**Supplementary Material for:**

**Comparative evaluation of genomic inbreeding parameters in seven commercial and autochthonous pig breeds**

Giuseppina Schiavo, Samuele Bovo, Francesca Bertolini, Silvia Tinarelli, Stefania Dall’Olio, Leonardo Nanni Costa, Maurizio Gallo and Luca Fontanesi

**Supplementary Table S1.** Pigs included in this study and single nucleotide polymorphisms (SNPs) retained after filtering.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Breeds | N. of pigs1 | Years of birth | N. of farms2 | N. of SNPs |
| Italian Large White | 1968 | 1993-2012 | NA | 46887 |
| Italian Duroc | 573 | 1997-2012 | NA | 42643 |
| Italian Landrace | 46 | 2011-2012 | NA | 50470 |
| Apulo-Calabrese | 90 | 2009-2012 | 4 | 42158 |
| Casertana | 96 | 2007-2012 | 6 | 41280 |
| Cinta Senese | 38 | 2013 | 2 | 46644 |
| Nero Siciliano | 48 | 2008-2013 | 5 | 49600 |

1All genotyped pigs passed the call rate threshold.

2NA = not applicable. These pigs were part of the national selection program.

**Supplementary Table S2.** The number of genotyped animals and the number of animals with the indicated minimum pedigree depth (>0, ≥4 and ≥ 10). No pedigree information was available for the Apulo-Calabrese and Nero Siciliano pigs. For a few animals of the other breeds, pedigree information could not be obtained.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Breeds | N. of genotyped pigs | N. of pigs with pedigree depth > 0 | N. of pigs with pedigree depth ≥ 4 | N. of pigs with pedigree depth ≥ 10 |
| Italian Large White | 1968 | 1452 | 1437 | 1380 |
| Italian Duroc | 573 | 545 | 538 | 509 |
| Italian Landrace | 46 | 45 | 45 | 45 |
| Apulo-Calabrese | 90 | - | - | - |
| Casertana | 96 | 94 | 0 | 0 |
| Cinta Senese | 38 | 38 | 38 | 37 |
| Nero Siciliano | 48 | - | - | - |

**Supplementary Table S3.** Mean number of runs of homozygosity (ROH) per animal ± standard deviation for the five classes of ROH length (ROH1-2, 1-2 Mbp; ROH2-4, 2-4 Mbp; ROH4-8, 4-8 Mbp; ROH8-16, 8-16 Mbp; and ROH>16, >16 Mbp) in the investigated pig breeds.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Breeds | ROH1-2 | ROH2-4 | ROH4-8 | ROH8-16 | ROH>16 |
| Italian Large White | 2.3 ± 1.3 | 15.4 ± 4.5 | 13.3 ± 4.1 | 6.2 ± 2.6 | 3.7 ± 2.4 |
| Italian Duroc | 2.8 ± 1.4 | 20.0 ± 4.4 | 20.7 ± 4.4 | 10.3 ± 3.3 | 5.8 ± 3.2 |
| Italian Landrace | 3.24 ± 1.9 | 17.4 ± 4.5 | 14.9 ± 5.3 | 7.9 ± 3.2 | 5.1 ± 3.3 |
| Apulo-Calabrese | 1.3 ± 0.6 | 7.6 ± 4.1 | 12.2 ± 4.4 | 9.8 ± 3.7 | 11.7 ± 5.2 |
| Casertana | 2.3 ± 1.1 | 6.2 ± 2.2 | 10.4 ± 3.6 | 9.2 ± 3.4 | 11.0 ± 5.8 |
| Cinta Senese | 2.0 ± 1.2 | 12.7 ± 4.2 | 16.7 ± 5.5 | 9.7 ± 4.4 | 5.4 ± 3.2 |
| Nero Siciliano | 2.2 ± 1.1 | 6.9 ± 2.7 | 5.7 ± 3.2 | 2.9 ± 2.6 | 3.6 ± 3.2 |

