assembly of an octoploid strawberry genome sequence.

4.3 QTL Analysis

Although software such as Genstat (VSN International, Hemel Hempstead, UK), and MapQTL (www.kyazma.nl) (Van Ooijen, 2009) were designed to handle clonal F_1 populations, they suffer from computational limitation in handling large numbers of markers. The GACD software (Zhang *et al.,* 2015) used here for QTL mapping is a well-integrated software for genetic

analysis in clonal F_1 populations that can handle large number of markers and allowed us to use all 3933 SNPs. This software was recently used in Cassava (Masumba *et al.,* 2017; Nzuki *et al.,* 2017), Goji (Gong *et al.,* 2019), Eucalyptus (Subashini *et al.,* 2018), and Taro (Bellinger *et al.,* 2020).

We used two subsets consisting of 63 and 76 lines, respectively grown in EMR and UoR, that are comparable in population size with the earlier studies used 44 lines (Hossain *et al.,* 2019) and 95 lines (Vallarino *et al.,* 2019) for QTL mapping. It would have been desirable to have more lines in all of these studies, the present one included, and this is a limit of the experimental design particularly since the parental lines segregated so widely for our traits of interest. Both Hossain and Vallarino (2019) found that there was extremely limited consistency of QTL locations in different iterations of the population growth, presenting a problem for breeders in identifying suitable targets that can be used to enhance desirable traits. In these situations, particularly where the cross is very wide, it would be useful to have a larger population as this would be likely to generate more robust QTL and identify small areas of genome stability between environments.

Our results were consistent with others that have used small populations and traditional QTL mapping methods, in that there was a relatively low number of ~~the~~ co-located SNPs observed in the present study between the two locations/years. As in other studies, this is most likely to be the result of genotype x environment interaction, which was significant here, probably due to the pre-harvest conditions which included different cultivation sites and years. Verma et al. (2017) found that out of the 11 QTL mapped for flowering habit and fruit quality in U.S. strawberry (*Fragaria x ananassa*) breeding populations, over two locations and growing seasons, only 2 QTL were common and the other 9 QTL were specific to the locations or the growing seasons. A similar observation was also reported in the recent study (Vallarino et al., 2019) focusing on analyzing primary metabolite content in strawberry fruit over two growing seasons. An earlier study of agronomical and major fruit quality traits in strawberry identified 13 stable QTL over three harvest years, out of a total of 33 QTL (Zorrilla-Fontanesi *et al*., 2011). The same observation was also reported in other fruits. For example, in pear, out of the 32 QTL mapped for pear fruit quality related traits (Wu et al., 2014), only 12 QTL were stable over two successive years. Another study in apple mapped 26 stable QTL, out of the total 74 QTL over two years for fruit physiological traits (Kenis et al., 2008). More modern population structures, such as Multi-parent Advanced Generation Intercrosses (MAGIC) populations, have even more utility and enable multiple genotypes to be compared to obtain more robust markers for fruit quality (Wada et al., 2017) and these are the recommended way forward for breeding programmes.

Comparing the 7 homology groups (HG) of the octoploid strawberry genome showed that HG2, HG4, HG5, HG6 and HG7 had the largest number of significant SNPs which is similar to previous studies (Lerceteau-Kohler *et al.,* 2012; Verma *et al.,* 2017; Zorrilla-Fontanesi *et al.,* 2011)) that mapped the largest number of QTL associated with fruit quality traits to HG6, based on an SSR map. The FW QTL we detected on LG 7.3 and 4.4 was not observed in earlier studies, e.g. the QTL observed on LG 2BII and HG 2 in strawberry Fragaria × ananassa (Lerceteau-Kohler *et al.,* 2012; Verma *et al.,* 2017). However, mapping the same QTL over two shelf life days increase our

certainty of both QTL. A recent study also reported many QTL mapped to HG2 and HG5 (Vallarino *et al.,* 2019).

The results of this study showed major QTL for FW across shelf life points that are relevant for strawberry breeding which account for over 62 % of the variation and is stable across shelf life points. The SNP markers associated with those traits facilitates the first step towards identifying the underlying genes and to improving strawberry breeding programs. However, further testing would be necessary to confirm the significance and stability of the identified QTL in other octoploid mapping strawberry populations in different environments and over several years before they are considered in breeding programs (Kenis *et al.,* 2008).

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References

Antanaviciute, L., Fernández-Fernández, F., Jansen, J., Banchi, E., Evans, K.M., Viola, R., Velasco, R., Dunwell, J.M., Troggio, M., Sargent, D.J., 2012. Development of a dense SNP-based linkage map of an apple rootstock progeny using the *Malus* Infinium whole genome genotyping array. *BMC Genomics* 13, 203.

Antanaviciute, L., Šurbanovski, N., Harrison, N., McLeary, K.J., Simpson, D.W., Wilson, F., Sargent, D.J., Harrison, R.J., 2015. Mapping QTL associated with *Verticillium dahliae* resistance in the cultivated strawberry (*Fragaria* × *ananassa*). *Horticulture Research* 2, 15009.

Ayala-Zavala, J.F., Wang, S.Y., Wang, C.Y., González-Aguilar, G., 2004. Effect of storage temperatures on antioxidant capacity and aroma compounds in strawberry fruit. *Food Science and Technology* 37, 687–695.

Bellinger, M.R., Paudel, R., Starnes, S., Kambic, L., Kantar, M., Wolfgruber, T., Lamour, K., Geib, S., Sim, S., Miyasaka, S., Helmkampf, M., Shintaku, M., 2020. Taro Genome Assembly and Linkage Map Reveal QTLs for Resistance to Taro Leaf Blight. *G3 (Bethesda, Md.)*.

Bassil, N. V, Davis, T.M., Zhang, H., Ficklin, S., Mittmann, M., Webster, T., Mahoney, L., Wood, D., Alperin, E.S., Rosyara, U.R., Putten, H.K., Monfort, A., Sargent, D.J., Amaya, I., Denoyes, B., Bianco, L., Dijk, T. Van, Pirani, A., Iezzoni, A., Main, D., Peace, C., Yang, Y., Whitaker, V., Verma, S., Bellon, L., 2015. Development and preliminary evaluation of a 90 K Axiom® SNP array for the allo-octoploid cultivated strawberry *Fragaria* × ananassa. *BMC Genomics* 1–30.

Cabrera, A., Kozik, A., Howad, W., Arus, P., Iezzoni, A.F., Knaap, E., 2009. Development and bin mapping of a Rosaceae Conserved Ortholog Set (COS) of markers. *BMC Genomics* 10, 562.

Cockerton, H.M., Li, B., Vickerstaff, R.J., Eyre, C.A., Sargent, D.J., Armitage, A.D., Marina-Montes, C., Garcia-Cruz, A., Passey, A.J., Simpson, D.W., Harrison, R.J., 2019. Identifying *Verticillium dahliae* resistance in strawberry through disease screening of multiple populations and image based phenotyping. *Frontiers in Plant Science* 10, 924.

Cockerton, H.M., Li, B., Stavridou, E., Johnson, A., Karlström, A., Armitage, A.D., Martinez-Crucis, A., Galiano-Arjona, L., Harrison, N., Barber-Pérez, N., Cobo-Medina, M., Harrison, R.J., 2020. Genetic and phenotypic associations between root architecture, arbuscular mycorrhizal fungi colonisation and low phosphate tolerance in strawberry (*Fragaria* × *ananassa*). *BMC Plant Biology* 20, 154.

Cockerton, H.M., Vickerstaff, R.J., Karlström, A., Wilson, F., Sobczyk, M., He, J.Q., Sargent, D.J., Passey, A.J., McLeary, K.J., Pakozdi, K., Harrison, N., Lumbreras-Martinez, M., Antanaviciute, L., Simpson, D.W., Harrison, R.J., 2018. Identification of powdery mildew resistance QTL in strawberry (*Fragaria* × *ananassa*). *Theoretical and Applied Genetics* 131, 1995–2007.

Crespo, P., Bordonaba, J., Terry, L., Carlen, C., 2010. Characterisation of major taste and health-related compounds of four strawberry genotypes grown at different Swiss production sites. *Food Chemistry* 122, 16–24.

Davik, J., Sargent, D.J., Brurberg, M.B., Lien, S., Kent, M., Alsheikh, M., 2015. A ddRAD Based Linkage Map of the Cultivated Strawberry, *Fragaria* × *ananassa*. *PLOS ONE* 10, e0137746.

Dirlewanger, E., Cosson, P., Tavaud, M., Aranzana, M., Poizat, C., Zanetto, A., Arús, P.,

Laigret, F., 2002. Development of microsatellite markers in peach [*Prunus persica* (L.) Batsch] and their use in genetic diversity analysis in peach and sweet cherry (*Prunus avium* L.). *Theoretical and Applied Genetics* 105, 127–138.

Edger, P.P., Poorten, T.J., VanBuren, R., Hardigan, M.A., Colle, M., McKain, M.R., Smith, R.D., Teresi, S.J., Nelson, A.D.L., Wai, C.M., Alger E.I., Bird, K.A., Yocca, A.E., Pumplin, N., Ou, S., Ben-Zvi, G., Brodt, A., Baruch, K., Swale, T., Shiue, L., Acharya, C.B., Cole, G.S., Mower, J.P., Childs, K.L., Jiang, N., Lyons, E., Freeling, M., Puzey, J.R., Knapp, S.J., 2019. Origin and evolution of the octoploid strawberry genome. *Nature Genetics*, 51, 541–547.

El Hadi, M.A.M., Zhang, F.-J., Wu, F.-F., Zhou, C.-H., Tao, J., 2013. Advances in fruit aroma volatile research. *Molecules* 18, 8200–8229.

Forney, C., Kalt, W., Jordan, M., 2000. The composition of strawberry aroma is influenced by cultivar, maturity, and storage. *HortScience* 35, 1022–1026.

Gaston, A., Perrotte, J., Lerceteau-Köhler, E., Rousseau-Gueutin, M., Petit, A.P., Hernould, M., Rothan, C., Denoyes, B., 2013. PFRU, a single dominant locus regulates the balance between sexual and asexual plant reproduction in cultivated strawberry. *Journal of Experimental Botany* 64, 1837–1848.

Gong, H., Rehman, F., Yang, T., Li, Z., Zeng, S., Pan, L., Li, Y., Wang, Y., 2019. Construction of the first high-density genetic map and QTL mapping for photosynthetic traits in *Lycium barbarum* L. *Molecular Breeding* 39, 106.

Grattapaglia, D., Sederoff, R., 1994. Genetic linkage maps of Eucalyptus grandis and Eucalyptus urophylla using a pseudo-testcross: Mapping strategy and RAPD markers. *Genetics* 137, 1121–1137.

Hakala, M. a, Lapveteläinen, A.T., Kallio, H.P., 2002. Volatile compounds of selected strawberry varieties analyzed by purge-and-trap headspace GC-MS. *Journal of Agricultural and Food Chemistry* 50, 1133–1142.

Hardigan, M.A., Feldmann, M.J., Lorant, A., Bird, K.A., Famula, R., Acharya, C., Cole, G., Edger, P.P., Knapp, S.J., 2020. Genome synteny has been conserved among the octoploid progenitors of cultivated strawberry over millions of years of evolution. *Frontiers in Plant Science* 10.

Halbwirth, H., Puhl, I., Haas, U., Jezik, K., Treutter, D., Stich, K., 2006. Two-phase flavonoid formation in developing strawberry (*Fragaria × ananassa*) fruit. *Journal of Agricultural and Food Chemistry* 54, 1479–1485.

Hancock, J.F., 1999. Strawberries. CAB International, Wallingford.

Hancock, J.F., Sooriyapathirana, S.S., Bassil, N. V., Stegmeir, T., Cai, L., Finn, C.E., Van de Weg, E., Weebadde, C.K., 2016. Public availability of a genotyped segregating population may foster marker assisted breeding (MAB) and quantitative trait loci (QTL) discovery: An example using strawberry. *Frontiers in Plant Science* 7, 619.

Hossain, M.R., Natarajan, S., Kim, H.-T., Jesse, D.M.I., Lee, C.-G., Park, J.-I., Nou, I.-S., 2019. High density linkage map construction and QTL mapping for runner production in allo-octoploid strawberry *Fragaria × ananassa* based on ddRAD-seq derived SNPs. *Scientific Reports* 9, 3275.

Jung, S., Cestaro, A., Troggio, M., Main, D., Zheng, P., Cho, I., Folta, K.M., Sosinski, B., Abbott, A., Celton, J.-M., Arús, P., Shulaev, V., Verde, I., Morgante, M., Rokhsar, D., Velasco, R., Sargent, D.J., 2012. Whole genome comparisons of *Fragaria, Prunus* and *Malus* reveal different modes of evolution between Rosaceous subfamilies. *BMC Genomics*

13, 129.
Kenis, K., Keulemans, J., Davey, M.W., 2008. Identification and stability of QTLs for fruit quality traits in apple. *Tree Genetics & Genomes* 4, 647–661.
Knee, M., 2002. Fruit quality and its biological basis. Sheffield Academic Press Ltd, Sheffield.
Krüger, E., Josuttis, M., Nestby, R., Toldam-Andersen, T.B., Carlen, C., Mezzetti, B., 2012. Influence of growing conditions at different latitudes of Europe on strawberry growth performance, yield and quality. *Journal of Berry Research* 2, 143–157.
Lerceteau-Kohler, E., Moing, A., Gue, G., Renaud, C., Petit, A., Rothan, C., 2012. Genetic dissection of fruit quality traits in the octoploid cultivated strawberry highlights the role of homoeo-QTL in their control. *Theoretical and Applied Genetics* 1059–1077.
Mahoney, L.L., Sargent, D.J., Abebe-Akele, F., Wood, D.J., Ward, J.A., Bassil, N. V., Hancock, J.F., Folta, K.M., Davis, T.M., 2016. A high-density linkage map of the ancestral diploid strawberry, constructed with single nucleotide polymorphism markers from the Istraw90 array and genotyping by sequencing. *The Plant Genome* 9, 0.
Masumba, E.A., Kapinga, F., Mkamilo, G., Salum, K., Kulembeka, H., Rounsley, S., Bredeson, J. V, Lyons, J.B., Rokhsar, D.S., Kanju, E., Katari, M.S., Myburg, A.A., van der Merwe, N.A., Ferguson, M.E., 2017. QTL associated with resistance to cassava brown streak and cassava mosaic diseases in a bi-parental cross of two Tanzanian farmer varieties, Namikonga and Albert. *Theoretical and Applied Genetics* 130, 2069–2090.
Mithöfer, A., Boland, W., 2012. Plant defense against herbivores: chemical aspects. *Annual Review of Plant Biology* 63, 431–450.
Nzuki, I., Katari, M.S., Bredeson, J. V, Masumba, E., Kapinga, F., Salum, K., Mkamilo, G.S., Shah, T., Lyons, J.B., Rokhsar, D.S., Rounsley, S., Myburg, A.A., Ferguson, M.E., 2017. QTL mapping for pest and disease resistance in cassava and coincidence of some QTL with introgression regions derived from *Manihot glaziovii*. *Frontiers in Plant Science* 8, 1168.
Rousseau-Gueutin, M., Lerceteau-Köhler, E., Barrot, L., Sargent, D.J., Monfort, A., Simpson, D., Arús, P., Guérin, G., Denoyes-Rothan, B., 2008. Comparative genetic mapping between octoploid and diploid *Fragaria* species reveals a high level of colinearity between their genomes and the essentially disomic behavior of the cultivated octoploid strawberry. *Genetics* 179, 2045–2060.
Sargent, D., Fernandéz-Fernandéz, F., Ruiz-Roja, J., Sutherland, B., Passey, A., Whitehouse, A., Simpson, D., 2009. A genetic linkage map of the cultivated strawberry (*Fragaria x ananassa*) progeny segregating for resistance to *Verticillium dahliae*, and its comparison to the diploid *Fragaria* reference map. *Molecular Breeding* 24, 293–303.
Sargent, D.J., Passey, T., Surbanovski, N., Lopez Girona, E., Kuchta, P., Davik, J., Harrison, R., Passey, A., Whitehouse, A.B., Simpson, D.W., 2012. A microsatellite linkage map for the cultivated strawberry (*Fragaria* × *ananassa*) suggests extensive regions of homozygosity in the genome that may have resulted from breeding and selection. *Theoretical and Applied Genetics* 124, 1229–1240.
Shulaev, V., Korban, S.S., Sosinski, B., Abbott, A.G., Aldwinckle, H.S., Folta, K.M., Iezzoni, A., Main, D., Arus, P., Dandekar, A.M., Lewers, K., Brown, S.K., Davis, T.M., Gardiner, S.E., Potter, D., Veilleux, R.E., 2008. Multiple models for Rosaceae genomics. *Plant Physiology* 147, 985–1003.
Skłodowska, M., Gajewska, E., Kuźniak, E., Wielanek, M., Mikiciński, A., Sobiczewski, P., 2011. Antioxidant profile and polyphenol oxidase activities in apple leaves after *Erwinia amylovora* infection and pretreatment with a Benzothiadiazole-type resistance inducer

(BTH). *Journal of Phytopathology* 159, 495–504.
Soria, C., López-Aranda, J., Medina, J.J., Miranda, L., Domínguez, F.J., 2008. Evaluation of strawberry production and fruit firmness under small and large plastic tunnels in annual crop system. *6th International Strawberry Symposium* 842, 119–124.
Spencer, J.P.E., 2009. The impact of flavonoids on memory: physiological and molecular considerations. *Chemical Society Reviews* 38, 1152–1161.
Spigler, R.B., Lewers, K.S., Main, D.S., Ashman, T.-L., 2008. Genetic mapping of sex determination in a wild strawberry, Fragaria virginiana, reveals earliest form of sex chromosome. *Heredity* 101, 507–517.
Subashini, V., Bachpai, V.K.W., Mayavel, A., Nagarajan, B., Sivakumar, V., Yasodha, R., 2018. Quantitative Trait Loci (QTL) for salinity tolerance traits in interspecific hybrids of *Eucalyptus*. *Indian Journal of Plant Physiology* 23, 822–832.
Treutter, D., 2006. Significance of flavonoids in plant resistance: a review. *Environmental Chemistry Letters* 4, 147–157.
Urrutia, M., Bonet, J., Arús, P., Monfort, A., 2015. A near-isogenic line (NIL) collection in diploid strawberry and its use in the genetic analysis of morphologic, phenotypic and nutritional characters. *Theoretical and Applied Genetics* 128, 1261–1275.
Vallarino, J.G., Pott, D.M., Cruz-Rus, E., Miranda, L., Medina-Minguez, J.J., Valpuesta, V., Fernie, A.R., Sánchez-Sevilla, J.F., Osorio, S., Amaya, I., 2019. Identification of quantitative trait loci and candidate genes for primary metabolite content in strawberry fruit. *Horticulture Research* 6, 4.
Van Ooijen, J.W., 2009. MapQTL® 6. Software for the mapping of quantitative trait loci in experimental populations. *Kyazma BV*. Wageningen.
Vauzour, D., Vafeiadou, K., Rodriguez-Mateos, A., Rendeiro, C., Spencer, J.P.E., 2008. The neuroprotective potential of flavonoids: a multiplicity of effects. *Genes & Nutrition* 3, 115–26.
Verma, S., Zurn, J.D., Salinas, N., Mathey, M.M., Denoyes, B., Hancock, J.F., Finn, C.E., Bassil, N. V, Whitaker, V.M., 2017. Clarifying sub-genomic positions of QTLs for flowering habit and fruit quality in U.S. strawberry (*Fragaria* × *ananassa*) breeding populations using pedigree-based QTL analysis. *Horticulture Research* 4, 17062.
Vickerstaff, R.J., Harrison, R.J., 2017. Crosslink: A fast, scriptable genetic mapper for outcrossing species. *BioRxiv* 135277.
Wada, T., Oku, K., Nagano, S., Isobe, S., Suzuki, H., Mori, M., Takata, K., Hirata, C., Shimomura, K., Tsubone, M., Katayama, T., Hirashima, K., Uchimura, Y., Ikegami, H., Sueyoshi, T., Obu, K.I., Hayashida, T., Shibato, Y., 2017. Development and characterization of a strawberry MAGIC population derived from crosses with six strawberry cultivars. *Breeding Science* 67, 370–381.
Wang, S., Lewers, K., 2007. Antioxidant capacity and flavonoid content in wild strawberries. *Journal of the American Society for Horticultural Science* 132, 629–637.
Watson, R., Wright, C.J., McBurney, T., Taylor, A.J., Linforth, R.S.T., 2002. Influence of harvest date and light integral on the development of strawberry flavour compounds. *Journal of Experimental Botany* 53, 2121–2129.
Wu, C., Du, L., Zou, L., Lillehoj, P.B., Huang, L., Wang, P., 2014. Recent advances in taste cell- and receptor-based biosensors. *Sensors and Actuators B: Chemical*.
Zhang, L., Meng, L., Wu, W., Wang, J., 2015. GACD: Integrated software for genetic analysis in

clonal F 1 and double cross populations. *Journal of Heredity* 106, 741–744.
Zheng, J., Yang, B., Tuomasjukka, S., Ou, S., Kallio, H., 2009. Effects of latitude and weather conditions on contents of sugars, fruit acids, and ascorbic acid in black currant (*Ribes nigrum* L.) juice. *Journal of Agricultural and Food Chemistry* 57, 2977–2987.
Zorrilla-Fontanesi, Y., Rambla, J.-L., Cabeza, A., Medina, J.J., Sánchez-Sevilla, J.F., Valpuesta, V., Botella, M.A, Granell, A., Amaya, I., 2012. Genetic analysis of strawberry fruit aroma and identification of O-methyltransferase FaOMT as the locus controlling natural variation in mesifurane content. *Plant Physiology* 159, 851–870.
Zorrilla-Fontanesi, Y., Cabeza, A., Domínguez, P., Medina, J.J., Valpuesta, V., Denoyes-Rothan, B., Sánchez-Sevilla, J.F., Amaya, I., 2011. Quantitative trait loci and underlying candidate genes controlling agronomical and fruit quality traits in octoploid strawberry (*Fragaria* × *ananassa*). *Theoretical and Applied Genetics* 123, 755–778.

Table 1. Geographical and climatic conditions at two different sites during the strawberry seasons, April - June 2013 for EMR, April - June 2014 for Reading.

	EMR (2013)	Reading (2014)
Latitude	51° 17' 13"N	51° 26' 26"N
Longitude	0° 27' 0"N	0° 56' 11"N
Elevation (meter)	33.0	66.0
Average temperature (°C)	11.1	13.0
Standard deviation of temperature (°C)	±3.9	±3.0
Maximum temperature (°C)	25.2	24.4
Minimum temperature (°C)	−4.5	−0.4

Table 2: The consensus map illustrating number of SNPs per linkage group, length of each LG in cM. and SNP density/cM. cM refers to centiMorgans.

	Consensus map		
Linkage group	No. of SNPs	Length in (cM)	SNP density/ cM
1.1	204	86.8	0.4
1.2	148	80.9	0.5
1.3	94	80.5	0.9
1.4	82	65.2	0.8
2.1	230	162.8	0.7
2.2	137	88.2	0.6
2.3	145	85.9	0.6
2.4	89	81.1	0.9
3.1	235	116.9	0.5
3.2	99	71.3	0.7
3.3	152	104.9	0.7
3.4	149	83.5	0.6
4.1	99	72.7	0.7
4.2	169	95.3	0.6
4.3	100	71.6	0.7
4.4	105	89.6	0.9
5.1	216	113.3	0.5
5.2	72	93.5	1.3
5.3	137	85.9	0.6
5.4	107	58.3	0.5
6.1	272	145.0	0.5
6.2	103	107.9	1.0
6.3	141	118.6	0.8
6.4	157	120.8	0.8
7.1	162	112.3	0.7
7.2	107	86.6	0.8
7.3	107	76.7	0.7
7.4	115	68.6	0.6
Sum	3933	2624.7	

Table 3. Population and parental lines means and range values for quality traits of the overlapping individuals between the two sites. NS = not significant ($p \geq 0.05$). TSS = total soluble solids, TA= titratable acidity, L* = brightness-darkness spectrum, a* = green-red spectrum, b* = yellow-blue spectrum. Ellagic acid, pelargonidin and cyanidin content, TSS, TA, and FW.

		EMR							UoR						
Traits	Day	Parents		F_1 population				h2	Parents		F_1 population				h2
		Rg	H	Min	Max	SD	Mean		Rg	H	Min	Max	SD	Mean	
TSS (ºBRIX)	1	7.9	8.5	7	12	1.06	9.58	0.64	9.3	9.1	5	11	1.7	8.1	0.94
	4			-					9.3	8.8	5.65	11		8.48	0.93
	7	6.6	8.1	6.6	13	1.2	9.68	0.68	9.8	7.2	4.85	13	1.52	9.08	0.93
TA (%)	1	0.8	0.9	0.5	0.9	0.1	0.7	0.73	1.1	0.9	0.49	1.2	0.14	0.83	0.83
	4			-					1.1	0.9	0.53	1.2	0.14	0.87	0.94
	7	0.7	1	0.5	1.1	0.12	0.77	0.74	1.1	1	0.51	1.4	0.17	0.94	0.87
TSS / TA (%)	1	9.8	9.5	9.5	25	2.7	17.1	0.66	9	9.8	5.27	17	2.7	11.3	0.89
	4			-					8.6	9.5	5.42	19	2.15	12	0.95
	7	9.1	7.9	7.9	23	2.9	15.4	0.66	8.9	7.6	6.85	14	1.75	10.4	0.86
L*	1	29	38	28	46	3.5	36.7	0.56	38	35	29.5	42	3.8	35.8	0.59
	4			-					36	32	30	42	2.5	35.7	0.55
	7	35	36	29	43	3.3	35.9	0.25	35	36	28.4	41	2.7	34.6	0.61
a*	1	18	22	15	33	3.6	24	0.65	28	25	17.5	33	3.5	25.1	0.6
	4			-					28	25	18.4	31	3.1	24.9	0.57
	7	21	24	15	31	3.3	23.2	0.24	25	23	14.2	29	3.2	21.4	0.57
b*	1	14	19	9.3	26	3.4	17.6	0.59	18	19	10.4	24	3.03	17.2	0.56
	4			-					17	18	9.33	21	2.5	15.2	0.41
	7	12	19	7.6	24	3.03	16	0.4	13	16	8.52	20	2.6	14.1	0.51
Ellagic acid (mmol/g FW)	1	4.3	1.7	1.1	13	2.2	6.97	0.76	2.3	3	1.4	6.6	1.2	3.99	0.79
	4			-					5.5	5.2	0.85	8.3	1.4	4.55	0.96
	7	3.3	1.3	0.8	11	2.06	5.83	0.76	6.1	3.7	0.92	7.4	1.5	4.18	0.9

Pelargonidin (mmol/g FW)	1	7.6	6.5	0.7	13	1.9	6.6	0.8	3	4.7	0.23	7.8	1.5	3.99	0.95
	4			-					4.5	3.7	0.53	6.2	1.2	3.37	0.96
	7	9.7	3.3	0.5	11	1.9	5.58	0.8	5.4	4.5	0.64	6.4	1.2	3.52	0.85
Cyanidin (mmol/g FW)	1	0.8	0.6	0.3	1.2	0.2	0.71	0.73	0.4	0.5	0.24	1.7	0.2	0.96	0.53
	4			-					0.6	0.4	0.17	1.1	0.18	0.64	0.66
	7	0.9	0.4	0.3	1.6	0.2	0.97	0.69	0.9	0.6	0.2	1.3	0.21	0.74	0.61
FW (g)	1								13	15	5.67	18	3.7	11.9	0.41
	4								12	13	5.17	17	2.6	11.3	0.42
	7								12	14	4.97	16	2.5	10.3	0.41
Firmness (N)	1								8.9	11	7.28	13	1.1	9.87	0.39
	4								6.2	9.6	3.53	12	1.5	7.91	0.49
	7								6.5	8.1	0.93	12	2.4	6.5	0.49

Table 4: Mixed linear model for the 25 common lines between the two experiments. Values represent the significance level at α = 0.05.

Mixed Linear Model						
Trait	Genotype	Environment	Day	GenotypexEnvironment	GenotypexDay	EnvironmentxDay
a*	0.000	0.042	0.025	0.000	0.147	0.682
b*	0.000	0.892	0.440	0.057	0.901	0.159
Cyanidin	0.035	0.301	0.764	0.001	0.004	0.006
Ellagic acid	0.000	0.132	0.910	0.000	0.175	0.152
L*	0.000	0.490	0.625	0.072	0.748	0.525
Pelargonidin	0.000	0.227	0.582	0.001	0.165	0.016
TA	0.000	0.125	0.995	0.166	0.976	0.454
TSS	0.000	0.157	0.824	0.267	0.888	0.121
TSS/TA	0.000	0.016	0.912	0.012	0.441	0.868

Table 5. QTL detected for all traits measured at EMR (2013) and The University of Reading (2014) using the Rg x Hapil population. TSS = total soluble solids, TA= titratable acidity, L* = brightness-darkness spectrum, a* = green-red spectrum, b* = yellow-blue spectrum. Positive values indicate an effect from the Rg parent and negative values indicate an effect from the Hapil parent. A LOD threshold of P<0.05 based on 1000 permutation test was used for all traits and groups to identify significant QTL and the threshold is shown here. [a] LOD above the threshold, R^2 is percentage of total phenotypic variation explained by the QTL (positive values refer to effect from Rg and minus values refer to the effect from H). Codes used for all quality traits refer to "trait-day-year".

Trait Name	QTL Name	Chr	Pos	Left_CI	Right_CI	Left Marker	Right Marker	LOD threshold*	LOD[a]	R^2
a-4-14	qa-4-14.RH-ch4.1	4.2	40	37.5	42.5	AX89786137nmh	AX89824346ph3	3.45	5.8	-11.0
a-4-14	qa-4-14.RH-ch4.2	4.2	94	92.5	94.5	AX89807269ph3	AX89804013nmh		7.6	-14.5
a-7-13	qa-7-13.RH-ch3.1	3.1	51	49.5	51.5	AX89873530nmh	AX89803121nmh	4.4	18.9	-12.7
a-7-13	qa-7-13.RH-ch6.1	6.2	34	32.5	34.5	AX89830478ph3	AX89887622ph3		6.4	-2.7
a-7-13	qa-7-13.RH-ch3.2	6.3	11	10.5	11.5	AX89905813ph3	AX89805071nmh		10.2	-6.7
a-7-14	qa-7-14.RH-ch2.1	2.2	16	15.5	16.5	AX89882026ph3	AX89884448ph3	5.36	12.5	32.1
a-7-14	qa-7-14.RH-ch2.2	2.2	39	37.5	39.5	AX89884963ph3	AX89827817nmh		6.3	12.0
a-7-14	qa-7-14.RH-ch3.1	3.4	96	94.5	96.5	AX89808563ph3	AX89899480nmh		12.9	-28.4
b-7-13	qb-7-13.RH-ch7.1	7.2	47	46.5	48.5	AX89887678ph3	AX89887268nmh	3.36	6.4	44.6
Cyanidin-7-13	qCya-7-13.RH-ch5.1	5.1	55	48.5	55.5	AX89783689ph3	AX89880541ph2		7.7	-20.0
Cyanidin-7-13	qCya-7-13.RH-ch2.1	2.4	7	6.5	7.5	AX89873438ph3	AX89779355ph3		7.8	-26.5
Ellagic-acid-1-14	qEA-1-14.RH-ch7.1	7.3	17	16.5	17.5	AX89906484ph3	AX89874457nmh	5.72	7.2	-22.4
Firmness-7-14	qFir-7-14.RH-ch5.1	5.3	82	80.5	82.5	AX89828937nmh	AX89885994ph3	5.19	10.0	53.3
FW-1-14	qFW-1-14.RH-ch7.1	7.3	26	24.5	26.5	AX89778715ph3	AX89850117ph3	5.20	7.3	26.8
FW-1-14	qFW-1-14.RH-ch4.1	4.4	13	12.5	13.5	AX89801472ph3	AX89801474nmh		8.8	35.6
FW-4-14	qFW-4-14.RH-ch7.1	7.3	26	24.5	26.5	AX89778715ph3	AX89850117ph3	3.60	7.4	26.9
FW-4-14	qFW-4-14.RH-ch4.1	4.4	13	12.5	13.5	AX89801472ph3	AX89801474nmh		8.8	35.6
L-1-13	qL-1-13.RH-ch3.1	3.2	2	1.5	2.5	AX89884094ph3	AX89786698ph3	3.39	9.1	10.8

L-1-13	qL-1-13.RH-ch4.1	4.2	22	21.5	22.5	AX89892578ph3	AX89883232nmh		5.8	7.9
L-1-13	qL-1-13.RH-ch4.2	4.4	5	4.5	5.5	AX89902513nmh	AX89801904nmh		7.3	7.2
L-1-13	qL-1-13.RH-ch5.1	5.4	49	44.5	53.5	AX89904050ph3	AX89802126nmh		10.7	-13.5
L-1-14	qL-1-14.RH-ch2.1	2.4	0	0	0.5	AX89881623nmh	AX89872273nmh	3.85	5.9	-26.7
Pelargonidin-1-14	qPel-1-14.RH-ch2.1	2.2	0	0	0.5	AX89907741nmh	AX89784219ph3	4.32	8.3	-27.4
Pelargonidin-7-13	qPel-7-13.RH-ch2.1	2.2	11	10.5	11.5	AX89825685ph3	AX89884628nmh		6.3	16.4
Pelargonidin-7-13	qPel-7-13.RH-ch3.1	3.3	21	20.5	21.5	AX89794104ph3	AX89794340ph3	5.1	5.9	12.4
Pelargonidin-7-13	qPel-7-13.RH-ch2.2	2.4	3	2.5	4.5	AX89872273nmh	AX89895998ph3		6.7	-19.1
TSS_TA-4-14	qTSS/TA-4-14.RH-ch6.1	6.3	37	35.5	37.5	AX89832392ph3	AX89889559ph3	3.2	6.3	-18.1
TSS_TA-7-13	qTSS/TA-7-13.RH-ch4.1	4.3	71	70.5	71.5	AX89794266nmh	AX89848345ph3	4.25	5.8	-23.3
TSS-1-13	qTSS-1-13.RH-ch3.1	3.3	105	104.5	105.5	AX89899152ph3	AX89798888ph3	3.84	5.8	10.8

* A universal LOD threshold of 5.7 was used to identify potentially significant QTL.

Figure legends

Figure 1: SNP-based consensus linkage map of an octoploid strawberry F_1 mapping population Rg x H composed of 3933 SNPs distributed over 28 linkage groups with total length of 2524.7 cM

Figure 2. Heat map showing the correlation between the measured traits at the two locations; EMR (A) and The University of Reading (B). TSS = total soluble solids, TA= titratable acidity, L = L* brightness-darkness spectrum, a = a* green-red spectrum, b = b* yellow-blue spectrum, FW = fresh weight. Suffixes _1, _4 and _7 indicate measurements taken at 1, 4 and 7 days postharvest respectively.

Figure 3. Positions of significant QTL (exceeding the universal LOD threshold of 5.7) mapped for the investigated traits measured at the University of Reading (UoR) in red, and at EMR in blue. TSS = total soluble solids, TA= titratable acidity, L = brightness-darkness spectrum, a = green-red spectrum, b = yellow-blue spectrum, FW = fresh weight. Suffixes _1, _4 and _7 indicate measurements taken at 1, 4 and 7 days postharvest respectively.

Supplementary Table 1. Map of Rg x H population showing the 28 linkage groups of octoploid strawberry and the distribution of 3900 SNPs.

Supplementary Table 2. Correlation between the measured traits at the two locations.

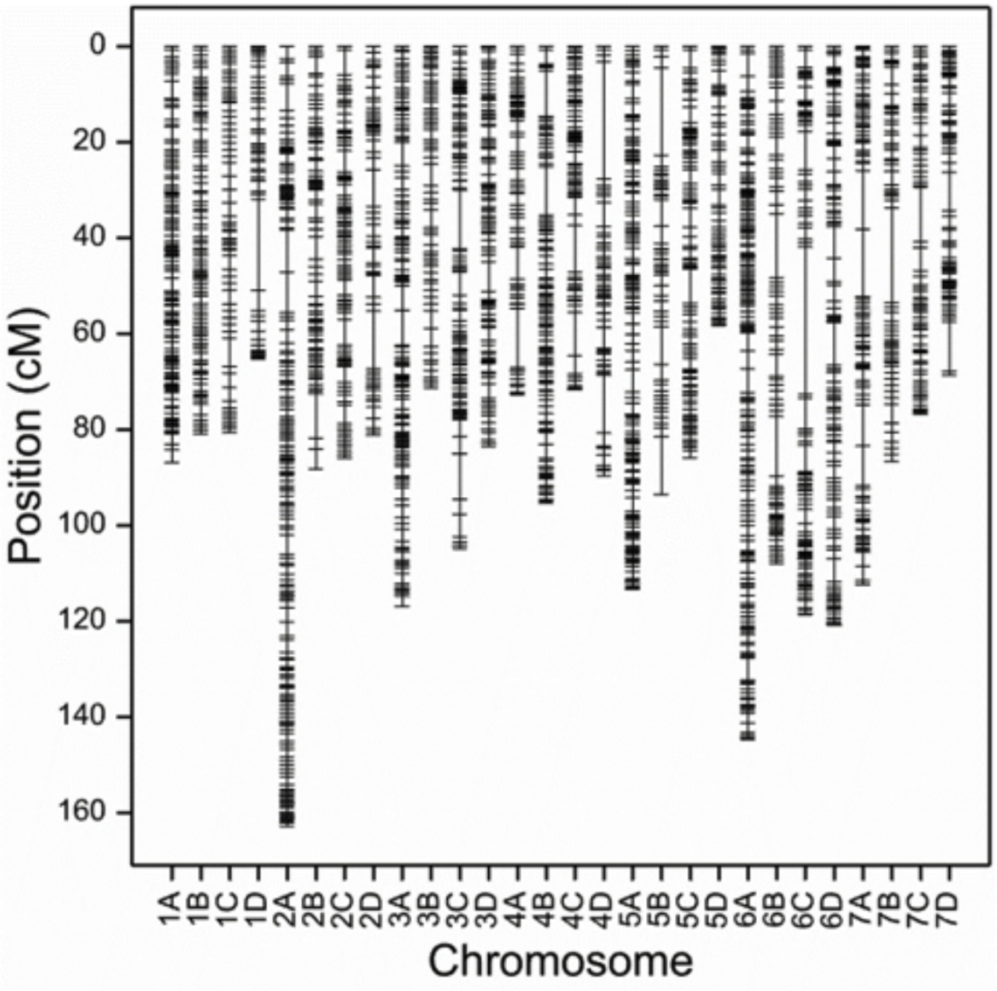


Figure 1: SNP-based consensus linkage map of an octoploid strawberry F1 mapping population Rg x H composed of 3933 SNPs distributed over 28 linkage groups with total length of 2524.7 cM

170x169mm (300 x 300 DPI)

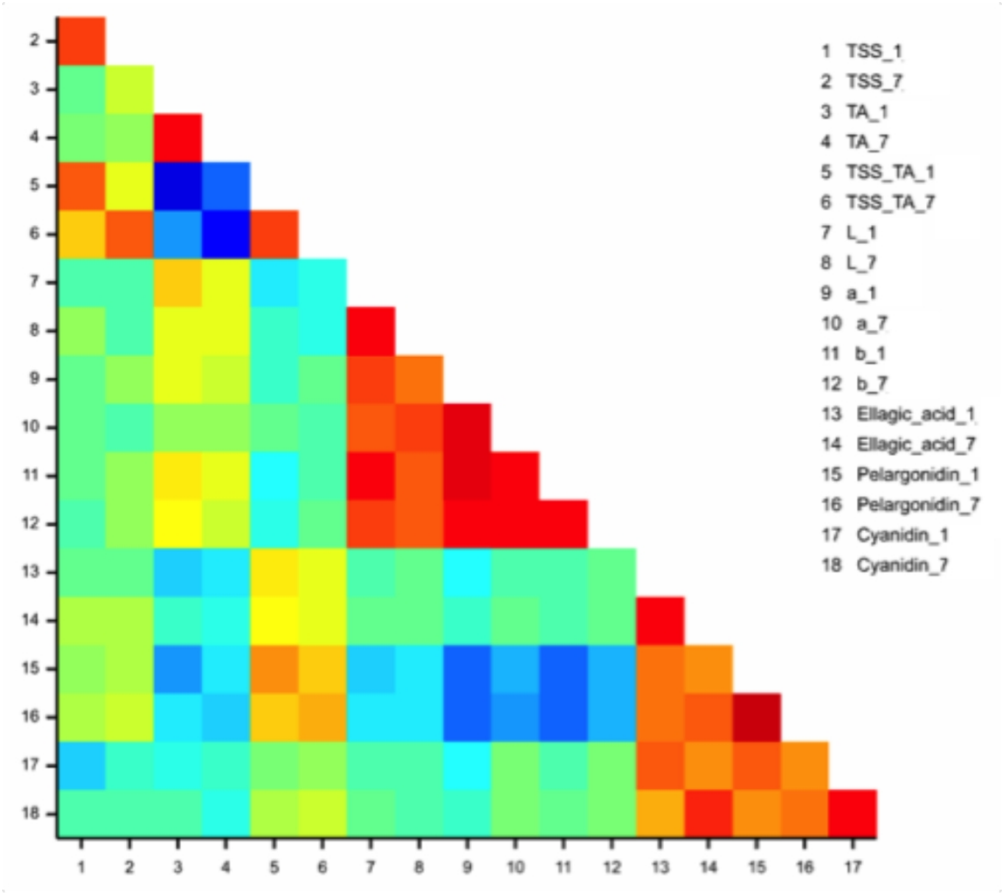


Figure 2. Heat map showing the correlation between the measured traits at the two locations; EMR (A) and The University of Reading (B). TSS = total soluble solids, TA= titratable acidity, L = L* brightness-darkness spectrum, a = a* green-red spectrum, b = b* yellow-blue spectrum, FW = fresh weight. Suffixes _1, _4 and _7 indicate measurements taken at 1, 4 and 7 days postharvest respectively.

178x158mm (300 x 300 DPI)

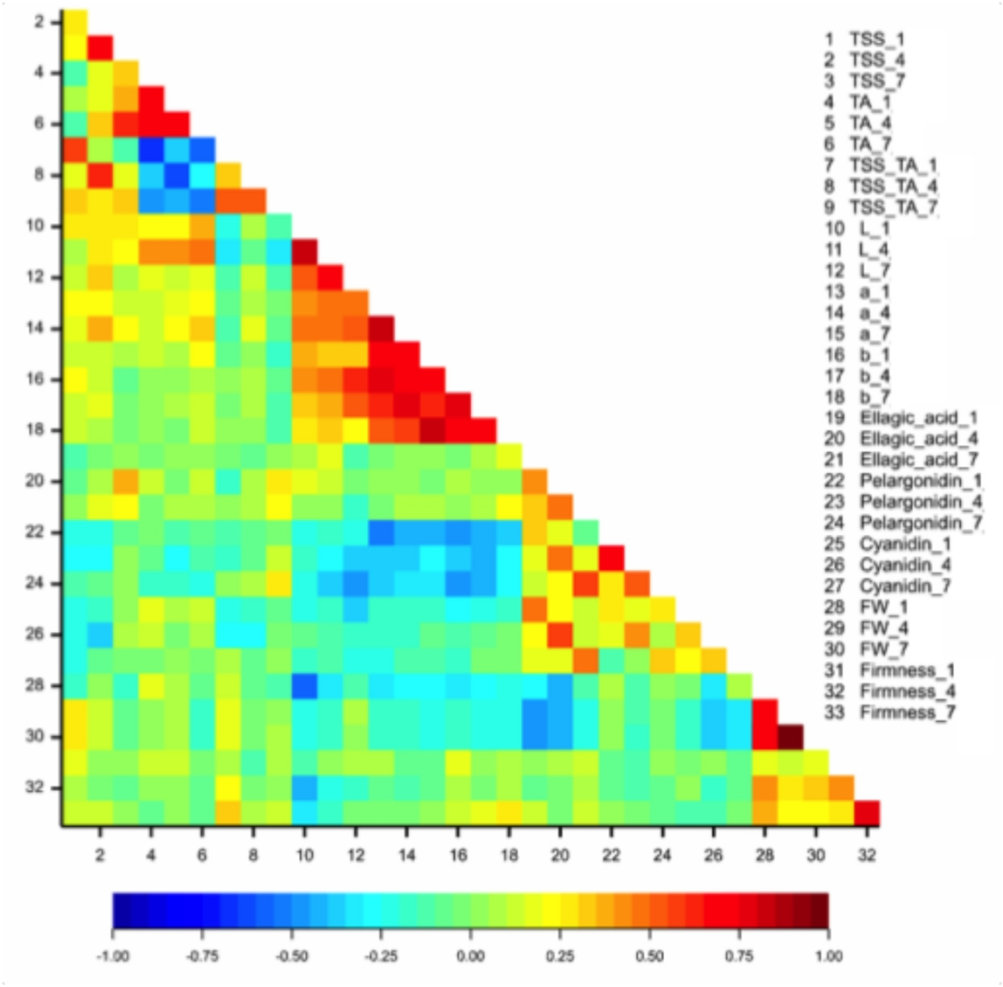
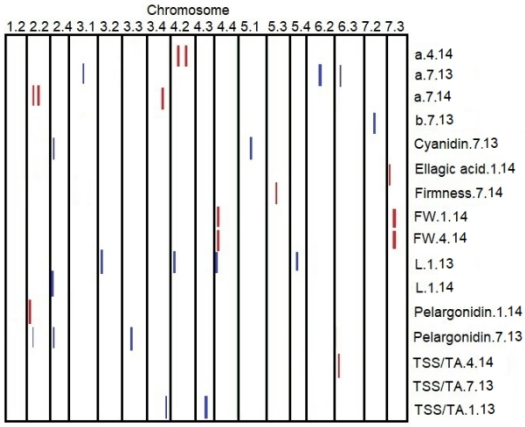


Figure 2. Heat map showing the correlation between the measured traits at the two locations; EMR (A) and The University of Reading (B). TSS = total soluble solids, TA= titratable acidity, L = L* brightness-darkness spectrum, a = a* green-red spectrum, b = b* yellow-blue spectrum, FW = fresh weight. Suffixes _1, _4 and _7 indicate measurements taken at 1, 4 and 7 days postharvest respectively.

181x178mm (300 x 300 DPI)



Positions of significant QTL (exceeding the universal LOD threshold of 5.7) mapped for the investigated traits measured at the University of Reading (UoR) in red, and at EMR in blue. TSS = total soluble solids, TA= titratable acidity, L = brightness-darkness spectrum, a = green-red spectrum, b = yellow-blue spectrum, FW = fresh weight. Suffixes _1, _4 and _7 indicate measurements taken at 1, 4 and 7 days postharvest respectively.