**Supplementary Table S4.** Mean sum of all runs of homozygosity (ROH) segments by animals (SROH, in Mbp) ± standard deviation, minimum (Min) and maximum (Max) SROH values in the analysed pig breeds and considering different length classes (ROH ≥ 1 Mbp, ≥ 2 Mbp, ≥ 4 Mbp, ≥ 8 Mbp and ≥ 16 Mbp).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ROH length class | Breeds | Mean SROH ± SD | Min | Max |
| ROH ≥ 1 Mbp | Italian Large White | 287.3 ± 106.8 | 10.0 | 921.5 |
|  | Italian Duroc | 458.0 ± 125.9 | 152.7 | 1114.4 |
|  | Italian Landrace | 373.8 ± 125.2 | 71.2 | 755.4 |
|  | Apulo-Calabrese | 668.6 ± 268.6 | 165.7 | 1233.5 |
|  | Casertana | 553.5 ± 261.7 | 59.9 | 1144.6 |
|  | Cinta Senese | 401.7 ± 153.4 | 106.7 | 721.4 |
|  | Nero Siciliano | 179.1 ± 144.9 | 20.9 | 604.9 |
| ROH ≥ 2 Mbp | Italian Large White | 283.8 ± 106.6 | 8.3 | 915.7 |
|  | Italian Duroc | 453.5 ± 126.3 | 150.8 | 1114.4 |
|  | Italian Landrace | 368.7 ± 126.0 | 67.8 | 753.9 |
|  | Apulo-Calabrese | 667.5 ± 268.7 | 163.9 | 1230.5 |
|  | Casertana | 550.4 ± 261.1 | 56.2 | 1137.8 |
|  | Cinta Senese | 399.6 ± 152.9 | 106.7 | 721.4 |
|  | Nero Siciliano | 175.3 ± 145.1 | 18.9 | 603.4 |
| ROH ≥ 4 Mbp | Italian Large White | 237.9 ± 104.6 | 4.7 | 876.9 |
|  | Italian Duroc | 392.8 ± 128.5 | 123.3 | 1076.5 |
|  | Italian Landrace | 316.7 ± 126.3 | 37.7 | 707.1 |
|  | Apulo-Calabrese | 644.1 ± 267.3 | 152.9 | 1204.4 |
|  | Casertana | 531.4 ± 260.8 | 48.2 | 1128.4 |
|  | Cinta Senese | 360.8 ± 147.9 | 73.4 | 673.8 |
|  | Nero Siciliano | 155.3 ± 143.9 | 9.8 | 590.0 |
| ROH ≥ 8 Mbp | Italian Large White | 164.7 ± 96.4 | 8.3 | 797.1 |
|  | Italian Duroc | 276.4 ± 126.2 | 67.3 | 987.0 |
|  | Italian Landrace | 233.8 ± 115.1 | 8.4 | 624.6 |
|  | Apulo-Calabrese | 574.6 ± 258.8 | 94.7 | 1127.2 |
|  | Casertana | 470.9 ± 251.3 | 25.4 | 1050.9 |
|  | Cinta Senese | 266.1 ± 136.7 | 52.6 | 604.3 |
|  | Nero Siciliano | 127.1 ± 135.7 | 8.8 | 572.9 |
| ROH ≥ 16 Mbp | Italian Large White | 104.0 ± 84.3 | 16.0 | 662.3 |
|  | Italian Duroc | 162.9 ± 113.2 | 16.5 | 870.4 |
|  | Italian Landrace | 149.9 ± 96.0 | 18.4 | 470.6 |
|  | Apulo-Calabrese | 463.1 ± 236.1 | 42.3 | 1006.6 |
|  | Casertana | 372.7 ± 225.0 | 20.9 | 864.5 |
|  | Cinta Senese | 166.3 ± 112.8 | 16.3 | 524.3 |
|  | Nero Siciliano | 135.7 ± 121.3 | 22.0 | 501.7 |