Response to reviewers' comments

Reviewer(s)' Comments to Author:

Comments to the Author

Reviewer's comments	Author's response
The number of individuals is quite low for a QTL study and is problematic when considering the traits targeted as most of them are highly influenced by the environment.	We agree that it would have been desirable to have a larger population size. We have addressed this more fully in the discussion in the latest version (see line 363) rather than adding additional text to the methods.
Please briefly describe how cultivation at EMR was conducted so the reader does not have to find the Antanaviciute et al., (2015) paper.	This has been done in line 98. See additional text highlighted in yellow.
Were the fruit punctured on day 4 and day 7 the same as the fruit punctured on day 1? I would think that puncturing the fruit once would compromise the structural integrity of the fruit preventing repeated measures. Please clarify this point.	Different fruit were punctured on each day. To clarify, post-harvest quality assessment was conducted on fresh fruits including FW and colour using **non-destructive** methods allowing repeat measurements of the same fruit. Then, one **experimental rep** of each block was prepared after measuring the firmness, by blending the three fruits used for firmness measurement. See additional text highlighted in yellow (see line 129)
Based on this sentence berries from each block were maintained as individual samples. How were data treated for QTL analysis? Was an average of the blocked data points used or were BLUPs calculated for each environment and then used for QTL analysis. Using BLUPs would help reduce the effect of environmental variability which could lead to more reliable QTL detection.	Average values of the blocked data points were used directly for qtl mapping. As the heritability was high for the majority of the traits, we believe that the environmental variance between blocks within each trial was low. Therefore, we believe that using BLUBs wouldn't improve results that much.
Why not construct the model using all of the samples for a trait? If done well BLUPs for each trait could be used which may improve QTL detection by removing some of the environmental variability.	As we analyzed each location separately, and due to the high heritability for most of the traits, we believe that the environmental factor is not the main reason to map low number of significant QTL
Please use the standardized naming convention for QTLs in Rosaceae. See the GDR website for more information.	This has been done throughout the manuscript. see line 275 and Table 5.
results of MLM should be mentioned in this section.	This has been done in line 317. See additional text highlighted in yellow.

Cockerton 2020 did not produce a physical map. Their approach was also generated a linkage map but used a different program.	Thank you for the correction and sorry for this mistake. We have corrected this sentence. See additional text highlighted in yellow (line 334).
F. x ananassa. also list the cross from this study.	This has been done in line 339. See additional text highlighted in yellow.
How does your Redgauntlet x Hapil map compare to the Cockerton 2020 one?	The map length presented in Cockerton 2018 was in Mb not in cM (Figure 5, Supplementary Fig 1, Supplementary Fig 2). Cockerton 2020 (Figure 4). Therefore, it is difficult to compare the map length or to compare marker positions. Only distance between markers were presented in cM, i.e. on average 0.75 cM.
Citing poorly done QTL work is not a good way to justify issues with your study. Vallarino et al., 2019 even runs into some issues even at a population size approaching 100 but they still managed to find QTLs that appear in the same genetic location over multiple environments. Please place more effort toward discussing the limitations of this study due to population size. If the distributions of the traits targeted were more binary, indicating a major effect locus, a smaller population would be fine but given the quantitative nature of the traits in this study the population size is an issue. P8	A paragraph has now been added to the manuscript, beginning on Line 372. This now highlights some of the limitations of our study due to population size.
What about SSC QTLs? P9	We think this reviewer means SSR not SSC based markers and is asking if there is any co-location between the SSR QTL and the ones that we have identified in the present manuscript. Unfortunately, we cannot compare QTL mapped from our results with the QTL mapped on the SSR map due to two factors; First, SSR based studies didn't measure the same traits. Secondly, we can't be sure of the co-locations of SNPs and SSR markers as the maps were built independently.
Add unit information as parenthesis in the table following the trait rather than up in the description.	This has been done.
What are these values? Are they model coefficients?	Values represent the significance level at α = 0.05. See additional text highlighted in yellow.
this is misspelled	This has been done.

Is R2 the last column in this table? If it is not I would like to see the rest of the table to adequately look at the results. Also please follow the Rosaceae naming conventions for QTLs	This has been done.

group 1A	cM
AX-89780504:nmh	0
AX-89806486:ph3	0.719
AX-89779866:nmh	0.719
AX-89874808:ph3	2.169
AX-89778378:nmh	2.888
AX-89812209:nmh	2.888
AX-89779723:nmh	3.608
AX-89817742:nmh	3.608
AX-89817701:ph3	4.327
AX-89779683:nmh	4.327
AX-89851085:nmh	5.047
AX-89860579:nmh	5.766
AX-89874771:nmh	5.766
AX-89854388:nmh	7.215
AX-89874676:nmh	7.215
AX-89817396:ph3	10.921
AX-89816774:ph3	10.921
AX-89817467:ph3	10.921
AX-89847000:ph3	11.351
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AX-89778950:ph3	25.009
AX-89816715:ph3	25.797
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AX-89815690:ph3	34.08
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AX-89780843:nmh	41.146
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AX-89819021:nmh	42.196
AX-89876214:nmh	42.431
AX-89780734:nmh	43.021
AX-89876077:nmh	43.021
AX-89876185:ph3	43.069
AX-89818934:ph3	43.707
AX-89818863:nmh	44.682
AX-89780608:nmh	45.507
AX-89780557:nmh	46.332
AX-89904302:ph3	46.992
AX-89780543:nmh	47.157
AX-89780630:nmh	47.63
AX-89780488:nmh	47.982
AX-89847139:ph3	48.268
AX-89780593:nmh	48.268
AX-89780482:nmh	48.807
AX-89875817:nmh	48.807
AX-89806530:nmh	49.632

AX-89818679:nmh	50.456
AX-89818677:nmh	50.456
AX-89818662:nmh	51.281
AX-89818708:nmh	51.978
AX-89818560:nmh	52.106
AX-89780393:nmh	52.106
AX-89780219:nmh	53.768
AX-89803299:nmh	54.593
AX-89875707:nmh	55.538
AX-89875492:nmh	56.255
AX-89803295:nmh	56.255
AX-89811605:nmh	57.08
AX-89818334:nmh	57.904
AX-89875431:nmh	58.729
AX-89818449:nmh	58.823
AX-89780254:ph3	59.461
AX-89854581:nmh	60.099
AX-89780271:ph3	60.099
AX-89875390:nmh	60.391
AX-89875228:nmh	61.216
AX-89818059:ph3	62.041
AX-89818082:nmh	62.041
AX-89875427:nmh	62.041
AX-89891489:ph3	62.615
AX-89834284:ph3	63.189
AX-89891460:nmh	63.965
AX-89862693:nmh	63.982
AX-89841528:nmh	65.505
AX-89779900:ph3	66.131
AX-89904260:nmh	66.393
AX-89793105:nmh	67.64
AX-89804341:nmh	68.05
AX-89875075:ph3	68.205
AX-89862691:nmh	68.371
AX-89779931:nmh	69.432
AX-89891449:ph3	69.432
AX-89834251:nmh	70.513
AX-89818198:nmh	71.954
AX-89778881:nmh	72.571
AX-89873667:ph3	72.571
AX-89818242:nmh	72.93
AX-89904273:nmh	73.298
AX-89778953:ph3	74.025
AX-89779306:ph3	74.025
AX-89779017:nmh	74.6
AX-89874574:nmh	76.951
AX-89874605:ph3	76.951
AX-89874816:nmh	78.014
AX-89874805:ph3	78.035
AX-89779591:ph3	78.035

AX-89817621:ph3	78.035
AX-89779600:nmh	78.755
AX-89803055:nmh	79.474
AX-89875223:nmh	80.193
AX-89780315:ph3	80.935
group 1C	
AX-89875762:nmh	0
AX-89779986:nmh	0.719
AX-89779982:nmh	0.719
AX-89874906:nmh	1.439
AX-89874891:nmh	2.158
AX-89874773:nmh	2.878
AX-89817755:nmh	3.597
AX-89817700:nmh	3.597
AX-89874736:nmh	5.047
AX-89779638:ph3	5.766
AX-89874634:ph3	5.766
AX-89817658:nmh	5.766
AX-89874603:nmh	6.593
AX-89873967:nmh	7.42
AX-89816608:ph3	8.67
AX-89779121:nmh	8.67
AX-89780074:nmh	9.392
AX-89780110:ph3	10.114
AX-89875368:ph3	10.114
AX-89804946:nmh	10.114
AX-89779580:nmh	10.763
AX-89779709:ph3	11.412
AX-89803226:nmh	11.412
AX-89817756:nmh	11.412
AX-89875189:ph3	11.741
AX-89780008:ph3	13.508
AX-89868455:nmh	14.692
AX-89780226:nmh	16.071
AX-89818120:nmh	16.071
AX-89780246:nmh	16.071
AX-89818469:nmh	17.449
AX-89910597:nmh	18.828
AX-89875853:ph3	18.828
AX-89875911:ph3	20.207
AX-89904303:ph3	21.585
AX-89818888:ph3	22.964
AX-89847145:ph3	24.342
AX-89780710:nmh	24.342
AX-89819030:nmh	27.119
AX-89819123:ph3	27.119
AX-89822738:nmh	29.897
AX-89841542:nmh	32.674
AX-89898671:nmh	35.451

AX-89798492:nmh	35.451
AX-89898653:nmh	36.83
AX-89798443:ph3	36.83
AX-89898658:nmh	36.83
AX-89841381:nmh	36.83
AX-89841384:ph3	36.83
AX-89798411:nmh	37.42
AX-89898558:ph3	38.272
AX-89798386:ph3	38.631
AX-89841263:nmh	38.631
AX-89798378:nmh	38.631
AX-89816570:ph3	40.085
AX-89816497:nmh	40.121
AX-89873732:nmh	40.584
AX-89873630:nmh	41.099
AX-89803109:nmh	41.315
AX-89798365:nmh	42.136
AX-89816618:nmh	42.509
AX-89846887:ph3	43.703
AX-89832793:nmh	43.703
AX-89779204:nmh	46.595
AX-89817134:nmh	48.03
AX-89874285:nmh	49.465
AX-89873530:nmh	50.9
AX-89803121:nmh	53.791
AX-89846908:ph3	55.226
AX-89903467:nmh	56.661
AX-89903507:nmh	58.096
AX-89816178:nmh	59.531
AX-89778602:nmh	60.966
AX-89872986:nmh	66.835
AX-89910277:nmh	66.835
AX-89816226:ph3	66.835
AX-89792673:nmh	68.27
AX-89778470:nmh	68.27
AX-89803010:nmh	71.161
AX-89873121:nmh	74.052
AX-89904320:ph3	75.487
AX-89815828:ph3	75.487
AX-89876317:nmh	75.487
AX-89819278:nmh	76.206
AX-89780886:ph3	76.936
AX-89860475:nmh	77.656
AX-89803011:ph3	78.375
AX-89819222:nmh	79.095
AX-89876343:ph3	79.095
AX-89861902:nmh	79.134
AX-89904333:ph3	79.814
AX-89807021:nmh	79.814
AX-89817438:ph3	80.591

AX-89819177:nmh	80.591
group 1D	
AX-89875440:nmh	0
AX-89874863:nmh	0
AX-89817594:ph3	0.301
AX-89874411:ph3	0.301
AX-89874665:ph3	0.301
AX-89874865:nmh	0.837
AX-89817656:nmh	0.934
AX-89779669:ph3	1.373
AX-89874860:nmh	1.373
AX-89817205:ph3	2.028
AX-89779624:nmh	2.028
AX-89779632:ph3	3.004
AX-89779585:nmh	3.004
AX-89816725:nmh	4.233
AX-89875379:nmh	6.438
AX-89779102:nmh	7.523
AX-89779044:nmh	7.523
AX-89793059:nmh	7.532
AX-89780084:nmh	7.532
AX-89778874:nmh	8.603
AX-89778880:nmh	8.603
AX-89834280:nmh	8.627
AX-89867497:nmh	9.721
AX-89779886:nmh	10.794
AX-89818021:ph3	11.525
AX-89891483:nmh	12.908
AX-89847069:ph3	15.229
AX-89818077:ph3	15.229
AX-89875214:nmh	15.229
AX-89875407:nmh	17.367
AX-89818124:nmh	17.474
AX-89818314:ph3	18.211
AX-89818296:nmh	18.211
AX-89904278:ph3	20.354
AX-89875529:ph3	20.354
AX-89780227:nmh	20.354
AX-89780244:nmh	20.894
AX-89780270:ph3	21.433
AX-89847103:ph3	21.433
AX-89780337:nmh	21.433
AX-89780388:nmh	21.955
AX-89780443:nmh	22.478
AX-89872291:ph3	23.529
AX-89847129:ph3	24.052
AX-89818854:nmh	25.641
AX-89847141:ph3	26.163
AX-89818767:nmh	26.163

AX-89875966:ph3	26.163
AX-89876059:ph3	27.34
AX-89780687:ph3	27.924
AX-89819069:nmh	28.049
AX-89819008:ph3	30.314
AX-89910717:nmh	30.898
AX-89780801:ph3	30.898
AX-89907222:ph3	30.898
AX-89798543:nmh	30.898
AX-89841547:ph3	30.898
AX-89906394:ph3	31.95
AX-89803159:nmh	50.931
AX-89816682:nmh	55.235
AX-89816845:nmh	55.235
AX-89873516:nmh	56.288
AX-89846846:ph3	56.288
AX-89778745:nmh	56.288
AX-89816442:ph3	57.34
AX-89846909:ph3	59.46
AX-89816834:nmh	59.46
AX-89872264:ph3	61.28
AX-89778381:ph3	61.28
AX-89874063:nmh	62.375
AX-89904101:ph3	63.47
AX-89816174:nmh	63.47
AX-89816157:nmh	63.65
AX-89906274:ph3	63.83
AX-89778540:nmh	64.16
AX-89795942:nmh	64.548
AX-89816119:ph3	64.548
AX-89846804:ph3	64.548
AX-89873183:ph3	64.908
AX-89847808:ph3	65.268
AX-89904213:ph3	65.268
AX-89876338:nmh	65.268
group 2A	
AX-89911593:nmh	0
AX-89880417:nmh	0
AX-89822438:nmh	2.633
AX-89823181:nmh	3.353
AX-89880337:ph3	3.353
AX-89880378:nmh	6.295
AX-89783847:ph3	7.014
AX-89783880:ph3	7.741
AX-89783848:nmh	7.748
AX-89783897:nmh	13.432
AX-89907662:nmh	14.989
AX-89808526:ph3	16.545
AX-89859524:ph3	18.008

AX-89799152:ph3	18.016
AX-89799121:ph3	19.487
AX-89882243:ph3	20.206
AX-89882312:nmh	20.931
AX-89911999:ph3	20.931
AX-89785411:ph3	21.29
AX-89825137:ph3	21.65
AX-89882280:nmh	21.65
AX-89803836:ph3	22.01
AX-89882267:nmh	22.19
AX-89904818:ph3	22.37
AX-89783473:nmh	24.423
AX-89785483:ph3	24.925
AX-89783451:ph3	25.65
AX-89879876:ph3	26.374
AX-89847542:ph3	27.824
AX-89822757:ph3	27.824
AX-89867788:ph3	28.919
AX-89863038:ph3	29.279
AX-89783416:ph3	29.638
AX-89783279:ph3	29.638
AX-89806801:ph3	29.998
AX-89822661:ph3	30.358
AX-89822640:ph3	30.717
AX-89892815:ph3	31.077
AX-89879609:ph3	31.437
AX-89905820:ph3	31.437
AX-89835586:ph3	31.797
AX-89835571:ph3	32.156
AX-89879805:ph3	32.881
AX-89847532:ph3	33.6
AX-89863030:ph3	33.6
AX-89823399:nmh	33.78
AX-89879768:ph3	33.96
AX-89879787:ph3	33.96
AX-89880159:ph3	35.88
AX-89863070:nmh	36.51
AX-89880242:ph3	36.51
AX-89854868:ph3	37.965
AX-89879047:nmh	37.965
AX-89822649:nmh	37.965
AX-89782715:nmh	38.335
AX-89783689:ph3	47.161
AX-89880541:ph2	55.583
AX-89822962:nmh	56.407
AX-89783649:ph3	56.407
AX-89822480:ph3	57.18
AX-89869925:nmh	59.156
AX-89823467:ph3	59.156
AX-89783671:ph3	61.979

AX-89783759:nmh	63.64
AX-89880580:nmh	64.181
AX-89783972:ph3	64.181
AX-89782148:ph3	65.635
AX-89880226:ph3	65.635
AX-89823087:ph3	65.995
AX-89823157:ph3	65.995
AX-89876601:ph3	66.72
AX-89822584:nmh	66.72
AX-89904609:ph3	67.804
AX-89878964:nmh	67.804
AX-89862961:nmh	67.804
AX-89783544:nmh	68.573
AX-89847514:ph3	69.863
AX-89831857:nmh	70.12
AX-89822986:ph2	70.12
AX-89847521:ph3	70.54
AX-89879724:nmh	71.668
AX-89822560:nmh	73.216
AX-89863100:nmh	73.984
AX-89876409:ph3	74.753
AX-89819304:nmh	74.753
AX-89876404:nmh	74.753
AX-89784021:nmh	75.764
AX-89781006:ph3	77.304
AX-89876458:nmh	77.304
AX-89876476:nmh	77.304
AX-89876513:nmh	77.912
AX-89847204:ph3	77.912
AX-89819357:ph3	78.52
AX-89819488:nmh	79.081
AX-89876620:nmh	79.743
AX-89876578:nmh	80.351
AX-89781082:nmh	80.858
AX-89876610:nmh	80.858
AX-89876724:ph3	80.959
AX-89876688:nmh	81.566
AX-89876641:nmh	81.566
AX-89820013:nmh	82.174
AX-89819915:nmh	82.174
AX-89904378:ph3	83.398
AX-89910814:nmh	83.542
AX-89781170:nmh	84.424
AX-89803445:nmh	84.424
AX-89876795:nmh	85.247
AX-89781233:nmh	85.247
AX-89781188:nmh	85.306
AX-89806599:nmh	85.306
AX-89847253:nmh	85.855
AX-89819991:nmh	86.188

AX-89781488:nmh	86.188
AX-89819749:nmh	86.462
AX-89872314:nmh	87.07
AX-89860725:ph3	87.07
AX-89877029:nmh	87.07
AX-89877045:ph3	87.977
AX-89819983:ph3	87.977
AX-89876920:ph3	88.884
AX-89819856:ph3	89.244
AX-89819874:ph3	89.244
AX-89862827:ph3	89.604
AX-89904377:ph3	89.604
AX-89876887:nmh	90.691
AX-89820126:nmh	91.778
AX-89819712:ph3	91.778
AX-89876932:nmh	92.325
AX-89904397:ph3	92.873
AX-89820090:nmh	92.873
AX-89820095:nmh	92.873
AX-89820109:nmh	93.869
AX-89877249:nmh	95.175
AX-89803499:nmh	95.738
AX-89806639:ph3	95.876
AX-89904423:ph3	96.872
AX-89877366:nmh	96.872
AX-89820329:ph3	96.872
AX-89820234:ph3	97.714
AX-89820243:nmh	97.714
AX-89781678:nmh	98.556
AX-89782052:ph3	100.107
AX-89820598:ph3	100.735
AX-89803519:ph3	102
AX-89907385:nmh	102
AX-89820621:nmh	106.085
AX-89782058:nmh	106.085
AX-89820430:nmh	106.853
AX-89820394:nmh	108.013
AX-89820361:nmh	108.364
AX-89820551:ph3	110.264
AX-89820325:nmh	111.37
AX-89877296:nmh	112.33
AX-89803548:nmh	112.774
AX-89781650:ph3	112.806
AX-89860740:nmh	112.806
AX-89781776:nmh	113.766
AX-89847312:nmh	113.766
AX-89806643:nmh	114.242
AX-89877474:nmh	114.719
AX-89820540:nmh	115.195
AX-89820679:nmh	115.733

AX-89782099:nmh	117.201
AX-89783142:nmh	120.16
AX-89837683:ph3	123.119
AX-89837703:ph3	123.119
AX-89795645:nmh	123.881
AX-89864195:ph3	123.881
AX-89822830:nmh	126.555
AX-89837607:ph3	127.666
AX-89847488:nmh	128.031
AX-89795661:nmh	129.524
AX-89820959:nmh	129.889
AX-89894870:ph3	130.159
AX-89837698:nmh	131.17
AX-89878063:nmh	131.302
AX-89878049:nmh	131.955
AX-89911158:nmh	133.272
AX-89877995:nmh	133.606
AX-89820863:ph3	133.925
AX-89803566:ph3	135.241
AX-89820816:nmh	135.895
AX-89860792:ph3	135.96
AX-89820832:ph3	136.556
AX-89820708:nmh	136.825
AX-89862889:ph3	137.612
AX-89821711:nmh	138.398
AX-89878778:nmh	139.184
AX-89782756:nmh	139.971
AX-89847404:ph3	139.971
AX-89821536:nmh	140.876
AX-89821587:nmh	140.928
AX-89878737:nmh	141.422
AX-89821600:ph3	141.782
AX-89855328:nmh	142.6
AX-89851535:nmh	143.419
AX-89782673:nmh	145.067
AX-89878679:nmh	145.885
AX-89878630:nmh	146.704
AX-89862946:nmh	148.352
AX-89878449:nmh	149.17
AX-89806716:nmh	149.989
AX-89815335:ph3	150.807
AX-89782438:nmh	151.625
AX-89782402:nmh	152.444
AX-89783025:ph3	154.142
AX-89878237:nmh	155.047
AX-89867070:nmh	155.483
AX-89782385:nmh	155.483
AX-89878247:nmh	155.919
AX-89782372:nmh	156.355
AX-89783024:ph3	156.791

AX-89783049:nmh	157.226
AX-89879135:nmh	157.662
AX-89879126:ph3	158.098
AX-89879101:nmh	158.534
AX-89821970:nmh	158.97
AX-89782937:nmh	159.848
AX-89872349:ph3	160.284
AX-89782896:nmh	160.284
AX-89782890:ph3	160.643
AX-89782859:nmh	161.003
AX-89847421:ph3	161.363
AX-89821756:ph3	161.363
AX-89782871:ph3	161.723
AX-89879014:ph3	162.082
AX-89806751:nmh	162.082
AX-89860876:ph3	162.082
AX-89879057:ph3	162.823
group 2B	
AX-89782925:nmh	0
AX-89803683:nmh	0
AX-89878141:nmh	0.73
AX-89782307:nmh	1.449
AX-89878129:ph3	1.449
AX-89904480:nmh	1.449
AX-89822091:ph3	2.169
AX-89878140:nmh	2.169
AX-89783068:ph3	2.169
AX-89822023:nmh	2.169
AX-89878225:nmh	5.731
AX-89821099:nmh	6.302
AX-89878232:nmh	6.302
AX-89821136:nmh	8.207
AX-89865329:nmh	10.161
AX-89904492:ph3	11.13
AX-89782501:nmh	11.13
AX-89878486:nmh	12.1
AX-89878520:nmh	12.1
AX-89878608:nmh	13.07
AX-89782637:nmh	13.07
AX-89821574:nmh	15.023
AX-89855337:nmh	15.023
AX-89821548:nmh	15.023
AX-89878792:nmh	15.992
AX-89821710:nmh	16.962
AX-89877848:nmh	17.36
AX-89820814:nmh	17.932
AX-89782161:ph3	17.932
AX-89820761:nmh	18.111
AX-89820819:ph3	18.291

AX-89782281:nmh	18.291
AX-89855216:nmh	18.77
AX-89878105:ph3	19.735
AX-89878103:ph3	19.735
AX-89877962:nmh	19.915
AX-89878109:ph3	20.095
AX-89782798:nmh	21.412
AX-89879465:ph3	23.349
AX-89837643:nmh	23.7
AX-89837581:ph3	23.744
AX-89877480:nmh	25.969
AX-89907378:ph3	27.069
AX-89781854:nmh	27.069
AX-89904431:ph3	27.788
AX-89847328:nmh	28.148
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AX-89781915:ph3	28.507
AX-89877646:nmh	28.867
AX-89820528:ph3	28.867
AX-89847334:ph3	29.227
AX-89877765:ph3	29.587
AX-89877816:ph3	29.95
AX-89911116:ph3	29.95
AX-89781773:nmh	32.166
AX-89820316:nmh	32.897
AX-89877368:nmh	35.884
AX-89781727:nmh	35.884
AX-89910996:nmh	35.928
AX-89877350:ph3	36.636
AX-89781692:nmh	36.636
AX-89910974:nmh	36.636
AX-89781525:nmh	38.188
AX-89820142:ph3	38.188
AX-89819696:ph3	39.739
AX-89819663:nmh	39.739
AX-89819781:ph3	44.462
AX-89781303:nmh	44.462
AX-89877041:nmh	46.014
AX-89781433:nmh	46.014
AX-89819935:nmh	47.565
AX-89781490:nmh	47.565
AX-89872309:nmh	49.117
AX-89819538:nmh	52.242
AX-89781120:nmh	52.242
AX-89819492:nmh	53.794
AX-89876617:nmh	53.794
AX-89876615:nmh	54.038
AX-89910786:nmh	55.345
AX-89876470:nmh	55.953

AX-89819365:nmh	56.896
AX-89876435:ph3	56.896
AX-89780948:ph3	57.256
AX-89876523:nmh	57.436
AX-89876439:ph3	57.616
AX-89819320:nmh	57.616
AX-89880662:nmh	58.581
AX-89823526:ph3	59.06
AX-89880621:ph3	59.42
AX-89879691:ph3	60.144
AX-89879701:ph3	60.144
AX-89880587:ph3	60.144
AX-89822486:ph3	61.229
AX-89880130:nmh	61.409
AX-89822952:ph3	61.589
AX-89822478:ph3	61.589
AX-89783572:nmh	61.589
AX-89823156:ph3	63.043
AX-89847333:ph3	63.043
AX-89822069:nmh	63.043
AX-89823164:ph3	63.223
AX-89781801:ph3	63.403
AX-89879853:nmh	63.403
AX-89781721:ph3	63.403
AX-89823132:nmh	63.403
AX-89907639:nmh	63.403
AX-89879854:nmh	64.213
AX-89823112:nmh	64.706
AX-89806839:nmh	65.353
AX-89783694:ph3	65.353
AX-89822821:nmh	65.846
AX-89904651:ph3	66.656
AX-89880542:ph3	66.836
AX-89879789:nmh	67.016
AX-89860946:nmh	67.016
AX-89879917:nmh	67.016
AX-89822604:ph3	67.016
AX-89872814:nmh	67.896
AX-89847533:ph3	68.461
AX-89809454:nmh	69.102
AX-89865437:ph3	69.475
AX-89879957:nmh	69.475
AX-89847541:ph3	70.611
AX-89799124:nmh	71.362
AX-89799148:ph3	71.362
AX-89799116:ph3	71.362
AX-89850226:ph3	71.362
AX-89882354:nmh	71.902
AX-89850228:ph3	72.441
AX-89799119:nmh	72.441

AX-89785409:ph3	72.441
AX-89874909:ph3	81.844
AX-89880358:nmh	81.844
AX-89783829:nmh	84.034
AX-89823275:nmh	84.034
AX-89783822:nmh	88.275
group 2C	
AX-89783844:nmh	0
AX-89823213:ph3	0.719
AX-89825151:ph3	5.987
AX-89882282:ph3	5.987
AX-89863080:ph2	5.987
AX-89907864:nmh	5.987
AX-89799155:nmh	7.072
AX-89850227:ph3	7.072
AX-89825110:nmh	8.148
AX-89803758:nmh	8.717
AX-89882330:nmh	9.225
AX-89825178:ph3	9.246
AX-89785488:nmh	9.906
AX-89783453:nmh	11.21
AX-89879598:nmh	11.695
AX-89783280:ph3	11.695
AX-89783475:nmh	11.857
AX-89783478:ph3	11.857
AX-89783504:nmh	12.504
AX-89865418:ph3	12.504
AX-89822797:nmh	12.504
AX-89783499:nmh	12.504
AX-89822760:nmh	12.504
AX-89847540:ph3	12.504
AX-89822443:ph3	14.149
AX-89822441:nmh	14.149
AX-89849663:ph3	15.793
AX-89783722:ph3	17.437
AX-89904633:ph3	17.437
AX-89880561:ph3	17.437
AX-89847530:ph3	17.8
AX-89855650:ph3	18.162
AX-89880310:ph3	18.162
AX-89783395:nmh	18.162
AX-89904650:ph3	18.881
AX-89783345:ph3	18.881
AX-89781511:ph3	19.241
AX-89904495:ph3	19.966
AX-89878257:ph3	19.966
AX-89847434:ph3	20.685
AX-89879981:ph3	21.78
AX-89847547:ph3	21.78

AX-89876406:nmh	26.267
AX-89904581:ph3	26.267
AX-89822506:ph3	26.992
AX-89847517:ph3	27.351
AX-89823451:ph3	27.711
AX-89880604:ph3	27.711
AX-89847524:ph3	28.071
AX-89876459:nmh	28.829
AX-89876593:nmh	31.138
AX-89819446:nmh	31.897
AX-89881700:nmh	32.655
AX-89781172:nmh	33.414
AX-89876991:nmh	33.842
AX-89877130:nmh	34.172
AX-89819906:nmh	34.526
AX-89781451:nmh	34.93
AX-89819898:nmh	35.689
AX-89872312:ph3	36.531
AX-89803471:nmh	36.625
AX-89781330:nmh	37.084
AX-89819819:nmh	37.48
AX-89876864:nmh	38.335
AX-89876889:nmh	38.335
AX-89905221:ph3	38.335
AX-89819778:nmh	38.874
AX-89819729:ph3	39.414
AX-89781277:nmh	39.774
AX-89904370:ph3	39.774
AX-89819697:nmh	39.774
AX-89847252:ph3	39.774
AX-89781558:nmh	40.489
AX-89781552:nmh	40.489
AX-89862841:nmh	40.497
AX-89781569:nmh	41.22
AX-89847285:ph3	41.22
AX-89781537:nmh	41.944
AX-89851357:ph3	42.667
AX-89820045:nmh	42.667
AX-89781522:nmh	42.667
AX-89781634:nmh	43.278
AX-89907347:nmh	44.509
AX-89781675:nmh	45.74
AX-89820221:ph3	46.352
AX-89851376:nmh	46.963
AX-89877329:nmh	47.574
AX-89877344:nmh	48.185
AX-89781740:nmh	48.796
AX-89910982:nmh	48.796
AX-89867642:nmh	51.943
AX-89781835:nmh	52.036

AX-89904428:ph3	52.911
AX-89781842:nmh	53.174
AX-89820526:nmh	53.785
AX-89781852:ph3	53.785
AX-89820402:ph3	53.785
AX-89877754:ph3	54.325
AX-89806659:nmh	54.864
AX-89781935:ph3	54.864
AX-89820444:ph3	54.864
AX-89820558:ph3	55.572
AX-89820585:nmh	55.596
AX-89820638:nmh	57.069
AX-89837599:nmh	62.425
AX-89820966:ph3	63.156
AX-89837623:nmh	63.156
AX-89837579:ph3	63.156
AX-89837659:nmh	63.156
AX-89837636:nmh	63.156
AX-89894889:ph3	63.967
AX-89878002:nmh	64.779
AX-89782165:ph3	65.181
AX-89877873:nmh	65.181
AX-89821626:nmh	65.584
AX-89782796:nmh	65.584
AX-89911289:nmh	65.987
AX-89782699:nmh	65.987
AX-89855339:nmh	65.987
AX-89878664:nmh	66.389
AX-89821544:nmh	66.389
AX-89879488:ph3	66.527
AX-89878657:nmh	66.792
AX-89822169:ph3	70.17
AX-89820881:ph3	71.043
AX-89821613:ph3	71.881
AX-89782790:ph3	71.881
AX-89878010:nmh	72.72
AX-89782247:ph3	72.72
AX-89782695:ph3	74.169
AX-89904518:ph3	74.169
AX-89803635:nmh	74.889
AX-89878587:nmh	78.788
AX-89878542:nmh	79.507
AX-89878605:nmh	80.227
AX-89821355:nmh	80.946
AX-89782534:nmh	81.666
AX-89782489:nmh	82.385
AX-89878468:nmh	82.385
AX-89878139:nmh	83.105
AX-89783040:nmh	83.105
AX-89860814:nmh	83.824

AX-89878274:nmh	84.543
AX-89782416:ph3	85.263
AX-89821763:nmh	85.982
group 2D	
AX-89820552:ph3	0
AX-89911035:nmh	0
AX-89781917:ph3	1.252
AX-89823235:nmh	1.252
AX-89820344:ph3	2.942
AX-89877470:ph3	2.942
AX-89877426:ph3	3.661
AX-89820302:ph3	3.661
AX-89781837:nmh	4.194
AX-89813454:nmh	4.388
AX-89862858:ph3	6.385
AX-89781725:nmh	8.575
AX-89820287:ph3	8.575
AX-89781628:nmh	10.765
AX-89877247:nmh	10.765
AX-89820085:nmh	11.484
AX-89877264:ph3	12.945
AX-89781260:nmh	13.674
AX-89904384:ph3	14.394
AX-89819831:nmh	14.394
AX-89904376:ph3	14.394
AX-89781340:nmh	14.394
AX-89877053:nmh	14.995
AX-89830326:nmh	15.596
AX-89819496:ph3	16.198
AX-89819622:ph3	16.198
AX-89854873:ph3	16.198
AX-89819544:ph3	16.557
AX-89910787:nmh	16.92
AX-89847222:ph3	17.282
AX-89904354:ph3	17.282
AX-89781195:nmh	17.819
AX-89781031:ph3	18.372
AX-89819413:nmh	19.603
AX-89819392:ph3	19.603
AX-89823514:nmh	22.083
AX-89823448:ph3	22.083
AX-89879697:ph3	23.314
AX-89783369:nmh	23.314
AX-89847515:ph3	25.794
AX-89823178:ph3	33.46
AX-89806842:ph3	34.691
AX-89880185:nmh	34.691
AX-89783935:nmh	35.922
AX-89783410:nmh	37.153

AX-89879594:nmh	39.633
AX-89849346:ph3	40.864
AX-89892826:ph3	40.864
AX-89783278:nmh	40.864
AX-89823365:ph3	40.864
AX-89822773:ph3	40.864
AX-89799149:ph3	41.729
AX-89882265:nmh	42.104
AX-89799109:nmh	42.104
AX-89788386:nmh	45.275
AX-89851437:nmh	45.891
AX-89782079:nmh	45.891
AX-89806866:nmh	47.118
AX-89880460:ph3	47.118
AX-89823313:nmh	47.126
AX-89789689:nmh	47.485
AX-89880365:nmh	47.485
AX-89867822:ph3	47.845
AX-89867816:nmh	47.845
AX-89831067:nmh	52.326
AX-89879409:nmh	53.775
AX-89795554:nmh	55.224
AX-89894792:nmh	55.224
AX-89782815:nmh	67.283
AX-89878787:nmh	68.002
AX-89782780:nmh	68.721
AX-89782726:nmh	69.441
AX-89821607:nmh	70.16
AX-89904513:ph3	70.88
AX-89821479:nmh	70.88
AX-89878387:nmh	71.06
AX-89806712:ph3	71.78
AX-89821352:ph3	73.07
AX-89878427:nmh	73.07
AX-89821221:ph3	73.789
AX-89904486:ph3	73.97
AX-89878299:nmh	75.239
AX-89782393:ph3	77.675
AX-89806767:nmh	79.719
AX-89879210:nmh	79.719
AX-89821978:ph3	80.439
AX-89782966:nmh	80.439
AX-89860879:nmh	81.158
AX-89847424:ph3	81.158
group 3A	
AX-89907741:nmh	0
AX-89784389:ph3	0.719
AX-89880891:nmh	0.719
AX-89880815:nmh	0.719

AX-89880986:nmh	0.719
AX-89904700:ph3	0.719
AX-89784219:ph3	0.719
AX-89881400:ph3	0.719
AX-89787986:nmh	1.084
AX-89785160:nmh	2.575
AX-89904962:ph3	3.644
AX-89803936:nmh	4.157
AX-89787035:nmh	5.088
AX-89787037:ph3	5.088
AX-89807304:nmh	5.088
AX-89794066:ph3	5.088
AX-89884866:nmh	5.088
AX-89827056:ph3	5.807
AX-89787019:nmh	5.807
AX-89881082:nmh	5.807
AX-89824834:nmh	5.807
AX-89786825:ph3	6.527
AX-89794734:nmh	6.527
AX-89848148:ph3	7.246
AX-89827149:nmh	7.246
AX-89807254:nmh	7.246
AX-89883576:nmh	8.7
AX-89786396:nmh	8.7
AX-89904894:nmh	9.421
AX-89883351:ph3	9.43
AX-89826439:ph3	9.43
AX-89883110:nmh	10.143
AX-89826006:ph3	10.147
AX-89904890:ph3	10.147
AX-89807122:ph3	10.864
AX-89825685:ph3	10.864
AX-89884628:nmh	11.769
AX-89785791:ph3	12.673
AX-89827302:nmh	13.036
AX-89785507:ph3	13.398
AX-89825354:ph3	13.398
AX-89785241:ph3	13.398
AX-89884647:nmh	14.303
AX-89882026:ph3	15.207
AX-89882022:ph3	15.207
AX-89824842:ph3	15.207
AX-89884448:ph3	16.292
AX-89824795:ph3	17.066
AX-89827346:nmh	17.644
AX-89787123:ph3	18.826
AX-89784739:ph3	18.951
AX-89884406:ph3	19.457
AX-89804239:ph3	19.962
AX-89827482:nmh	24.928

AX-89884560:ph3	24.928
AX-89827380:nmh	26.178
AX-89827378:nmh	27.427
AX-89827358:nmh	29.945
AX-89804218:nmh	31.194
AX-89848231:ph3	32.469
AX-89885291:nmh	32.954
AX-89828040:ph3	33.913
AX-89848226:ph3	33.913
AX-89885167:nmh	33.913
AX-89787812:nmh	34.997
AX-89884882:nmh	34.997
AX-89827711:nmh	34.997
AX-89885118:nmh	36.082
AX-89885168:ph3	36.082
AX-89828080:ph3	36.082
AX-89828055:nmh	36.082
AX-89804269:nmh	36.68
AX-89856683:nmh	36.984
AX-89884963:ph3	37.886
AX-89787576:nmh	37.886
AX-89827874:nmh	37.886
AX-89884914:ph3	39.713
AX-89827817:nmh	39.713
AX-89787526:ph3	40.073
AX-89902909:nmh	40.433
AX-89825833:ph3	41.16
AX-89845998:nmh	41.52
AX-89845954:nmh	41.52
AX-89845873:ph3	41.538
AX-89847932:ph3	41.538
AX-89883077:ph3	42.268
AX-89883027:ph3	42.998
AX-89883107:nmh	42.998
AX-89883026:ph3	42.998
AX-89825940:nmh	42.998
AX-89856271:nmh	44.363
AX-89856269:nmh	44.363
AX-89786122:ph3	44.812
AX-89856266:nmh	44.812
AX-89890244:ph3	46.643
AX-89905494:ph3	46.643
AX-89890253:nmh	46.643
AX-89863856:nmh	46.643
AX-89792203:ph3	47.727
AX-89785905:ph3	48.087
AX-89882749:ph3	48.087
AX-89882729:ph3	48.447
AX-89825552:ph2	48.447
AX-89847908:ph3	48.447

AX-89904853:ph3	48.626
AX-89785764:ph3	48.806
AX-89825565:nmh	49.188
AX-89787980:ph3	49.957
AX-89890277:ph2	55.07
AX-89825711:ph3	55.133
AX-89882927:ph3	55.147
AX-89791301:ph3	62.376
AX-89831890:ph3	62.376
AX-89889067:nmh	62.376
AX-89791282:ph3	62.736
AX-89791249:ph3	63.828
AX-89885457:ph3	64.912
AX-89911719:nmh	65.453
AX-89885495:ph3	65.999
AX-89828381:ph3	65.999
AX-89885498:ph3	65.999
AX-89904696:ph3	66.358
AX-89806924:ph3	66.358
AX-89880959:ph3	66.358
AX-89823896:nmh	66.538
AX-89784319:ph3	66.718
AX-89823927:ph3	68.553
AX-89881332:ph3	68.553
AX-89867863:ph3	68.916
AX-89881187:ph3	68.916
AX-89806963:ph2	69.096
AX-89784371:ph3	69.276
AX-89881402:ph2	69.455
AX-89806959:ph3	69.635
AX-89784595:ph3	69.635
AX-89784366:nmh	70.175
AX-89881401:ph3	70.714
AX-89824296:ph3	70.894
AX-89824266:ph3	71.074
AX-89847727:ph3	71.074
AX-89784631:ph3	71.074
AX-89855884:ph2	71.074
AX-89904723:ph3	71.979
AX-89881455:ph3	72.883
AX-89824291:ph3	72.883
AX-89803929:nmh	72.883
AX-89881492:nmh	73.607
AX-89820637:ph3	75.809
AX-89847485:ph3	76.893
AX-89847758:ph3	76.893
AX-89783177:ph3	77.253
AX-89847471:ph3	77.253
AX-89904557:ph3	77.613
AX-89847463:ph3	78.697

AX-89806775:ph3	78.697
AX-89879325:ph3	79.057
AX-89847795:ph3	80.512
AX-89904549:ph3	80.512
AX-89824694:ph3	80.872
AX-89904777:ph3	80.872
AX-89824666:ph3	81.231
AX-89863191:ph3	81.231
AX-89807241:ph3	81.591
AX-89827069:ph3	81.591
AX-89786967:ph3	81.951
AX-89786978:ph3	82.31
AX-89884250:ph3	82.67
AX-89827113:ph3	82.67
AX-89824624:ph3	83.03
AX-89827117:ph3	83.03
AX-89784929:nmh	83.392
AX-89784831:ph3	83.755
AX-89863184:ph3	83.755
AX-89847777:ph3	83.755
AX-89885433:ph3	84.479
AX-89885430:ph3	84.479
AX-89883162:ph3	85.199
AX-89904880:ph3	85.199
AX-89824654:nmh	85.738
AX-89905224:ph3	86.278
AX-89824571:ph3	86.997
AX-89855989:nmh	86.997
AX-89824743:ph3	87.004
AX-89785108:ph3	87.628
AX-89824746:ph3	87.716
AX-89785116:nmh	89.707
AX-89826261:nmh	90.04
AX-89847974:ph3	90.63
AX-89826164:ph3	90.63
AX-89826166:ph3	90.63
AX-89786199:ph3	91.349
AX-89883261:ph3	91.349
AX-89826130:ph3	91.349
AX-89861146:ph3	91.349
AX-89883279:ph3	91.349
AX-89826091:ph3	92.069
AX-89883233:ph3	92.069
AX-89804114:ph3	92.069
AX-89856288:ph3	92.069
AX-89811950:nmh	94.582
AX-89882618:ph3	94.582
AX-89825301:nmh	95.829
AX-89807064:ph3	95.829
AX-89904836:ph3	98.343

AX-89847886:ph3	99.59
AX-89904839:ph3	99.59
AX-89872427:ph3	100.838
AX-89786579:nmh	103.351
AX-89807028:ph3	104.598
AX-89785224:nmh	104.598
AX-89847825:ph3	104.958
AX-89785285:nmh	104.958
AX-89856366:nmh	105.524
AX-89856364:ph3	105.524
AX-89883657:nmh	107.248
AX-89863355:nmh	107.814
AX-89826621:nmh	107.961
AX-89848055:nmh	108.381
AX-89848062:ph3	108.947
AX-89848063:nmh	108.947
AX-89883910:ph3	110.031
AX-89811234:ph3	110.031
AX-89786710:nmh	110.031
AX-89884077:ph3	112.221
AX-89848121:nmh	112.318
AX-89786356:ph2	113.128
AX-89786379:nmh	113.446
AX-89904906:nmh	113.937
AX-89883493:nmh	114.093
AX-89848096:ph3	114.741
AX-89884038:nmh	114.741
AX-89884020:ph3	114.747
AX-89786850:nmh	114.747
AX-89883524:ph3	114.747
AX-89848116:nmh	116.93
group 3B	
AX-89786849:ph3	0
AX-89786425:ph3	0.371
AX-89826334:ph3	1.09
AX-89884094:ph3	1.45
AX-89826324:ph3	1.45
AX-89786698:ph3	2.174
AX-89786700:ph3	2.174
AX-89904928:ph3	2.534
AX-89811768:ph3	3.254
AX-89848030:nmh	3.254
AX-89826489:nmh	3.917
AX-89883614:ph3	4.039
AX-89883593:nmh	4.58
AX-89785260:nmh	5.917
AX-89882118:nmh	5.917
AX-89825388:nmh	7.253
AX-89825345:nmh	7.253

AX-89867911:ph3	7.253
AX-89825300:nmh	7.973
AX-89861107:nmh	7.973
AX-89912026:nmh	7.973
AX-89907882:nmh	7.973
AX-89882571:nmh	8.692
AX-89785352:nmh	8.692
AX-89851905:nmh	9.411
AX-89807041:ph3	9.411
AX-89882371:nmh	9.422
AX-89847901:ph3	9.422
AX-89883206:ph3	10.141
AX-89892576:nmh	10.141
AX-89883296:ph3	10.861
AX-89786258:nmh	10.861
AX-89804126:nmh	11.58
AX-89883354:nmh	13.03
AX-89911927:nmh	13.749
AX-89795896:nmh	14.469
AX-89881686:nmh	15.188
AX-89789867:nmh	15.907
AX-89830359:ph3	15.907
AX-89786153:nmh	16.627
AX-89799208:ph3	16.627
AX-89843606:nmh	17.346
AX-89884888:ph3	17.346
AX-89824599:nmh	19.536
AX-89827110:ph3	20.256
AX-89786985:nmh	20.975
AX-89884222:nmh	20.975
AX-89827077:nmh	21.695
AX-89786956:nmh	21.695
AX-89824719:ph3	23.144
AX-89881866:nmh	24.593
AX-89822122:nmh	29.074
AX-89911441:nmh	30.523
AX-89911427:ph3	30.523
AX-89822365:nmh	31.973
AX-89784818:ph3	32.692
AX-89823232:nmh	34.142
AX-89824344:ph3	37.847
AX-89803926:nmh	38.566
AX-89824230:ph3	39.286
AX-89824179:nmh	41.476
AX-89911754:ph3	41.476
AX-89881210:ph3	42.925
AX-89881241:nmh	42.925
AX-89881121:nmh	43.645
AX-89823889:ph3	44.364
AX-89784315:nmh	45.084

AX-89784316:ph3	45.803
AX-89784291:nmh	47.253
AX-89881025:ph3	47.253
AX-89863127:nmh	48.702
AX-89848271:ph3	49.421
AX-89885512:nmh	49.421
AX-89791263:nmh	49.421
AX-89882716:nmh	50.871
AX-89825536:ph3	50.871
AX-89825638:ph3	52.32
AX-89825678:nmh	52.32
AX-89857612:nmh	53.769
AX-89792166:ph3	53.769
AX-89785993:ph3	55.219
AX-89903274:ph3	55.219
AX-89903179:ph3	55.219
AX-89827849:ph3	58.924
AX-89787723:nmh	62.63
AX-89828043:ph3	62.63
AX-89828162:ph3	64.079
AX-89787894:nmh	64.079
AX-89827763:nmh	65.528
AX-89804249:ph3	65.528
AX-89827616:nmh	66.248
AX-89827381:nmh	67.697
AX-89827465:nmh	67.697
AX-89827299:ph3	67.697
AX-89786031:nmh	69.147
AX-89827017:nmh	69.866
AX-89883234:nmh	69.866
AX-89881973:ph3	70.585
AX-89826831:nmh	71.312

group 3C	
AX-89826975:ph3	0
AX-89786879:ph3	0
AX-89883529:ph3	0
AX-89826780:nmh	1.095
AX-89883455:nmh	1.668
AX-89826639:ph3	3.335
AX-89786751:nmh	4.618
AX-89786701:nmh	4.806
AX-89883773:ph3	5.901
AX-89883717:ph3	6.867
AX-89786554:nmh	7.346
AX-89786559:ph3	7.346
AX-89786590:nmh	7.705
AX-89883696:ph3	8.068
AX-89786517:nmh	8.43
AX-89883653:ph3	8.79

AX-89824888:nmh	8.97
AX-89848028:ph3	9.149
AX-89826502:nmh	9.509
AX-89826470:nmh	9.509
AX-89904910:ph3	9.869
AX-89785172:nmh	10.946
AX-89785181:nmh	10.957
AX-89847821:ph3	10.957
AX-89824916:nmh	12.202
AX-89882051:nmh	12.613
AX-89856063:nmh	13.863
AX-89824958:nmh	13.863
AX-89824957:nmh	13.863
AX-89847840:ph3	13.863
AX-89785292:nmh	14.402
AX-89785689:nmh	14.941
AX-89785289:nmh	14.944
AX-89904840:ph3	16.026
AX-89847884:ph3	16.026
AX-89825393:nmh	16.026
AX-89785365:nmh	16.026
AX-89904834:nmh	16.746
AX-89882502:ph3	16.767
AX-89882448:ph3	17.233
AX-89785534:ph3	17.712
AX-89882364:ph3	18.679
AX-89904852:ph3	20.139
AX-89882638:nmh	20.619
AX-89872428:ph3	20.619
AX-89892578:ph3	21.099
AX-89804113:nmh	21.099
AX-89786158:ph3	21.099
AX-89883210:ph3	21.099
AX-89883232:nmh	22.464
AX-89786311:nmh	22.644
AX-89872453:ph3	23.141
AX-89826237:nmh	23.411
AX-89826236:nmh	23.411
AX-89881713:nmh	24.178
AX-89813060:nmh	24.178
AX-89786202:nmh	25.203
AX-89784892:nmh	26.513
AX-89881714:nmh	27.974
AX-89824557:nmh	28.058
AX-89887567:nmh	29.603
AX-89905229:nmh	29.603
AX-89786137:nmh	30.036
AX-89824346:ph3	42.255
AX-89784703:nmh	42.698
AX-89784689:ph3	43.793

AX-89824257:ph3	44.7
AX-89904738:ph3	45.607
AX-89879521:ph3	45.607
AX-89824357:nmh	46.155
AX-89824271:ph3	46.702
AX-89847735:ph3	47.062
AX-89784670:ph3	47.062
AX-89824115:nmh	52.023
AX-89824022:nmh	53.653
AX-89824000:ph3	53.653
AX-89784441:ph3	53.653
AX-89784322:ph3	54.618
AX-89872402:ph3	55.097
AX-89881026:ph3	55.097
AX-89885526:nmh	55.097
AX-89788067:ph3	55.097
AX-89831855:nmh	57.302
AX-89831888:nmh	58.388
AX-89791303:ph3	58.388
AX-89788035:ph3	58.388
AX-89783378:nmh	59.476
AX-89882715:nmh	60.016
AX-89882769:ph3	60.557
AX-89785845:ph3	60.557
AX-89785870:ph3	60.916
AX-89785808:nmh	60.916
AX-89785912:nmh	61.457
AX-89882931:nmh	61.997
AX-89890261:ph3	63.085
AX-89787995:nmh	63.085
AX-89786084:nmh	63.265
AX-89786092:nmh	63.445
AX-89786052:ph3	63.445
AX-89907936:ph3	63.625
AX-89882994:ph3	63.805
AX-89883039:ph3	63.805
AX-89786001:nmh	63.805
AX-89884987:ph3	64.407
AX-89852194:nmh	64.407
AX-89884931:nmh	65.008
AX-89902956:nmh	65.606
AX-89787578:ph3	66.141
AX-89884927:nmh	66.464
AX-89903244:nmh	67.451
AX-89852207:nmh	68.438
AX-89848228:ph3	68.687
AX-89827977:ph3	68.687
AX-89885065:nmh	69.425
AX-89787685:nmh	69.915
AX-89827975:nmh	69.915

AX-89828007:ph3	70.04
AX-89787769:nmh	70.405
AX-89787896:nmh	71.392
AX-89885232:ph3	71.392
AX-89868091:ph3	71.392
AX-89787817:nmh	71.392
AX-89868097:nmh	71.392
AX-89787900:nmh	72.357
AX-89828201:nmh	72.357
AX-89884815:nmh	72.835
AX-89787921:ph3	72.84
AX-89828280:nmh	72.84
AX-89848202:ph3	73.314
AX-89889894:nmh	74.288
AX-89827364:nmh	74.288
AX-89863444:nmh	74.771
AX-89848176:ph3	75.735
AX-89787294:ph3	75.735
AX-89870344:nmh	76.095
AX-89827495:ph3	76.455
AX-89827497:nmh	76.815
AX-89787247:nmh	77.176
AX-89787256:nmh	77.176
AX-89827281:nmh	77.537
AX-89827541:ph3	77.894
AX-89784856:nmh	81.476
AX-89827337:nmh	85.018
AX-89884434:nmh	85.018
AX-89807269:ph3	85.087
AX-89872417:nmh	94.588
AX-89804013:nmh	94.588
AX-89826281:nmh	97.698
AX-89865667:ph3	102.38
AX-89827783:ph3	103.463
AX-89885335:ph3	104.182
AX-89784566:nmh	104.909
group 3D	
AX-89828350:ph3	0
AX-89823564:ph3	0
AX-89847674:ph3	0
AX-89880905:nmh	0.18
AX-89827567:ph3	0.36
AX-89848249:ph3	0.36
AX-89852152:ph3	1.079
AX-89793952:ph3	1.079
AX-89846249:nmh	1.079
AX-89848137:ph3	2.91
AX-89786520:nmh	2.91
AX-89786431:ph3	2.91

AX-89882775:nmh	3.511
AX-89825497:nmh	4.112
AX-89882377:ph3	4.714
AX-89785467:nmh	4.714
AX-89785340:ph3	4.714
AX-89904823:ph3	4.714
AX-89824674:ph3	5.798
AX-89904999:ph3	5.798
AX-89904752:ph3	5.798
AX-89784770:nmh	5.798
AX-89787138:nmh	5.798
AX-89848178:ph3	6.883
AX-89884650:nmh	6.883
AX-89863426:nmh	7.967
AX-89905008:ph3	7.967
AX-89884718:nmh	9.051
AX-89870358:nmh	9.051
AX-89884767:ph3	9.051
AX-89787498:nmh	9.957
AX-89827698:nmh	10.406
AX-89885286:nmh	10.855
AX-89848201:ph3	10.855
AX-89848257:ph3	11.215
AX-89885259:nmh	12.299
AX-89885348:nmh	12.299
AX-89787861:ph3	12.299
AX-89787854:nmh	12.299
AX-89885188:nmh	13.315
AX-89885077:nmh	13.819
AX-89885126:nmh	14.324
AX-89885098:ph3	14.828
AX-89815461:ph3	15.188
AX-89885075:ph3	16.283
AX-89827954:ph3	16.642
AX-89902217:ph3	19.285
AX-89787588:ph3	19.806
AX-89827834:nmh	20.42
AX-89825821:nmh	21.034
AX-89882945:ph3	21.034
AX-89845814:ph3	21.394
AX-89825894:nmh	23.151
AX-89825911:nmh	23.584
AX-89872441:ph3	23.584
AX-89883076:ph3	24.308
AX-89807677:nmh	26.827
AX-89825997:ph3	28.727
AX-89788001:nmh	29.077
AX-89787992:nmh	29.441
AX-89890262:ph3	29.441
AX-89882869:nmh	29.806

AX-89792176:ph3	29.806
AX-89785924:nmh	29.806
AX-89831842:nmh	29.806
AX-89828418:ph3	29.806
AX-89826001:nmh	30.404
AX-89890182:ph3	30.404
AX-89831841:nmh	30.708
AX-89788025:ph3	31.61
AX-89828363:nmh	31.61
AX-89831830:nmh	32.089
AX-89831874:nmh	33.547
AX-89831872:nmh	34.026
AX-89856176:nmh	34.519
AX-89785760:nmh	35.484
AX-89804068:nmh	35.963
AX-89882782:nmh	35.963
AX-89785817:ph3	35.963
AX-89825523:nmh	35.963
AX-89825663:ph3	36.654
AX-89880969:nmh	36.714
AX-89784234:nmh	36.714
AX-89785868:nmh	37.345
AX-89823796:nmh	38.035
AX-89885542:nmh	38.035
AX-89803894:nmh	38.726
AX-89881062:ph2	38.999
AX-89784364:nmh	40.511
AX-89784422:nmh	42.024
AX-89824026:ph3	42.774
AX-89881207:nmh	43.525
AX-89881251:nmh	45.037
AX-89783239:nmh	51.184
AX-89847482:ph3	51.184
AX-89783249:ph3	51.184
AX-89824330:nmh	52.908
AX-89824290:nmh	53.168
AX-89904724:ph3	53.441
AX-89881487:ph2	53.734
AX-89904718:ph3	54.159
AX-89784672:nmh	54.159
AX-89784702:ph3	54.723
AX-89879322:nmh	55.967
AX-89824384:ph3	55.967
AX-89824383:ph3	55.967
AX-89785041:nmh	55.967
AX-89822256:nmh	56.95
AX-89881819:nmh	57.335
AX-89881821:nmh	57.335
AX-89879343:ph3	57.438
AX-89822222:ph3	57.438

AX-89884153:ph3	58.421
AX-89884143:nmh	58.704
AX-89827016:nmh	58.704
AX-89827072:ph3	61.461
AX-89884186:nmh	61.461
AX-89856500:nmh	61.461
AX-89884248:ph3	61.461
AX-89827121:nmh	62.366
AX-89800580:nmh	63.734
AX-89861053:nmh	64.184
AX-89799209:ph3	65.089
AX-89826024:ph3	65.089
AX-89883176:nmh	65.449
AX-89904881:ph3	65.449
AX-89904759:ph3	65.809
AX-89904762:ph3	65.989
AX-89881697:ph3	66.169
AX-89883327:nmh	67.988
AX-89826262:ph3	67.988
AX-89883410:ph3	67.988
AX-89883397:ph3	68.348
AX-89786208:nmh	69.067
AX-89826076:nmh	70.517
AX-89847865:ph3	73.459
AX-89785529:nmh	74.178
AX-89785531:ph3	74.178
AX-89785559:nmh	74.898
AX-89807071:nmh	75.617
AX-89882601:nmh	76.337
AX-89811741:nmh	77.056
AX-89785274:ph3	78.505
AX-89786475:nmh	79.955
AX-89786528:nmh	80.674
AX-89883744:nmh	82.124
AX-89786772:nmh	82.843
AX-89865636:nmh	82.843
AX-89786390:nmh	83.562
group 4A	
AX-89905083:ph3	0
AX-89829754:ph3	0
AX-89791488:nmh	0.719
AX-89888621:nmh	0.719
AX-89888690:nmh	1.664
AX-89791520:nmh	3.623
AX-89791547:nmh	5.073
AX-89887919:nmh	6.522
AX-89892081:ph3	7.242
AX-89857981:nmh	7.961
AX-89793568:nmh	8.68

AX-89793608:nmh	9.4
AX-89807899:ph2	9.4
AX-89892153:ph3	9.4
AX-89908829:nmh	10.119
AX-89892193:ph3	10.119
AX-89793639:nmh	10.119
AX-89791536:nmh	10.299
AX-89888955:nmh	10.479
AX-89892198:ph3	10.479
AX-89868312:ph3	10.479
AX-89791150:ph3	10.839
AX-89831723:ph3	10.839
AX-89889023:nmh	11.418
AX-89791096:ph3	11.788
AX-89905355:ph3	11.917
AX-89791082:ph3	12.276
AX-89848713:ph3	12.276
AX-89788164:ph3	12.636
AX-89788314:ph3	13.356
AX-89791054:ph3	13.356
AX-89828600:ph3	13.715
AX-89905180:ph3	14.074
AX-89848421:ph3	14.433
AX-89829658:ph3	14.793
AX-89789198:ph3	14.793
AX-89868171:ph3	15.518
AX-89789171:ph3	15.518
AX-89829518:ph3	18.011
AX-89829504:ph3	18.83
AX-89784745:ph3	22.18
AX-89804356:nmh	22.999
AX-89886446:ph3	23.818
AX-89905147:ph3	24.637
AX-89868159:ph3	25.456
AX-89852345:ph3	27.949
AX-89912959:nmh	28.769
AX-89788970:ph3	28.769
AX-89781168:ph3	28.769
AX-89887096:nmh	29.488
AX-89789478:ph3	29.488
AX-89789456:ph3	29.488
AX-89789565:nmh	30.403
AX-89848470:ph3	30.403
AX-89830006:nmh	30.682
AX-89830478:ph3	33.19
AX-89887622:ph3	34.105
AX-89830451:nmh	35.021
AX-89887624:ph3	35.021
AX-89830430:nmh	35.75
AX-89830406:ph3	37.968

AX-89887578:ph3	37.968
AX-89865926:ph3	38.697
AX-89789780:ph3	38.697
AX-89887432:nmh	40.173
AX-89830138:ph3	40.909
AX-89789675:ph3	40.909
AX-89830614:ph3	41.638
AX-89789649:ph3	41.815
AX-89887967:ph3	48.608
AX-89790195:nmh	48.608
AX-89848554:ph3	48.608
AX-89830834:nmh	49.698
AX-89790332:nmh	50.243
AX-89790304:nmh	50.788
AX-89807592:ph3	51.878
AX-89848582:ph3	51.878
AX-89857232:ph3	51.878
AX-89913169:ph3	52.512
AX-89867192:ph3	53.687
AX-89913200:nmh	53.826
AX-89807608:nmh	53.826
AX-89872574:nmh	54.7
AX-89790484:ph3	54.769
AX-89804629:nmh	67.023
AX-89790773:nmh	67.597
AX-89868274:ph3	67.698
AX-89888508:ph3	68.374
AX-89788811:nmh	68.374
AX-89790739:ph3	68.374
AX-89829092:nmh	69.469
AX-89788735:ph3	70.564
AX-89886289:nmh	70.564
AX-89886315:ph3	70.924
AX-89829073:ph3	70.924
AX-89829052:ph3	72.191
AX-89788598:ph3	72.378
AX-89829080:ph3	72.743
AX-89886218:ph3	72.743
group 4B	
AX-89788656:nmh	0
AX-89886290:nmh	0.719
AX-89848357:ph3	0.719
AX-89886354:nmh	0.719
AX-89790751:ph3	3.713
AX-89831335:nmh	3.713
AX-89848654:ph3	3.713
AX-89872581:nmh	4.076
AX-89848642:ph3	4.438
AX-89848632:ph3	4.438

AX-89888456:nmh	4.438
AX-89790696:nmh	5.163
AX-89831159:ph3	14.635
AX-89831161:ph3	14.635
AX-89790592:nmh	15.175
AX-89848618:ph3	15.714
AX-89848620:ph3	15.714
AX-89905304:ph3	15.714
AX-89905293:ph3	16.557
AX-89888296:ph3	16.978
AX-89790543:ph3	17.4
AX-89872577:ph3	18.243
AX-89888237:ph3	18.243
AX-89848592:ph3	18.61
AX-89848587:ph3	19.508
AX-89790454:nmh	19.508
AX-89790422:nmh	20.324
AX-89905281:ph3	21.14
AX-89888106:nmh	22.224
AX-89848577:ph3	22.224
AX-89888090:nmh	22.764
AX-89848572:ph3	23.304
AX-89830913:ph3	23.304
AX-89888067:nmh	23.304
AX-89848562:ph3	24.522
AX-89905259:ph3	25.126
AX-89830130:nmh	35.261
AX-89887324:ph3	35.865
AX-89789697:nmh	36.47
AX-89830153:ph3	37.075
AX-89887421:nmh	37.622
AX-89905217:ph3	38.17
AX-89887459:nmh	38.17
AX-89830339:ph3	38.529
AX-89789839:nmh	38.529
AX-89863645:nmh	39.13
AX-89861428:ph3	40.339
AX-89789962:nmh	40.518
AX-89848510:ph3	40.698
AX-89848513:ph3	40.698
AX-89887758:nmh	41.962
AX-89830059:nmh	42.398
AX-89848520:ph3	42.507
AX-89829988:nmh	43.71
AX-89905235:ph3	45.38
AX-89790049:nmh	46.522
AX-89830487:nmh	46.569
AX-89887678:ph3	46.569
AX-89887268:nmh	48.402
AX-89789602:ph3	48.866

AX-89887228:nmh	49.8
AX-89830046:ph3	49.8
AX-89830018:ph3	50.16
AX-89830023:ph3	50.16
AX-89848466:ph3	50.519
AX-89857094:ph3	50.519
AX-89829849:nmh	51.604
AX-89789500:ph3	51.604
AX-89905203:ph3	51.604
AX-89887142:ph3	51.604
AX-89848444:ph3	51.966
AX-89789410:ph3	52.329
AX-89789334:nmh	52.989
AX-89886659:ph3	53.648
AX-89863611:ph3	53.922
AX-89789017:nmh	54.308
AX-89829441:nmh	54.968
AX-89887061:ph3	55.515
AX-89829421:nmh	55.628
AX-89886580:ph3	55.628
AX-89788940:nmh	56.468
AX-89887039:ph3	57.108
AX-89829851:ph3	57.108
AX-89789335:ph3	57.898
AX-89789332:ph3	57.898
AX-89788916:nmh	58.293
AX-89829426:ph3	58.689
AX-89886569:nmh	58.689
AX-89807438:nmh	59.622
AX-89829317:ph3	60.282
AX-89788864:nmh	60.282
AX-89872543:ph3	60.282
AX-89789281:nmh	61.428
AX-89863177:ph2	61.428
AX-89789295:ph3	62.796
AX-89807461:ph3	63.085
AX-89829494:nmh	63.085
AX-89861325:ph3	63.313
AX-89912742:nmh	63.313
AX-89789127:nmh	63.716
AX-89905164:ph3	64.15
AX-89886885:ph3	64.987
AX-89848414:ph3	64.987
AX-89886789:nmh	64.987
AX-89886785:ph3	64.987
AX-89886816:ph3	64.987
AX-89861388:ph3	65.455
AX-89905087:ph2	65.924
AX-89848680:ph3	66.392
AX-89789260:ph3	66.535

AX-89880097:nmh	67.819
AX-89885792:nmh	68.083
AX-89872596:ph3	68.083
AX-89832070:ph3	68.763
AX-89885907:nmh	69.707
AX-89831430:ph3	69.959
AX-89791332:nmh	70.412
AX-89783605:ph3	71.758
AX-89857361:nmh	71.985
AX-89863754:nmh	72.765
AX-89885682:ph3	73.792
AX-89870780:nmh	73.792
AX-89831649:ph3	75.138
AX-89848718:ph3	75.138
AX-89791063:ph3	75.138
AX-89848721:ph3	76.592
AX-89791140:nmh	76.592
AX-89888918:nmh	76.592
AX-89791127:ph3	76.592
AX-89831764:nmh	78.379
AX-89831776:ph3	78.379
AX-89810084:nmh	78.748
AX-89888980:ph3	79.873
AX-89892188:ph3	79.873
AX-89806446:ph3	80.053
AX-89889017:ph3	80.233
AX-89848727:ph3	80.593
AX-89791135:nmh	83.1
AX-89834893:nmh	86.018
AX-89793544:nmh	86.018
AX-89863976:nmh	86.525
AX-89848759:ph3	87.723
AX-89804567:nmh	87.904
AX-89824232:nmh	88.441
AX-89828574:ph3	88.441
AX-89791527:ph3	89.166
AX-89831573:nmh	89.525
AX-89790949:nmh	89.525
AX-89807636:nmh	89.885
AX-89790918:ph3	89.885
AX-89863738:nmh	89.885
AX-89831497:ph3	89.885
AX-89892083:nmh	90.065
AX-89905333:ph3	90.245
AX-89888607:nmh	91.716
AX-89870761:nmh	91.716
AX-89793554:ph3	91.885
AX-89831426:nmh	92.441
AX-89888749:nmh	93.165
AX-89905379:ph3	93.165

AX-89790346:nmh	93.525
AX-89830511:ph3	93.525
AX-89886727:ph2	94.609
AX-89861535:ph3	94.609
AX-89886125:ph3	94.972
AX-89886560:nmh	95.334
AX-89848309:ph3	95.334
AX-89863574:ph3	95.334
AX-89886410:ph3	95.334
group 4C	
AX-89789495:ph3	0
AX-89789002:nmh	0
AX-89811829:ph3	0.36
AX-89791499:nmh	1.084
AX-89848448:ph3	1.27
AX-89885734:ph3	2.179
AX-89885761:nmh	2.359
AX-89872565:ph3	2.539
AX-89831507:nmh	3.27
AX-89888730:ph3	4
AX-89885716:nmh	4.731
AX-89788203:nmh	4.731
AX-89811310:nmh	6.189
AX-89831505:ph3	6.196
AX-89887917:nmh	6.752
AX-89793534:nmh	7.302
AX-89790186:ph3	7.853
AX-89834916:nmh	8.962
AX-89790184:nmh	9.345
AX-89830767:nmh	10.383
AX-89834949:ph3	11.213
AX-89892095:nmh	11.421
AX-89834994:nmh	11.763
AX-89888916:nmh	12.314
AX-89831739:nmh	12.314
AX-89834973:ph3	13.512
AX-89888986:nmh	14.55
AX-89791059:nmh	15.588
AX-89791076:nmh	15.588
AX-89791455:nmh	16.957
AX-89791055:ph3	17.68
AX-89856806:nmh	18.066
AX-89783604:ph3	18.29
AX-89790861:ph3	18.649
AX-89822949:ph3	18.649
AX-89912730:nmh	18.829
AX-89848685:ph3	19.008
AX-89789080:ph3	19.368
AX-89872551:ph3	19.368

AX-89848409:ph3	19.728
AX-89829571:nmh	20.088
AX-89886930:nmh	20.834
AX-89885952:ph3	21.94
AX-89886615:nmh	24.518
AX-89788890:nmh	24.518
AX-89886588:ph3	24.518
AX-89789037:nmh	24.877
AX-89788948:ph3	25.602
AX-89788910:nmh	25.602
AX-89886603:ph3	26.322
AX-89848436:ph3	26.681
AX-89789342:nmh	27.417
AX-89829818:ph3	28.152
AX-89886986:ph3	28.512
AX-89852391:nmh	28.512
AX-89886966:ph3	28.872
AX-89887052:nmh	29.596
AX-89905193:ph3	29.596
AX-89857086:nmh	30.321
AX-89789559:ph3	30.681
AX-89789476:ph3	30.681
AX-89868202:ph3	31.041
AX-89829872:nmh	31.532
AX-89905231:ph3	35.129
AX-89848503:ph3	35.129
AX-89804500:ph3	37.371
AX-89790224:ph3	47.182
AX-89790291:ph3	47.182
AX-89887988:nmh	47.182
AX-89790373:ph3	48.205
AX-89790389:nmh	48.713
AX-89888125:nmh	49.735
AX-89831040:nmh	50.243
AX-89888285:nmh	50.751
AX-89913176:nmh	50.94
AX-89888146:ph3	50.94
AX-89831124:ph3	52.174
AX-89790661:nmh	52.827
AX-89848631:ph3	52.827
AX-89790564:ph3	53.093
AX-89848623:ph3	54.078
AX-89790619:nmh	55.547
AX-89888358:ph3	55.547
AX-89781839:ph3	64.537
AX-89790714:ph3	68.381
AX-89848651:nmh	68.381
AX-89857300:ph3	68.381
AX-89790715:nmh	68.381
AX-89790729:ph3	69.1

AX-89790741:ph3	69.1
AX-89790803:nmh	69.819
AX-89888515:ph3	69.819
AX-89861335:nmh	70.785
AX-89811819:ph3	71.264
AX-89807420:ph3	71.264
AX-89829035:ph3	71.264
AX-89788646:nmh	71.264
AX-89829216:nmh	71.445
AX-89807924:ph3	71.627
AX-89886243:nmh	71.627
group 4D	
AX-89829234:nmh	0
AX-89886364:nmh	0
AX-89788668:nmh	0.719
AX-89886316:ph3	0.719
AX-89886234:nmh	0.719
AX-89788597:nmh	0.719
AX-89886259:nmh	0.719
AX-89790744:nmh	1.836
AX-89790815:ph3	1.836
AX-89790777:nmh	1.836
AX-89888412:nmh	3.227
AX-89790602:nmh	27.722
AX-89790586:nmh	29.112
AX-89905291:ph3	29.802
AX-89831110:nmh	29.802
AX-89790495:nmh	30.492
AX-89888065:nmh	30.492
AX-89888196:nmh	31.182
AX-89857217:nmh	32.572
AX-89913133:nmh	32.572
AX-89830824:nmh	32.572
AX-89887339:nmh	37.624
AX-89887343:nmh	37.624
AX-89789720:nmh	39.014
AX-89848491:ph3	39.014
AX-89789755:nmh	39.704
AX-89887414:ph3	39.704
AX-89887466:nmh	41.094
AX-89789761:nmh	41.784
AX-89807523:nmh	41.784
AX-89887516:nmh	42.474
AX-89830393:nmh	42.474
AX-89887598:nmh	43.864
AX-89789913:nmh	44.554
AX-89830446:nmh	44.554
AX-89887676:nmh	45.244
AX-89789979:nmh	45.244

AX-89830540:nmh	45.934
AX-89790030:ph3	45.934
AX-89830570:nmh	45.934
AX-89830575:nmh	45.934
AX-89789994:nmh	45.934
AX-89872559:ph3	46.293
AX-89863629:nmh	47.675
AX-89887265:nmh	48.253
AX-89830092:nmh	48.253
AX-89789604:ph3	48.831
AX-89887216:nmh	48.831
AX-89829970:nmh	49.886
AX-89887161:nmh	50.41
AX-89789587:nmh	50.933
AX-89848463:nmh	51.457
AX-89829941:nmh	51.981
AX-89829930:nmh	51.981
AX-89789413:ph3	52.327
AX-89789011:nmh	52.327
AX-89887090:nmh	52.505
AX-89887085:nmh	52.505
AX-89789389:ph3	53.533
AX-89789414:nmh	54.057
AX-89789412:nmh	54.057
AX-89886562:nmh	55.671
AX-89788963:ph3	55.712
AX-89886516:nmh	57.161
AX-89789033:nmh	57.163
AX-89912881:nmh	57.163
AX-89829374:ph3	58.674
AX-89829413:nmh	58.73
AX-89885935:ph3	63.08
AX-89908242:nmh	63.446
AX-89829345:ph3	63.856
AX-89788894:nmh	63.856
AX-89788877:ph3	63.856
AX-89848376:ph3	64.216
AX-89788376:nmh	64.216
AX-89886710:ph3	65.522
AX-89789147:nmh	65.522
AX-89829595:ph3	66.567
AX-89789244:nmh	66.749
AX-89789196:ph3	66.749
AX-89886892:nmh	67.714
AX-89789251:ph3	68.193
AX-89788260:ph3	68.553
AX-89788214:ph3	68.553
AX-89885849:nmh	68.553
AX-89788354:nmh	68.553
AX-89828616:nmh	68.553

AX-89793627:nmh	80.713
AX-89848291:ph3	83.475
AX-89848770:nmh	83.655
AX-89788189:ph3	83.835
AX-89908547:nmh	85.288
AX-89913358:nmh	85.288
AX-89899762:ph3	85.288
AX-89889308:nmh	87.493
AX-89848517:ph3	88.218
AX-89848695:nmh	88.218
AX-89888717:nmh	88.218
AX-89913246:nmh	88.578
AX-89831499:nmh	88.578
AX-89868285:ph3	88.578
AX-89790785:ph3	89.662
AX-89905265:ph3	89.662
AX-89790854:nmh	89.662
AX-89888540:ph3	89.662
group 5A	
AX-89794064:nmh	0
AX-89807969:ph3	0
AX-89893243:ph3	0
AX-89833101:nmh	0.904
AX-89804852:ph3	1.808
AX-89792830:nmh	2.712
AX-89791871:nmh	3.077
AX-89905677:ph3	3.616
AX-89792058:nmh	3.675
AX-89792080:nmh	4.272
AX-89891977:ph3	5.437
AX-89913725:nmh	5.476
AX-89892078:nmh	5.476
AX-89835101:ph3	7.258
AX-89835415:nmh	7.295
AX-89908881:nmh	7.295
AX-89793954:nmh	7.893
AX-89892774:nmh	10.954
AX-89794041:nmh	11.858
AX-89849378:ph3	14.294
AX-89905115:ph3	14.61
AX-89794241:nmh	14.891
AX-89849380:ph3	15.514
AX-89835795:ph3	17.335
AX-89893021:ph3	17.335
AX-89794224:nmh	17.335
AX-89794185:nmh	18.975
AX-89794176:nmh	19.514
AX-89892956:ph3	19.514
AX-89892958:ph3	19.514

AX-89849361:ph3	20.052
AX-89794104:ph3	20.601
AX-89807957:ph3	21.688
AX-89794340:ph3	21.688
AX-89835899:ph3	21.868
AX-89794308:ph3	21.868
AX-89905836:ph3	22.048
AX-89794414:ph3	22.048
AX-89892864:nmh	22.048
AX-89794325:ph3	22.528
AX-89864068:ph3	23.007
AX-89893146:ph3	23.487
AX-89794069:nmh	23.667
AX-89892874:ph3	23.847
AX-89893282:ph3	24.383
AX-89861801:ph3	26.05
AX-89905845:ph3	27.143
AX-89836065:nmh	27.143
AX-89815608:ph3	27.143
AX-89905846:ph3	27.143
AX-89849429:ph3	28.315
AX-89893408:nmh	28.315
AX-89836666:nmh	28.7
AX-89794893:ph3	29.085
AX-89836642:nmh	29.085
AX-89836593:nmh	30.257
AX-89849468:ph3	30.257
AX-89836580:nmh	30.642
AX-89893323:ph3	32.625
AX-89836200:ph3	32.625
AX-89836075:ph3	32.625
AX-89864076:ph3	33.48
AX-89794352:nmh	34.335
AX-89893235:nmh	35.19
AX-89893417:ph3	36.913
AX-89805106:ph3	36.913
AX-89808037:nmh	37.768
AX-89794793:ph3	37.862
AX-89836526:nmh	37.862
AX-89849457:ph3	38.483
AX-89893701:nmh	38.483
AX-89794773:nmh	38.623
AX-89794722:ph3	39.104
AX-89893641:ph3	39.725
AX-89849442:ph3	39.725
AX-89905873:ph3	40.346
AX-89809452:nmh	40.346
AX-89794655:ph3	40.346
AX-89849439:ph3	40.346
AX-89905867:ph3	41.065

AX-89872678:ph3	41.065
AX-89836304:ph3	41.065
AX-89893533:ph3	42.153
AX-89794765:nmh	44.352
AX-89808030:ph3	45.085
AX-89811980:ph3	45.449
AX-89794566:ph3	47.716
AX-89893469:ph3	47.716
AX-89836223:ph3	47.716
AX-89893448:ph3	47.716
AX-89807717:ph3	48.075
AX-89889570:ph3	48.075
AX-89832349:ph3	48.075
AX-89889496:ph3	48.435
AX-89863798:ph3	48.795
AX-89832229:ph3	48.795
AX-89832257:ph3	49.275
AX-89791636:ph3	49.754
AX-89857497:ph3	50.234
AX-89804734:ph3	50.234
AX-89852611:ph3	50.234
AX-89848779:ph3	50.234
AX-89791571:ph3	50.683
AX-89848775:ph3	51.132
AX-89836973:ph3	52.038
AX-89894153:ph3	52.517
AX-89849506:ph3	53.482
AX-89836948:ph3	53.482
AX-89795084:ph3	54.373
AX-89836882:ph3	54.755
AX-89849502:ph3	55.56
AX-89836687:nmh	57.946
AX-89894048:ph3	60.101
AX-89836822:ph3	60.163
AX-89872698:ph3	62.1
AX-89836856:ph3	63.542
AX-89905897:ph3	65.836
AX-89849485:ph3	67.432
AX-89836749:nmh	67.432
AX-89836771:ph3	67.432
AX-89848864:ph3	72.177
AX-89848841:ph3	73.337
AX-89889789:ph3	74.498
AX-89905413:ph3	76.835
AX-89848796:nmh	76.835
AX-89835320:ph3	76.835
AX-89905524:nmh	77.198
AX-89835335:ph3	77.56
AX-89793859:nmh	77.56
AX-89832481:ph3	78.282

AX-89848939:ph3	79.004
AX-89792411:nmh	79.004
AX-89890594:ph2	79.004
AX-89848951:ph3	79.004
AX-89890546:nmh	80.456
AX-89890386:ph3	81.19
AX-89848927:ph3	81.908
AX-89905518:ph3	82.268
AX-89833164:nmh	82.63
AX-89833178:nmh	82.993
AX-89890431:ph3	82.993
AX-89835389:nmh	83.9
AX-89848909:ph3	84.807
AX-89835388:ph3	84.807
AX-89835384:nmh	85.167
AX-89833530:ph3	85.349
AX-89890758:ph3	85.892
AX-89832858:nmh	86.251
AX-89833523:nmh	86.611
AX-89792533:ph3	86.611
AX-89905547:ph3	86.971
AX-89905637:nmh	86.971
AX-89905612:ph3	88.425
AX-89815561:ph3	88.425
AX-89804911:nmh	88.425
AX-89849037:ph3	88.785
AX-89891066:nmh	88.785
AX-89792747:ph3	90.227
AX-89833764:nmh	90.592
AX-89891411:ph3	90.954
AX-89890902:nmh	90.954
AX-89848988:ph3	90.954
AX-89848997:ph3	90.954
AX-89868412:ph3	91.314
AX-89908687:ph3	91.314
AX-89792871:nmh	91.314
AX-89890730:ph3	92.738
AX-89834312:ph3	94.162
AX-89891812:ph3	97.032
AX-89891820:ph3	97.756
AX-89834622:ph3	97.756
AX-89849199:nmh	98.119
AX-89881015:ph3	98.481
AX-89847690:ph3	98.481
AX-89834563:ph3	98.841
AX-89804969:ph3	98.841
AX-89834349:nmh	98.841
AX-89834536:ph3	99.56
AX-89849184:ph3	99.56
AX-89913825:ph3	100.285

AX-89861706:ph3	100.285
AX-89905694:ph3	101.38
AX-89905693:ph3	101.74
AX-89891663:ph3	101.74
AX-89834425:ph3	102.099
AX-89834395:ph3	102.099
AX-89793167:ph3	102.459
AX-89891573:ph3	102.998
AX-89875030:ph3	104.269
AX-89847060:ph3	104.269
AX-89779729:ph3	104.628
AX-89817799:ph3	104.628
AX-89874896:ph3	104.988
AX-89793530:ph3	105.348
AX-89892020:ph3	105.708
AX-89793497:ph3	105.708
AX-89793489:ph3	106.067
AX-89849225:ph3	106.792
AX-89793428:ph3	107.152
AX-89891907:ph3	107.511
AX-89849212:ph3	107.871
AX-89834697:ph3	107.871
AX-89863956:ph3	108.596
AX-89793850:ph3	108.596
AX-89892432:ph3	109.691
AX-89849304:ph3	109.691
AX-89793757:ph3	111.087
AX-89849289:ph3	111.504
AX-89892382:ph3	111.504
AX-89890163:ph3	111.864
AX-89792127:ph3	111.864
AX-89903710:ph3	112.589
AX-89892218:ph3	112.948
AX-89892226:ph3	112.948
AX-89892319:ph3	113.308
AX-89892320:ph3	113.308
group 5B	
AX-89868502:ph3	0
AX-89793739:ph3	0.719
AX-89793694:ph3	0.719
AX-89792136:nmh	2.169
AX-89892367:nmh	2.169
AX-89890161:ph3	2.169
AX-89835271:ph3	4.537
AX-89861737:ph3	22.768
AX-89875044:ph2	25.136
AX-89834400:ph3	25.136
AX-89849158:ph3	25.136
AX-89891697:ph3	25.856

AX-89834460:ph3	25.856
AX-89847686:ph3	26.58
AX-89905707:ph3	26.94
AX-89891551:ph3	26.94
AX-89833078:ph3	27.858
AX-89905499:ph3	28.383
AX-89875272:ph3	28.383
AX-89792927:nmh	28.93
AX-89891397:ph3	29.478
AX-89792983:ph3	29.838
AX-89905650:ph3	29.838
AX-89891369:nmh	29.838
AX-89833851:ph3	30.922
AX-89833828:ph3	30.922
AX-89849064:ph3	31.282
AX-89890962:nmh	32.047
AX-89833245:ph3	37.51
AX-89905535:ph3	41.194
AX-89889666:ph3	42.255
AX-89791812:nmh	42.436
AX-89807736:ph3	43.317
AX-89832578:ph3	44.378
AX-89889926:ph3	44.484
AX-89794915:nmh	45.518
AX-89849492:ph3	46.059
AX-89795045:nmh	46.059
AX-89849497:ph3	46.6
AX-89795124:nmh	47.14
AX-89894163:ph3	47.681
AX-89836958:nmh	47.681
AX-89864144:nmh	49.902
AX-89889406:nmh	52.067
AX-89889395:nmh	53.141
AX-89889423:nmh	55.305
AX-89836291:nmh	56.38
AX-89893599:nmh	57.454
AX-89893760:nmh	58.528
AX-89836457:nmh	58.528
AX-89794341:nmh	66.395
AX-89908945:nmh	66.395
AX-89835841:ph3	69.666
AX-89893043:nmh	69.666
AX-89794266:nmh	70.528
AX-89848345:ph3	71.968
AX-89835671:ph3	72.943
AX-89868139:ph3	73.668
AX-89835707:nmh	73.668
AX-89893016:nmh	74.52
AX-89828847:nmh	75.371
AX-89858118:nmh	76.223

AX-89835511:nmh	76.223
AX-89793962:ph3	77.522
AX-89892638:nmh	78.787
AX-89835399:ph3	79.639
AX-89892612:ph3	79.682
AX-89892665:ph3	79.682
AX-89891800:ph3	81.461
AX-89834854:nmh	81.461
AX-89793631:nmh	81.461
AX-89792043:nmh	93.519
group 5C	
AX-89891993:nmh	0
AX-89834794:nmh	0.763
AX-89793667:ph3	4.545
AX-89792123:nmh	5.489
AX-89792114:ph3	6.914
AX-89913490:nmh	7.494
AX-89892406:nmh	7.972
AX-89793784:ph3	8.936
AX-89905731:nmh	8.936
AX-89835214:nmh	8.936
AX-89835283:ph3	8.936
AX-89892439:ph3	8.936
AX-89849298:ph3	8.936
AX-89834636:ph3	9.474
AX-89807443:nmh	11.119
AX-89835266:ph3	11.119
AX-89832883:nmh	11.119
AX-89793398:ph3	12.675
AX-89793378:nmh	15.958
AX-89868489:ph3	17.078
AX-89905747:ph3	17.078
AX-89793408:nmh	17.258
AX-89847049:ph3	17.438
AX-89904246:ph3	17.798
AX-89905683:ph3	18.157
AX-89874944:ph3	18.225
AX-89779788:nmh	18.727
AX-89779781:ph3	18.875
AX-89806467:nmh	19.083
AX-89874899:nmh	19.34
AX-89905682:ph3	19.954
AX-89834444:nmh	20.554
AX-89861709:ph3	21.763
AX-89891732:ph3	21.763
AX-89904693:ph3	22.122
AX-89834548:ph3	22.122
AX-89891740:nmh	22.662
AX-89834594:ph3	23.202

AX-89793360:ph3	23.202
AX-89793147:ph3	24.109
AX-89890707:ph3	25.016
AX-89833453:ph3	25.016
AX-89848961:ph3	25.016
AX-89833090:ph3	25.735
AX-89818133:ph3	28.729
AX-89780053:ph3	28.729
AX-89818136:nmh	28.729
AX-89849145:ph3	29.579
AX-89834164:nmh	30.429
AX-89792899:ph3	31.279
AX-89792560:ph3	31.279
AX-89891242:nmh	31.279
AX-89905559:ph3	31.999
AX-89890971:nmh	31.999
AX-89833677:ph3	31.999
AX-89833717:ph3	32.359
AX-89833786:ph3	32.718
AX-89890952:ph3	32.718
AX-89891127:nmh	33.803
AX-89891047:ph3	33.803
AX-89891054:ph3	33.803
AX-89849039:ph3	33.803
AX-89833999:nmh	37.767
AX-89908603:nmh	39.734
AX-89890507:ph3	41.702
AX-89848911:ph3	41.702
AX-89792387:ph3	41.749
AX-89848948:ph3	42.332
AX-89890436:nmh	44.274
AX-89832446:ph3	44.274
AX-89905418:ph3	44.274
AX-89791808:ph3	44.634
AX-89905425:ph3	44.634
AX-89868363:ph3	45.356
AX-89872607:nmh	45.359
AX-89791995:nmh	45.719
AX-89889809:ph3	46.078
AX-89868368:ph3	46.438
AX-89791940:ph3	46.438
AX-89905906:ph3	53.699
AX-89836852:ph3	54.458
AX-89836879:ph3	55.217
AX-89849510:ph3	55.217
AX-89894091:nmh	55.977
AX-89832187:nmh	57.506
AX-89889446:ph3	59.035
AX-89889491:nmh	59.035
AX-89832313:nmh	59.795

AX-89905410:ph3	60.554
AX-89836240:nmh	62.083
AX-89893553:nmh	62.842
AX-89836356:nmh	63.602
AX-89893657:nmh	64.361
AX-89893694:nmh	65.12
AX-89849464:ph3	67.431
AX-89836573:nmh	67.611
AX-89849466:ph3	67.791
AX-89849469:ph3	68.15
AX-89853048:nmh	68.15
AX-89909010:ph3	68.15
AX-89893398:ph3	69.006
AX-89836672:nmh	69.401
AX-89836185:nmh	70.651
AX-89807993:ph3	70.651
AX-89905855:ph3	71.043
AX-89835978:nmh	72.029
AX-89794321:nmh	72.184
AX-89794397:ph3	72.847
AX-89893350:nmh	72.987
AX-89835884:nmh	74.018
AX-89794154:ph3	74.018
AX-89849402:ph3	74.654
AX-89886053:nmh	74.654
AX-89794215:ph3	74.654
AX-89794426:ph3	74.654
AX-89828877:ph3	75.778
AX-89828875:nmh	76.902
AX-89835620:ph3	77.38
AX-89892889:ph3	77.909
AX-89788464:nmh	78.025
AX-89794140:ph3	78.438
AX-89871174:nmh	78.438
AX-89892729:ph3	79.149
AX-89892764:nmh	79.149
AX-89835799:nmh	79.504
AX-89794268:nmh	80.033
AX-89828949:nmh	80.562
AX-89828937:nmh	81.091
AX-89885994:ph3	82.157
AX-89892767:ph3	82.686
AX-89914030:nmh	83.215
AX-89914029:nmh	83.215
AX-89793708:ph3	83.744
AX-89892496:nmh	83.744
AX-89892468:ph3	83.744
AX-89905702:ph3	84.464
AX-89836759:nmh	85.913

group 5D	
AX-89792265:nmh	0
AX-89833292:ph3	0
AX-89889802:ph3	0.36
AX-89836268:ph3	0.719
AX-89892157:nmh	0.719
AX-89807832:nmh	0.719
AX-89857608:ph3	1.259
AX-89848967:ph3	1.799
AX-89848965:ph3	1.799
AX-89792568:ph3	1.799
AX-89792965:ph3	2.889
AX-89891506:nmh	3.751
AX-89849233:ph3	5.053
AX-89835402:ph3	5.074
AX-89793304:ph3	5.074
AX-89793984:nmh	8.126
AX-89835291:ph3	8.568
AX-89905806:ph3	9.129
AX-89792247:nmh	9.129
AX-89835461:nmh	9.129
AX-89849338:ph3	9.586
AX-89849333:nmh	9.586
AX-89849331:ph3	9.754
AX-89788466:ph3	10.206
AX-89905813:ph3	10.206
AX-89864056:nmh	12.676
AX-89805071:nmh	12.676
AX-89849375:ph3	12.676
AX-89892992:nmh	14.31
AX-89835746:nmh	15.944
AX-89835722:ph3	15.944
AX-89835706:ph3	16.756
AX-89810305:nmh	18.39
AX-89794086:ph3	20.025
AX-89849384:ph3	20.836
AX-89835872:ph3	20.836
AX-89893144:ph3	21.647
AX-89893223:ph3	24.117
AX-89858225:nmh	24.928
AX-89893354:nmh	25.739
AX-89868564:ph3	25.739
AX-89794481:nmh	26.551
AX-89836186:nmh	29.02
AX-89808002:nmh	29.02
AX-89836637:ph3	29.832
AX-89836478:ph3	33.149
AX-89893819:ph3	33.149
AX-89858296:ph3	33.762
AX-89836364:nmh	34.767

AX-89836298:ph3	34.767
AX-89836376:ph3	34.767
AX-89832392:ph3	36.408
AX-89889559:ph3	37.738
AX-89889451:ph3	38.61
AX-89893498:ph3	38.61
AX-89889450:nmh	38.61
AX-89894161:nmh	39.335
AX-89836944:nmh	40.06
AX-89894109:nmh	40.784
AX-89795102:ph3	40.784
AX-89894085:nmh	40.784
AX-89894007:ph3	41.504
AX-89836859:nmh	41.504
AX-89872692:ph3	41.863
AX-89894047:nmh	42.58
AX-89849484:ph3	43.675
AX-89889963:nmh	44.041
AX-89905895:ph3	44.402
AX-89893959:nmh	44.402
AX-89832723:ph3	44.927
AX-89836853:nmh	45.703
AX-89848858:ph3	46.204
AX-89794982:nmh	46.304
AX-89889936:ph3	47.645
AX-89889940:nmh	47.652
AX-89791899:nmh	48.372
AX-89832605:ph3	48.372
AX-89848827:ph3	48.372
AX-89791872:ph3	48.731
AX-89791873:ph3	48.756
AX-89848813:ph3	49.455
AX-89889704:nmh	49.455
AX-89797466:ph3	49.455
AX-89791768:nmh	50.358
AX-89832441:ph3	50.538
AX-89892537:nmh	51.257
AX-89892546:ph3	51.257
AX-89848947:nmh	51.617
AX-89890597:ph3	51.617
AX-89848952:ph3	51.617
AX-89905512:ph3	52.712
AX-89848928:ph3	52.712
AX-89866248:ph3	53.432
AX-89834112:nmh	53.979
AX-89848878:ph3	54.527
AX-89792076:ph3	54.527
AX-89833987:ph3	54.886
AX-89872626:ph3	54.886
AX-89792347:nmh	55.794

AX-89849004:ph3	56.701
AX-89849007:ph3	56.701
AX-89834195:ph3	57.063
AX-89834041:ph3	57.426
AX-89833654:ph3	57.426
AX-89891349:ph3	57.954
AX-89863945:nmh	58.348
AX-89792461:ph3	58.348
group 6A	
AX-89797020:nmh	0
AX-89862066:nmh	0.719
AX-89806405:nmh	1.439
AX-89837339:ph3	6.241
AX-89837555:nmh	9.386
AX-89799529:nmh	10.746
AX-89894487:ph3	11.195
AX-89838309:nmh	11.195
AX-89837731:ph3	11.195
AX-89905983:ph3	11.195
AX-89899836:nmh	11.555
AX-89895096:nmh	12.097
AX-89899410:nmh	12.279
AX-89799442:nmh	12.639
AX-89906556:ph3	12.999
AX-89900192:ph3	12.999
AX-89906482:ph3	14.448
AX-89799217:ph3	14.448
AX-89799623:ph3	15.533
AX-89900059:ph3	15.533
AX-89906484:ph3	16.255
AX-89874457:nmh	17.51
AX-89858919:ph3	18.065
AX-89862644:nmh	18.244
AX-89849905:ph3	18.424
AX-89850105:ph3	18.424
AX-89796546:ph3	21.372
AX-89906178:ph3	21.372
AX-89849836:ph3	22.091
AX-89896121:ph3	22.091
AX-89816273:ph3	22.451
AX-89873353:ph3	22.451
AX-89904110:ph3	24.304
AX-89778715:ph3	24.664
AX-89850117:ph3	26.483
AX-89898582:ph3	26.483
AX-89798459:ph3	27.208
AX-89899151:ph3	27.782
AX-89850231:ph3	28.291
AX-89841853:ph3	28.651

AX-89808625:ph3	29.735
AX-89906546:ph3	29.735
AX-89899929:ph3	30.095
AX-89906542:ph3	30.095
AX-89850330:ph3	30.455
AX-89842577:ph3	30.635
AX-89899893:ph3	30.814
AX-89850324:ph3	30.814
AX-89799692:ph3	31.174
AX-89899809:ph3	31.174
AX-89859649:nmh	31.534
AX-89850313:ph3	31.534
AX-89799684:ph3	32.142
AX-89899707:nmh	32.75
AX-89799653:nmh	32.75
AX-89899701:ph3	33.309
AX-89899691:nmh	33.309
AX-89842379:nmh	33.358
AX-89899618:nmh	33.358
AX-89842417:nmh	33.966
AX-89799624:nmh	34.189
AX-89899594:nmh	35.07
AX-89799580:nmh	35.07
AX-89842291:nmh	35.191
AX-89899503:nmh	35.951
AX-89859600:nmh	35.951
AX-89842288:nmh	36.416
AX-89899534:nmh	37.024
AX-89899527:nmh	37.024
AX-89842181:ph3	37.632
AX-89805785:ph3	37.632
AX-89842225:nmh	37.726
AX-89799414:nmh	37.726
AX-89799451:ph3	38.24
AX-89842179:ph3	38.24
AX-89808559:nmh	38.607
AX-89799371:nmh	38.848
AX-89842060:ph3	39.456
AX-89808552:nmh	39.456
AX-89799337:ph3	40.064
AX-89841999:ph3	41.288
AX-89899263:ph3	41.288
AX-89842033:nmh	41.288
AX-89799317:nmh	41.288
AX-89799318:nmh	41.288
AX-89805764:ph3	41.684
AX-89850246:nmh	43.097
AX-89799296:ph3	43.097
AX-89841986:ph3	43.456
AX-89799291:ph3	43.456

AX-89799222:ph3	43.816
AX-89842807:ph3	44.176
AX-89808635:ph3	44.176
AX-89859552:nmh	44.176
AX-89900000:ph3	44.747
AX-89900104:ph3	45.619
AX-89900107:ph3	45.967
AX-89842821:ph3	45.987
AX-89864642:ph3	46.697
AX-89850353:nmh	47.237
AX-89799998:nmh	47.778
AX-89800063:nmh	48.319
AX-89800053:ph3	48.319
AX-89864649:ph3	48.86
AX-89864650:nmh	48.86
AX-89906563:ph3	48.86
AX-89905957:ph3	49.22
AX-89905954:ph3	49.58
AX-89808079:nmh	49.58
AX-89837378:nmh	50.119
AX-89843053:ph3	50.659
AX-89894555:nmh	50.659
AX-89905947:ph3	50.659
AX-89850374:ph3	51.018
AX-89800143:nmh	51.018
AX-89900271:ph3	51.555
AX-89872838:nmh	52.111
AX-89800105:ph3	52.635
AX-89864187:ph3	53.171
AX-89894657:nmh	53.204
AX-89837523:ph3	53.708
AX-89895055:ph3	54.244
AX-89894715:nmh	55.405
AX-89894748:ph2	56.497
AX-89815650:nmh	57.59
AX-89905989:ph3	57.59
AX-89795730:ph3	58.134
AX-89914496:ph3	58.318
AX-89837743:nmh	58.678
AX-89837741:ph3	58.678
AX-89838351:ph3	59.038
AX-89895570:ph3	59.038
AX-89864227:nmh	59.397
AX-89838410:ph3	59.397
AX-89838247:ph3	59.757
AX-89849702:ph3	59.757
AX-89906079:nmh	59.757
AX-89894375:ph3	63.519
AX-89895231:ph3	67.281
AX-89894220:ph3	72.335

AX-89905920:ph3	72.335
AX-89849810:ph3	72.335
AX-89849529:nmh	72.335
AX-89905926:ph3	73.321
AX-89905924:ph3	73.419
AX-89795885:ph3	73.853
AX-89895190:nmh	73.853
AX-89795201:ph3	74.29
AX-89849823:ph3	75.955
AX-89914706:ph3	75.955
AX-89796432:ph3	75.955
AX-89796439:ph3	76.966
AX-89838940:ph2	77.224
AX-89796445:ph3	78.494
AX-89906153:nmh	79.219
AX-89849835:ph3	79.219
AX-89864278:ph3	79.219
AX-89864281:ph3	79.943
AX-89805405:ph3	79.943
AX-89896151:ph3	80.303
AX-89838860:ph3	81.447
AX-89796500:ph3	83.175
AX-89896228:nmh	84.319
AX-89839019:ph3	84.319
AX-89839105:ph3	84.319
AX-89839114:nmh	85.988
AX-89839204:ph3	86.425
AX-89914807:ph3	87.471
AX-89839243:nmh	87.657
AX-89896542:nmh	88.517
AX-89805451:nmh	88.762
AX-89796934:nmh	89.31
AX-89896627:ph3	90.624
AX-89896458:ph3	90.624
AX-89864329:ph3	91.669
AX-89805467:ph3	92.715
AX-89830709:nmh	94.822
AX-89839496:nmh	94.822
AX-89830733:ph3	95.868
AX-89861450:nmh	96.913
AX-89887854:ph3	96.913
AX-89839658:ph3	97.959
AX-89797034:ph3	99.005
AX-89797062:nmh	100.051
AX-89839792:ph3	100.051
AX-89839802:nmh	102.158
AX-89849962:ph3	103.203
AX-89897273:nmh	103.203
AX-89897394:ph3	105.31
AX-89897581:ph3	105.67

AX-89849996:ph3	106.03
AX-89848738:ph3	106.03
AX-89840243:ph3	106.447
AX-89915024:nmh	107.201
AX-89797345:ph3	107.201
AX-89797328:nmh	107.201
AX-89840306:ph3	107.47
AX-89895119:nmh	109.839
AX-89795824:ph3	109.839
AX-89871645:nmh	111.149
AX-89906316:ph3	111.149
AX-89797602:ph3	111.149
AX-89840386:nmh	111.149
AX-89897710:ph3	111.149
AX-89797617:nmh	112.054
AX-89840398:ph3	112.054
AX-89840448:ph3	112.503
AX-89787085:ph3	112.953
AX-89840449:ph3	112.953
AX-89884365:ph3	112.953
AX-89837902:nmh	114.61
AX-89895088:ph3	114.61
AX-89841196:ph3	116.254
AX-89906319:ph3	116.272
AX-89906324:ph3	116.864
AX-89897723:nmh	116.864
AX-89859342:nmh	117.142
AX-89841255:nmh	117.142
AX-89797824:ph3	118.058
AX-89898396:ph3	118.058
AX-89850121:ph3	118.058
AX-89906412:ph3	119.025
AX-89840642:nmh	119.091
AX-89850151:ph3	119.14
AX-89850085:ph3	120.077
AX-89840702:nmh	120.96
AX-89897935:nmh	121.398
AX-89841578:ph3	121.669
AX-89897879:nmh	122.196
AX-89841581:ph3	122.788
AX-89840760:nmh	124.46
AX-89897912:ph3	124.932
AX-89840672:ph3	126.549
AX-89898036:ph3	126.966
AX-89850082:ph3	127.245
AX-89862098:nmh	127.71
AX-89862101:nmh	132.344
AX-89840958:ph3	132.344
AX-89798051:nmh	132.706
AX-89898236:ph3	133.069

AX-89840988:ph3	133.069
AX-89814687:nmh	133.069
AX-89872779:ph3	134.153
AX-89841019:ph3	134.153
AX-89798151:ph3	134.153
AX-89898287:nmh	135.06
AX-89841111:ph3	135.968
AX-89828474:ph3	136.327
AX-89798211:ph3	136.327
AX-89895454:ph3	136.327
AX-89798222:nmh	136.327
AX-89905076:ph3	137.412
AX-89906092:ph3	137.412
AX-89838138:nmh	137.412
AX-89898918:nmh	137.772
AX-89859442:nmh	137.772
AX-89805307:nmh	137.772
AX-89807382:ph3	138.131
AX-89848283:ph3	138.671
AX-89798654:nmh	139.21
AX-89850169:ph3	139.21
AX-89841682:ph3	139.21
AX-89915264:nmh	141.229
AX-89906449:ph3	143.247
AX-89866643:ph3	143.251
AX-89799029:nmh	143.797
AX-89850199:ph3	144.342
AX-89906464:ph3	144.342
AX-89798988:nmh	144.522
AX-89850217:ph3	144.702
AX-89810724:nmh	144.702
AX-89906454:ph3	145.061
group 6B	
AX-89799051:nmh	0
AX-89850185:ph3	0.719
AX-89899024:nmh	1.439
AX-89906425:ph3	2.158
AX-89798636:nmh	2.878
AX-89796193:nmh	3.597
AX-89841086:nmh	4.317
AX-89898319:nmh	5.036
AX-89841071:nmh	5.755
AX-89850104:ph3	5.755
AX-89798148:nmh	5.755
AX-89915259:nmh	6.352
AX-89798010:ph3	7.638
AX-89867339:ph3	8.572
AX-89850093:ph3	11.416
AX-89797873:ph3	14.26

AX-89840744:ph3	15.194
AX-89864442:nmh	15.194
AX-89897852:nmh	16.128
AX-89897844:ph3	17.062
AX-89841597:nmh	17.997
AX-89898837:nmh	17.997
AX-89841235:nmh	18.931
AX-89795808:nmh	22.751
AX-89908098:nmh	22.751
AX-89815667:ph3	23.686
AX-89840437:ph3	25.568
AX-89832012:ph3	26.502
AX-89906293:ph3	27.436
AX-89797407:nmh	29.318
AX-89897414:ph3	30.252
AX-89906253:ph3	33.096
AX-89839977:nmh	34.979
AX-89849876:ph3	48.317
AX-89839239:nmh	49.252
AX-89866468:nmh	50.186
AX-89839169:nmh	51.12
AX-89849864:ph3	52.054
AX-89839060:ph3	53.936
AX-89896225:ph3	54.871
AX-89796509:nmh	55.805
AX-89906150:ph3	56.739
AX-89896000:nmh	58.621
AX-89895275:ph3	60.503
AX-89796199:nmh	61.438
AX-89895376:nmh	63.32
AX-89849733:ph3	64.254
AX-89894739:nmh	68.922
AX-89837475:nmh	69.507
AX-89795685:ph3	70.686
AX-89837454:nmh	71.864
AX-89858471:nmh	73.645
AX-89837334:nmh	74.823
AX-89843062:nmh	76.002
AX-89842960:nmh	77.18
AX-89915591:ph3	89.744
AX-89850292:nmh	91.799
AX-89799628:nmh	92.384
AX-89899704:nmh	92.969
AX-89853683:nmh	92.969
AX-89842581:nmh	93.554
AX-89915651:ph3	94.4
AX-89816297:nmh	95.334
AX-89899926:ph3	95.334
AX-89859678:nmh	95.334
AX-89842697:ph3	95.334

AX-89850138:ph3	95.514
AX-89915657:ph3	95.694
AX-89850340:ph3	95.694
AX-89842702:nmh	95.694
AX-89799844:ph3	96.36
AX-89899894:nmh	96.36
AX-89895848:nmh	97.7
AX-89778633:ph3	97.7
AX-89816268:ph3	98.077
AX-89796755:ph3	98.366
AX-89839244:nmh	98.366
AX-89778653:ph3	98.86
AX-89849942:ph3	99.031
AX-89869251:nmh	99.643
AX-89897375:ph3	99.697
AX-89897464:ph3	100.362
AX-89895946:ph3	100.426
AX-89839063:nmh	100.426
AX-89803172:ph3	101.028
AX-89874341:nmh	101.028
AX-89896532:ph3	101.209
AX-89839323:nmh	101.209
AX-89874375:ph3	101.693
AX-89779350:nmh	101.693
AX-89897341:ph3	101.992
AX-89897364:nmh	101.992
AX-89803178:nmh	103.034
AX-89910345:ph3	104.375
AX-89779391:ph3	104.375
AX-89779400:ph3	104.382
AX-89840693:nmh	105.094
AX-89817310:ph3	105.094
AX-89779360:nmh	105.824
AX-89798649:nmh	106.544
AX-89894649:ph3	107.263
AX-89900178:nmh	107.263
AX-89837797:nmh	107.983
group 6C	
AX-89881623:nmh	0
AX-89872273:nmh	0.719
AX-89895998:ph3	4.425
AX-89858760:ph3	5.15
AX-89873337:ph3	5.509
AX-89778639:ph3	5.869
AX-89778644:ph3	5.869
AX-89816324:ph3	6.229
AX-89816293:ph3	6.229
AX-89873438:ph3	6.675
AX-89779355:ph3	8.428

AX-89841731:ph3	11.384
AX-89868918:ph3	11.743
AX-89799857:ph3	11.743
AX-89799830:ph3	12.103
AX-89899781:nmh	12.103
AX-89799756:ph3	12.462
AX-89842527:ph3	13.546
AX-89850314:ph3	13.546
AX-89799568:ph3	13.905
AX-89899627:ph3	13.905
AX-89842340:ph3	14.265
AX-89899530:ph3	14.265
AX-89842343:ph3	14.625
AX-89799409:ph3	15.35
AX-89850274:ph3	15.35
AX-89842170:ph3	15.709
AX-89850267:ph3	15.709
AX-89842437:nmh	15.709
AX-89850262:ph3	16.429
AX-89850261:ph3	16.429
AX-89899482:nmh	17.755
AX-89850346:nmh	25.848
AX-89900143:ph3	25.848
AX-89800083:ph3	26.641
AX-89868977:nmh	28.238
AX-89900239:ph3	28.238
AX-89842999:ph3	29.031
AX-89795159:ph3	29.824
AX-89853077:nmh	29.824
AX-89849575:ph3	32.238
AX-89849587:ph3	33.835
AX-89795460:nmh	34.628
AX-89905963:ph3	35.42
AX-89837821:ph3	37.018
AX-89849657:ph3	37.81
AX-89795762:nmh	37.81
AX-89838433:nmh	40.224
AX-89838434:ph3	40.224
AX-89872724:ph3	41.017
AX-89796072:nmh	41.017
AX-89838244:ph3	41.809
AX-89838307:nmh	41.809
AX-89839418:nmh	72.644
AX-89896581:nmh	73.437
AX-89839485:nmh	79.909
AX-89839522:ph3	79.909
AX-89868773:nmh	80.568
AX-89839600:nmh	80.568
AX-89839385:nmh	81.226
AX-89839348:nmh	81.226

AX-89838936:nmh	82.553
AX-89796568:ph3	82.553
AX-89796469:ph3	83.211
AX-89861989:nmh	83.211
AX-89872564:nmh	88.765
AX-89815503:ph3	88.765
AX-89830676:nmh	89.125
AX-89905254:ph3	89.485
AX-89810018:ph3	89.485
AX-89790094:nmh	90.21
AX-89887807:nmh	90.21
AX-89839770:nmh	90.21
AX-89896875:nmh	90.569
AX-89797072:ph3	90.569
AX-89871556:nmh	91.294
AX-89896975:nmh	91.294
AX-89839823:nmh	91.654
AX-89897027:ph3	91.654
AX-89897004:ph3	91.654
AX-89887803:nmh	91.654
AX-89906239:ph3	92.22
AX-89797206:nmh	92.22
AX-89897056:nmh	92.641
AX-89839851:ph3	92.641
AX-89797299:ph3	92.785
AX-89797261:ph3	93.629
AX-89797234:nmh	94.617
AX-89897268:nmh	95.604
AX-89897374:ph3	96.592
AX-89859059:nmh	96.592
AX-89840406:ph3	99.599
AX-89897610:nmh	99.599
AX-89785131:nmh	99.599
AX-89897768:ph3	101.357
AX-89906387:ph3	102.116
AX-89864519:nmh	102.97
AX-89840536:ph3	102.991
AX-89850053:ph3	103.35
AX-89787036:ph3	103.35
AX-89827228:ph3	103.71
AX-89906326:ph3	104.07
AX-89841200:ph3	104.429
AX-89906386:ph3	104.429
AX-89909448:nmh	105.456
AX-89898380:ph3	105.654
AX-89797789:ph3	105.873
AX-89840659:ph3	106.232
AX-89897931:ph3	106.591
AX-89909438:nmh	106.591
AX-89915158:nmh	106.771

AX-89840746:ph3	106.951
AX-89859198:ph3	106.951
AX-89840796:ph3	107.676
AX-89898053:ph3	108.328
AX-89898092:ph3	108.981
AX-89798103:nmh	110.115
AX-89864453:nmh	110.296
AX-89798031:ph3	110.296
AX-89805628:nmh	110.949
AX-89798133:nmh	111.73
AX-89898270:nmh	111.73
AX-89815682:ph3	112.264
AX-89853513:nmh	112.531
AX-89859302:nmh	112.866
AX-89898310:nmh	113.33
AX-89841106:nmh	113.33
AX-89795902:nmh	114.131
AX-89838036:nmh	114.131
AX-89898894:nmh	114.933
AX-89895747:nmh	114.933
AX-89895300:ph3	114.933
AX-89906107:ph3	114.933
AX-89841776:nmh	115.558
AX-89798762:nmh	115.558
AX-89849762:ph3	115.651
AX-89805743:nmh	117.211
AX-89788179:nmh	117.211
AX-89850180:ph3	117.73
AX-89862155:ph3	118.456
AX-89805738:nmh	118.661
group 6D	
AX-89850201:ph3	0
AX-89915462:nmh	0
AX-89853615:nmh	0
AX-89799080:ph3	0.723
AX-89799050:ph3	1.236
AX-89798901:nmh	1.749
AX-89798788:ph3	4.39
AX-89850179:ph3	4.39
AX-89899023:ph3	4.75
AX-89850176:ph3	4.75
AX-89841729:ph3	5.11
AX-89898956:ph3	5.469
AX-89898926:ph3	5.469
AX-89798629:ph3	5.469
AX-89841661:ph3	5.829
AX-89798682:nmh	5.829
AX-89872516:ph3	6.924
AX-89828537:ph3	6.924

AX-89796284:ph3	7.284
AX-89828516:ph3	7.284
AX-89849784:ph3	7.644
AX-89849786:ph3	7.644
AX-89838543:ph3	8.003
AX-89885608:ph3	8.363
AX-89841764:ph3	10.006
AX-89841113:ph3	11.648
AX-89906370:ph3	12.733
AX-89798170:ph3	13.457
AX-89841050:ph3	14.177
AX-89798146:ph3	14.537
AX-89840902:ph3	15.991
AX-89898075:ph3	18.187
AX-89840831:ph3	18.219
AX-89797870:ph3	19.621
AX-89897902:ph3	19.635
AX-89859172:nmh	19.995
AX-89797858:ph3	19.995
AX-89859178:ph3	20.355
AX-89797843:ph3	20.714
AX-89884357:nmh	23.449
AX-89797630:nmh	26.183
AX-89815664:ph3	28.917
AX-89906297:ph3	28.917
AX-89829473:nmh	28.917
AX-89840332:ph3	29.277
AX-89850019:nmh	30.002
AX-89850020:ph3	30.002
AX-89906287:ph3	30.002
AX-89850010:ph3	30.002
AX-89814539:ph2	31.451
AX-89897368:ph3	31.451
AX-89906266:ph3	31.811
AX-89897356:nmh	31.811
AX-89840119:ph3	32.906
AX-89897321:ph3	32.906
AX-89897332:ph3	32.906
AX-89797364:nmh	32.906
AX-89797259:ph3	34.361
AX-89839908:ph3	34.361
AX-89897139:ph3	34.361
AX-89897090:nmh	34.361
AX-89797178:ph3	34.879
AX-89840015:nmh	35.801
AX-89906244:ph3	35.801
AX-89864364:ph3	35.801
AX-89797327:nmh	36.701
AX-89897461:ph3	37.009
AX-89897283:ph3	37.609

AX-89897324:ph3	37.609
AX-89849951:ph3	44.228
AX-89862023:nmh	49.155
AX-89849911:ph3	49.882
AX-89849903:ph3	53.248
AX-89906214:ph3	53.248
AX-89896770:nmh	54.708
AX-89849897:ph3	56.169
AX-89906199:ph3	56.528
AX-89896389:ph3	56.888
AX-89896385:ph3	57.248
AX-89839336:nmh	57.248
AX-89796641:ph3	57.635
AX-89796504:nmh	66.629
AX-89796347:ph3	67.367
AX-89837032:ph3	67.503
AX-89838652:ph3	67.503
AX-89795907:nmh	68.085
AX-89838059:ph3	68.085
AX-89914640:nmh	70.065
AX-89795977:nmh	71.376
AX-89895382:ph3	71.376
AX-89895453:ph3	72.1
AX-89838339:ph3	72.129
AX-89895571:nmh	73.001
AX-89906081:ph3	73.452
AX-89858634:nmh	73.904
AX-89895468:ph3	73.904
AX-89914589:ph3	73.904
AX-89858679:ph3	75.358
AX-89796148:ph3	75.718
AX-89894935:ph3	76.437
AX-89837746:nmh	77.751
AX-89872711:nmh	79.065
AX-89837487:nmh	79.718
AX-89837804:ph3	79.718
AX-89837563:ph3	80.077
AX-89894627:nmh	81.161
AX-89795448:ph3	82.244
AX-89795435:ph3	82.244
AX-89894545:nmh	82.611
AX-89837397:ph3	82.611
AX-89843070:nmh	84.807
AX-89850362:ph3	84.807
AX-89906553:ph3	86.586
AX-89842874:ph3	87.469
AX-89899204:nmh	90.158
AX-89799373:ph3	91.041
AX-89899338:nmh	91.041
AX-89799328:ph3	91.924

AX-89799388:ph3	92.807
AX-89899387:ph3	93.69
AX-89808563:ph3	94.574
AX-89899480:nmh	96.353
AX-89899504:nmh	97.236
AX-89899507:ph3	98.119
AX-89799567:ph3	100.808
AX-89842427:ph3	101.691
AX-89915598:nmh	101.691
AX-89842598:nmh	102.574
AX-89899152:ph3	104.372
AX-89798888:ph3	105.095
AX-89778727:ph3	106.925
AX-89839295:ph3	111.799
AX-89896321:ph3	111.799
AX-89859063:nmh	112.767
AX-89897298:nmh	113.491
AX-89817257:nmh	114.214
AX-89779399:nmh	114.695
AX-89817316:nmh	115.176
AX-89840756:nmh	115.656
AX-89841769:nmh	116.137
AX-89798686:ph3	116.151
AX-89842334:nmh	116.865
AX-89899518:ph3	116.865
AX-89799763:ph3	117.225
AX-89842496:ph3	117.225
AX-89842898:ph3	117.584
AX-89799976:ph3	117.584
AX-89894285:nmh	118.309
AX-89894258:ph3	118.309
AX-89837128:ph3	118.309
AX-89795533:ph3	119.286
AX-89795455:ph3	119.392
AX-89861925:nmh	119.96
AX-89795465:ph3	120.472
AX-89795647:nmh	120.652
AX-89795677:ph3	120.831
AX-89864223:ph3	120.831
group 7A	
AX-89844948:ph3	0
AX-89902242:ph3	0
AX-89902304:nmh	0
AX-89872084:nmh	0.18
AX-89844823:ph3	0.36
AX-89902157:ph3	0.36
AX-89844789:nmh	0.36
AX-89902122:nmh	0.36
AX-89844910:ph3	0.719

AX-89844778:nmh	0.719
AX-89845026:ph3	2.169
AX-89902369:ph3	2.169
AX-89845122:ph3	2.529
AX-89845121:ph3	2.529
AX-89845089:nmh	2.888
AX-89845114:ph3	3.071
AX-89902458:ph3	3.613
AX-89902452:ph3	3.627
AX-89902561:nmh	3.982
AX-89845227:ph3	4.337
AX-89902513:nmh	4.337
AX-89801912:ph3	5.917
AX-89801904:nmh	5.917
AX-89845290:ph3	6.889
AX-89902673:nmh	7.506
AX-89802014:nmh	7.506
AX-89902634:ph3	8.718
AX-89845444:nmh	8.718
AX-89845456:ph2	8.718
AX-89902601:ph3	8.718
AX-89902777:nmh	9.985
AX-89845494:nmh	9.985
AX-89801963:ph3	10.411
AX-89862418:ph3	11.252
AX-89844749:nmh	11.252
AX-89901943:nmh	11.881
AX-89901986:nmh	11.881
AX-89806056:nmh	11.881
AX-89808879:nmh	12.092
AX-89916178:nmh	12.092
AX-89901916:nmh	12.51
AX-89801472:ph3	12.873
AX-89801474:nmh	13.606
AX-89844716:ph3	13.606
AX-89844679:nmh	14.412
AX-89901895:nmh	14.569
AX-89801337:ph3	15.218
AX-89801204:nmh	16.036
AX-89872048:nmh	16.512
AX-89850645:ph3	16.512
AX-89901861:nmh	16.854
AX-89901854:nmh	16.854
AX-89901604:ph3	17.672
AX-89844380:nmh	17.672
AX-89844258:nmh	18.49
AX-89844335:ph3	18.49
AX-89844240:ph3	19.308
AX-89823012:nmh	19.819
AX-89801084:nmh	20.126

AX-89862349:ph3	21.774
AX-89801056:nmh	21.774
AX-89806013:ph3	21.774
AX-89850591:ph3	22.321
AX-89853817:nmh	22.869
AX-89901477:nmh	22.869
AX-89901226:ph3	22.869
AX-89850614:ph3	24.018
AX-89801223:ph3	24.396
AX-89815738:nmh	25.94
AX-89850548:ph3	38.218
AX-89844013:ph3	38.218
AX-89906683:nmh	52.294
AX-89864755:ph3	52.706
AX-89800994:ph3	53.426
AX-89864742:ph3	54.155
AX-89843805:ph3	54.875
AX-89906662:ph3	54.875
AX-89843812:nmh	54.875
AX-89843836:ph3	54.875
AX-89800823:ph3	55.785
AX-89800978:nmh	55.97
AX-89800824:ph3	56.695
AX-89906694:nmh	56.695
AX-89901005:nmh	57.779
AX-89906665:ph3	57.779
AX-89800760:ph3	57.779
AX-89800711:ph3	58.504
AX-89843755:ph3	58.504
AX-89800720:nmh	58.504
AX-89864722:nmh	59.3
AX-89906640:ph3	60.097
AX-89900942:nmh	60.097
AX-89800670:nmh	60.501
AX-89859857:nmh	60.501
AX-89805942:nmh	61.701
AX-89811568:ph3	62.498
AX-89843622:nmh	62.498
AX-89850390:ph3	62.857
AX-89846686:ph3	62.857
AX-89843135:ph3	63.217
AX-89859825:ph3	64.302
AX-89800442:ph3	64.302
AX-89909792:ph3	66.121
AX-89808764:ph3	66.481
AX-89850555:ph3	66.481
AX-89906706:ph3	66.841
AX-89864823:ph3	67.2
AX-89872130:nmh	67.2
AX-89844658:ph3	67.301

AX-89906836:nmh	69.762
AX-89801866:ph3	69.762
AX-89902394:ph3	69.762
AX-89864898:nmh	70.484
AX-89902797:ph3	71.206
AX-89845510:ph3	71.206
AX-89802210:ph3	72.737
AX-89864861:ph3	73.75
AX-89808869:ph3	73.75
AX-89845629:ph3	73.75
AX-89801698:ph3	74.849
AX-89903094:nmh	83.34
AX-89903072:nmh	83.34
AX-89850381:ph3	91.688
AX-89800226:ph3	92.412
AX-89900389:nmh	92.412
AX-89900391:nmh	92.412
AX-89903162:nmh	93.901
AX-89904009:nmh	94.39
AX-89859779:ph3	95.153
AX-89900405:nmh	96.909
AX-89906584:ph3	97.894
AX-89850407:ph3	97.894
AX-89843248:ph2	98.621
AX-89850413:ph3	98.989
AX-89864679:ph3	99.349
AX-89800308:ph3	99.349
AX-89847641:ph3	100.803
AX-89904667:ph3	100.803
AX-89806892:nmh	102.253
AX-89880752:ph3	102.253
AX-89904671:ph3	102.253
AX-89904670:nmh	102.433
AX-89903950:ph3	102.613
AX-89846625:ph3	102.613
AX-89880843:nmh	103.16
AX-89847667:ph3	103.708
AX-89823725:nmh	103.708
AX-89823703:ph3	103.708
AX-89823688:ph3	104.067
AX-89846527:nmh	104.067
AX-89862284:ph3	104.787
AX-89906599:ph3	104.787
AX-89906945:ph3	105.147
AX-89850944:ph3	105.147
AX-89906939:ph3	105.506
AX-89808967:ph3	108.521
AX-89906891:ph3	111.535
AX-89903325:ph3	111.535
AX-89916254:nmh	111.535

AX-89862474:nmh	111.535
AX-89900724:nmh	112.262
AX-89802589:nmh	112.305
group 7B	
AX-89802520:nmh	0
AX-89903252:ph3	0
AX-89846071:nmh	0.719
AX-89903604:ph3	0.719
AX-89894503:ph3	0.719
AX-89903672:nmh	1.439
AX-89894467:nmh	1.439
AX-89802736:ph3	2.888
AX-89846292:nmh	2.888
AX-89906916:ph3	2.888
AX-89894472:ph3	3.248
AX-89795356:nmh	3.428
AX-89837272:ph3	3.608
AX-89894425:ph3	3.608
AX-89850909:ph3	4.33
AX-89864956:nmh	8.006
AX-89802642:ph3	8.006
AX-89802684:ph3	9.891
AX-89846140:nmh	12.423
AX-89862292:nmh	12.803
AX-89864950:nmh	13.042
AX-89802827:ph3	13.662
AX-89843431:ph3	13.662
AX-89843462:ph3	13.662
AX-89846474:nmh	13.662
AX-89800541:ph3	14.129
AX-89900762:ph3	15.474
AX-89859800:ph3	15.474
AX-89900561:ph3	15.474
AX-89869212:ph3	16.201
AX-89880816:nmh	17.666
AX-89823671:ph3	17.666
AX-89802932:nmh	18.386
AX-89880768:ph3	18.393
AX-89800271:nmh	20.324
AX-89850940:nmh	20.911
AX-89903910:ph3	21.613
AX-89800314:nmh	23.512
AX-89885585:ph3	23.512
AX-89885594:ph3	23.512
AX-89850418:ph3	23.871
AX-89800291:ph3	23.871
AX-89850425:ph3	23.871
AX-89843213:ph3	24.64
AX-89900447:ph3	26.045

AX-89800284:ph3	26.045
AX-89843094:ph3	28.993
AX-89850399:ph3	28.993
AX-89900400:ph3	28.993
AX-89903075:nmh	29.932
AX-89903006:ph3	30.399
AX-89845674:nmh	30.865
AX-89860252:nmh	31.332
AX-89845849:ph3	32.161
AX-89900343:nmh	33.734
AX-89862528:ph3	33.734
AX-89802998:nmh	33.734
AX-89904050:ph3	33.734
AX-89845878:ph3	33.734
AX-89850601:ph3	53.575
AX-89802126:nmh	53.575
AX-89850550:ph3	54.536
AX-89843746:nmh	55.496
AX-89900968:ph3	57.431
AX-89800637:nmh	58.392
AX-89843637:ph3	58.392
AX-89843844:nmh	59.352
AX-89800746:ph3	59.352
AX-89850549:ph3	60.313
AX-89843940:nmh	60.313
AX-89901300:nmh	60.313
AX-89901248:nmh	61.268
AX-89844207:ph3	61.801
AX-89843979:ph3	62.224
AX-89901595:nmh	62.698
AX-89844205:ph3	62.84
AX-89901577:nmh	63.656
AX-89844325:ph3	64.283
AX-89844293:nmh	64.283
AX-89901655:nmh	65.005
AX-89850626:ph3	65.727
AX-89808803:nmh	65.907
AX-89906728:ph3	66.087
AX-89801224:nmh	66.087
AX-89906750:ph3	66.806
AX-89850649:ph3	66.806
AX-89801386:nmh	66.806
AX-89906754:ph3	68.118
AX-89844684:nmh	69.429
AX-89845497:ph3	69.429
AX-89802107:nmh	70.74
AX-89916173:nmh	72.051
AX-89802089:nmh	72.051
AX-89916174:nmh	72.051
AX-89802010:ph3	72.051

AX-89906806:ph3	73.362
AX-89801978:ph3	74.673
AX-89853959:nmh	74.673
AX-89864830:nmh	78.665
AX-89902502:ph3	78.665
AX-89801846:ph3	80.546
AX-89845179:ph3	82.613
AX-89845332:nmh	83.924
AX-89864828:nmh	85.235
AX-89902255:ph3	85.235
AX-89902254:nmh	85.235
AX-89844900:ph3	86.685
group 7C	
AX-89801520:ph3	0
AX-89902204:nmh	0.734
AX-89844820:nmh	0.734
AX-89902346:ph3	1.453
AX-89902388:ph3	1.453
AX-89862391:nmh	1.453
AX-89844888:nmh	1.453
AX-89902376:nmh	2.173
AX-89801809:ph3	2.173
AX-89801853:ph3	3.706
AX-89872890:ph3	4.209
AX-89801864:nmh	4.711
AX-89902594:nmh	5.971
AX-89845358:nmh	5.971
AX-89860212:nmh	6.802
AX-89906809:ph3	7.23
AX-89845480:nmh	7.306
AX-89902775:nmh	8.49
AX-89902779:nmh	9.365
AX-89801464:nmh	11.028
AX-89801427:nmh	11.963
AX-89901979:nmh	12.288
AX-89844664:ph3	12.998
AX-89901925:nmh	13.548
AX-89844626:nmh	14.808
AX-89815748:ph3	16.067
AX-89806032:nmh	16.067
AX-89801200:ph3	18.605
AX-89801108:ph3	21.143
AX-89844272:nmh	21.645
AX-89844261:ph3	22.399
AX-89901270:ph3	23.659
AX-89800933:nmh	23.659
AX-89800878:ph3	24.918
AX-89906663:ph3	26.178
AX-89900994:ph3	26.178

AX-89866815:nmh	26.178
AX-89843643:ph3	27.263
AX-89850493:ph3	27.263
AX-89900355:ph3	28.358
AX-89906586:ph3	28.358
AX-89844276:ph3	29.082
AX-89800414:ph3	29.442
AX-89901141:ph3	29.442
AX-89845812:ph3	40.834
AX-89903143:ph3	42.025
AX-89906848:ph3	46.896
AX-89906866:ph3	47.991
AX-89903046:nmh	47.991
AX-89802366:nmh	47.991
AX-89808942:nmh	49.885
AX-89802466:nmh	50.507
AX-89903138:nmh	51.129
AX-89843090:ph3	52.383
AX-89846726:nmh	52.383
AX-89843130:nmh	52.383
AX-89800168:ph3	52.383
AX-89812103:nmh	52.879
AX-89843204:nmh	53.69
AX-89900504:ph3	53.69
AX-89800239:nmh	53.878
AX-89868996:nmh	54.375
AX-89843214:ph3	54.906
AX-89900448:nmh	54.944
AX-89800282:nmh	55.493
AX-89843236:nmh	56.6
AX-89800301:ph3	56.6
AX-89800332:nmh	57.707
AX-89900523:nmh	57.707
AX-89823552:nmh	58.256
AX-89784080:nmh	58.256
AX-89823636:nmh	58.805
AX-89823647:nmh	59.091
AX-89784131:nmh	60.477
AX-89784149:nmh	62.264
AX-89802968:ph3	63.307
AX-89906954:ph3	63.666
AX-89815796:ph3	64.026
AX-89903841:nmh	64.026
AX-89843311:ph3	65.733
AX-89843338:nmh	66.187
AX-89903868:nmh	66.229
AX-89802878:ph3	66.229
AX-89843544:nmh	67.648
AX-89900796:nmh	68.382
AX-89903790:nmh	69.861

AX-89802852:ph3	69.861
AX-89903443:nmh	70.586
AX-89850884:ph3	70.586
AX-89846122:ph3	70.586
AX-89846269:nmh	71.321
AX-89906623:ph3	72.057
AX-89900731:ph3	72.781
AX-89850950:ph3	72.781
AX-89843437:nmh	72.781
AX-89843574:ph3	73.141
AX-89802620:nmh	73.866
AX-89903390:ph3	73.866
AX-89906896:ph3	73.866
AX-89894403:nmh	74.961
AX-89903174:ph3	75.686
AX-89845988:nmh	76.045
AX-89906879:ph3	76.045
AX-89850843:ph3	76.045
AX-89850908:ph3	76.405
AX-89903665:ph3	76.405
AX-89903717:ph3	76.779

group 7D	
AX-89801556:nmh	0
AX-89860131:nmh	0
AX-89902173:ph3	0
AX-89808829:nmh	0
AX-89902228:nmh	0.805
AX-89902205:nmh	1.205
AX-89801696:nmh	1.604
AX-89801706:nmh	2.004
AX-89902365:nmh	2.403
AX-89850706:ph3	2.403
AX-89902413:nmh	3.208
AX-89850723:ph3	3.608
AX-89862403:nmh	3.608
AX-89850726:ph3	4.327
AX-89909945:nmh	4.327
AX-89801918:ph3	4.687
AX-89902596:nmh	4.687
AX-89810972:nmh	4.687
AX-89850736:ph3	5.406
AX-89802009:nmh	5.586
AX-89845378:ph3	5.766
AX-89802013:nmh	6.128
AX-89902698:ph3	6.491
AX-89802119:ph3	8.321
AX-89902016:ph3	8.321
AX-89802116:ph3	8.681
AX-89869132:nmh	9.714

AX-89901937:nmh	12.354
AX-89901951:ph3	12.354
AX-89850675:ph3	12.354
AX-89901952:ph3	12.379
AX-89844611:nmh	13.437
AX-89801382:ph3	13.437
AX-89901867:nmh	13.437
AX-89844571:ph3	14.009
AX-89901801:nmh	14.009
AX-89833088:nmh	14.278
AX-89844420:ph2	15.605
AX-89844421:nmh	15.605
AX-89850631:ph3	15.605
AX-89844356:nmh	15.965
AX-89906729:ph3	16.324
AX-89844482:nmh	16.324
AX-89850543:ph3	18.155
AX-89901530:nmh	18.155
AX-89850595:ph3	18.155
AX-89800941:nmh	18.517
AX-89844078:ph3	18.88
AX-89850560:ph3	18.88
AX-89844051:nmh	19.239
AX-89901348:ph3	19.796
AX-89844102:ph3	20.323
AX-89901388:nmh	20.323
AX-89901429:nmh	21.311
AX-89800842:nmh	22.3
AX-89843860:nmh	24.291
AX-89906671:ph3	26.283
AX-89906618:ph3	34.34
AX-89860054:ph3	35.479
AX-89850487:ph3	37.792
AX-89800415:ph3	38.357
AX-89906794:ph3	40.669
AX-89808893:ph3	41.235
AX-89902872:nmh	41.8
AX-89845660:ph3	44.113
AX-89845666:ph3	44.113
AX-89802341:ph3	45.015
AX-89860445:nmh	45.318
AX-89906853:ph3	45.917
AX-89802400:ph3	46.276
AX-89802479:nmh	46.456
AX-89906875:ph3	46.636
AX-89850837:ph3	46.636
AX-89850966:ph3	46.636
AX-89903126:nmh	46.998
AX-89800171:ph3	47.361
AX-89800200:ph3	47.361

AX-89843125:nmh	47.361
AX-89906583:ph3	48.816
AX-89900408:nmh	48.816
AX-89800242:nmh	48.995
AX-89800259:ph3	49.175
AX-89843177:nmh	49.175
AX-89843260:ph3	49.355
AX-89900507:ph3	49.535
AX-89869005:ph3	49.895
AX-89843266:ph3	49.895
AX-89885562:nmh	49.895
AX-89880751:nmh	50.075
AX-89880793:ph3	50.254
AX-89847661:ph3	50.614
AX-89807369:nmh	50.614
AX-89900661:nmh	51.334
AX-89846645:ph3	51.334
AX-89802949:ph3	51.334
AX-89784176:nmh	51.334
AX-89906949:ph3	51.334
AX-89815793:ph3	52.058
AX-89843361:ph3	52.418
AX-89906936:ph3	52.418
AX-89906628:ph3	52.776
AX-89900776:nmh	53.836
AX-89802904:nmh	53.882
AX-89843325:nmh	54.593
AX-89903789:nmh	55.304
AX-89906932:ph3	55.304
AX-89850924:ph3	56.028
AX-89850921:ph3	56.028
AX-89843590:nmh	56.028
AX-89862479:ph3	56.748
AX-89850928:ph3	56.748
AX-89802646:nmh	57.467
AX-89850860:ph3	67.905
AX-89845974:nmh	68.624
AX-89906884:ph3	68.624

	L_1_14	a_1_14	b_1_14	TSS_1_14	TA_1_14	TSS_TA_1_14	Ellagic_acid_1_14	Pelargonidin_1_14	Cyanidin_1_14	L_7_14
TSS_1_13	.021	.318	.242	-.070	-.008	.043	-.219	-.204	-.407	.225
TA_1_13	-.107	-.075	.039	-.322	.280	-.227	.037	-.209	-.196	.080
TSS_TA__1_13	.070	.259	.129	.169	-.265	.216	-.153	.045	-.075	.062
L_1_13	.180	-.042	-.161	-.068	.142	.000	.276	.091	.016	.065
a_1_13	.340	.334	.332	.023	.070	.034	.311	-.214	-.190	.432*
b_1_13	.232	.299	.365	-.042	.270	-.102	.318	-.304	-.128	.412*
Ellagic_acid_1_13	-.115	-.152	-.050	.078	-.350	.388	.344	.157	.271	-.142
Pelargonidin_1_13	-.092	-.466	-.478*	.041	-.272	.140	-.023	.648**	.083	-.472*
Cyanidin_1_13	.051	.324	.424	-.224	-.095	-.132	.059	-.038	.327	.217
TSS_7_13	.098	.232	.211	-.034	.037	-.053	-.186	-.433	-.263	.224
TA_7_13	-.184	-.042	.036	-.242	.464*	-.284	-.202	-.312	-.280	.109
TSS_TA__7_13	.145	.111	.024	.116	-.361	.185	.011	.000	.044	.031
L_7_13	.313	.592**	.463*	.183	-.124	.102	-.044	-.589**	-.304	.607**
a_7_13	.440*	.546**	.461*	.091	.143	-.078	.122	-.270	-.194	.607**
b_7_13	.407*	.307	.302	-.080	.042	-.198	-.007	-.115	-.344	.465*
Ellagic_acid_7_13	-.147	-.062	.008	.178	-.304	.360	-.051	.028	.007	-.211
Pelargonidin_7_13	-.257	-.649**	-.614**	-.066	-.225	.128	.031	.616**	.113	-.688**
Cyanidin_7_13	-.081	.217	.229	-.044	-.208	.122	-.161	.026	.082	-.021

a_7_14	b_7_14	TSS_7_14	TA_7_14	TSS_TA_7_14	Ellagic_acid_7_14	Pelargonidin_7_14	Cyanidin_7_14
.111	.000	.184	.335	-.192	-.142	-.449*	-.113
-.026	.004	-.115	.293	-.499*	.140	-.071	.338
.115	.026	.157	-.070	.273	-.225	-.221	-.331
-.094	-.188	.112	.293	-.210	.126	-.069	.191
.443*	.458*	-.009	.174	-.190	.076	-.491*	.169
.472*	.536**	-.061	.146	-.210	.280	-.425*	.371
-.098	.161	-.133	-.589*	.617**	-.037	.213	.151
-.484*	-.308	-.200	-.502*	.405	-.173	.526*	-.236
.295	.182	-.243	-.394	.243	-.262	-.133	.071
.136	.116	-.055	.298	-.467*	-.060	-.306	-.082
.096	.107	-.087	.315	-.452*	.063	-.290	.299
-.026	-.037	-.083	-.103	-.031	-.144	.030	-.289
.503*	.361	.243	.066	.250	.078	-.528**	.001
.585**	.386	.281	.254	.122	.081	-.473*	.001
.169	.089	-.132	-.081	-.031	.028	-.085	-.062
.134	.279	-.018	-.477*	.602**	-.109	.112	-.088
-.482*	-.214	-.259	-.513*	.346	-.113	.589*	-.109
.313	.100	.003	-.364	.457	-.086	.031	-.055