**Supplementary Table S5.** Pearson’s correlation coefficients between pedigree inbreeding coefficient (FPED) and all other genomic inbreeding measures in the breeds in which pedigree depth was ≥. ILW, Italian Large White; ID, Italian Duroc; IL, Italian Landrace; CS, Cinta Senese. Correlations were not reported for Casertana due to the limited pedigree depth of the animals (Supplementary Table 2).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Inbreeding measures1 | ILW | ID | IL | CS |
| FROH1 | 0.482\*\*\* | 0.545\*\*\* | 0.712\*\*\* | 0.148 |
| FROH2 | 0.483\*\*\* | 0.546\*\*\* | 0.715\*\*\* | 0.149 |
| FROH4 | 0.506\*\*\* | 0.554\*\*\* | 0.718\*\*\* | 0.150 |
| FROH8 | 0.538\*\*\* | 0.546\*\*\* | 0.730\*\*\* | 0.156 |
| FROH16 | 0.547\*\*\* | 0.540\*\*\* | 0.714\*\*\* | 0.228 |
| Fhat1/FGRM | 0.033 | 0.130\*\*\* | -0.299\* | -0.129 |
| Fhat2 | 0.143\*\*\* | 0.437\*\*\* | 0.532\*\*\* | 0.170 |
| Fhat3 | 0.135\*\*\* | 0.380\*\*\* | -0.070 | 0.165 |
| FHOM | 0.390\*\*\* | 0.532\*\*\* | 0.650\*\*\* | 0.138 |

\*P <0.05, \*\*\*P <0.001.

1 FROH1, inbreeding coefficient based on runs of homozygosity (ROH) of minimum size of 1 Mbp; FROH2, inbreeding coefficient based on ROH of minimum size of 2 Mbp; FROH4, inbreeding coefficient based on ROH of minimum size of 4 Mbp; FROH8, inbreeding coefficient based on ROH of minimum size of 8 Mbp; FROH16, inbreeding coefficient based on ROH of minimum size of 16 Mbp; Fhat1, inbreeding coefficient based on the variance-standardized relationship minus 1; FGRM, values of the diagonal elements of the genomic relationship matrix; Fhat2, inbreeding coefficient based on excess of homozygosity; Fhat3, inbreeding coefficient based on correlation between uniting gametes; FHOM, inbreeding coefficient based on number of homozygous genotypes.

**Supplementary Table S6.** Spearman’s rank correlation coefficients between all pair of genomic inbreeding parameters in all breeds (ILW, Italian Large White; ID, Italian Duroc; IL, Italian Landrace; AC, Apulo-Calabrese; CT, Casertana; CS, Cinta Senese; NS, Nero Siciliano).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Correlations1 | ILW | ID | IL | AC | CT | CS | NS |
| FGRM *-* FROH1 | 0.147\*\*\* | 0.096\* | -0.151 | -0.118 | -0.206\* | -0.608\*\*\* | 0.346\* |
| FGRM *-* FROH2 | 0.147\*\*\* | 0.099\* | -0.162 | -0.119 | -0.202\* | -0.605\*\*\* | 0.344\* |
| FGRM *-* FROH4 | 0.137\*\*\* | 0.109\*\* | -0.153 | -0.133 | -0.201\* | -0.584\*\*\* | 0.351\* |
| FGRM *-* FROH8 | 0.141\*\*\* | 0.135\*\* | -0.169 | -0.129 | -0.185 | -0.485\*\* | 0.326\* |
| FGRM - FROH16 | 0.167\*\*\* | 0.159\*\*\* | -0.124 | -0.13 | -0.145 | -0.329\* | 0.320 |
| FHOM - FROH1 | 0.928\*\*\* | 0.945\*\*\* | 0.955\*\*\* | 0.984\*\*\* | 0.985\*\*\* | 0.905\*\*\* | 0.790\*\*\* |
| FHOM - FROH2 | 0.927\*\*\* | 0.944\*\*\* | 0.953\*\*\* | 0.984\*\*\* | 0.985\*\*\* | 0.903\*\*\* | 0.790\*\*\* |
| FHOM - FROH4 | 0.907\*\*\* | 0.938\*\*\* | 0.942\*\*\* | 0.982\*\*\* | 0.984\*\*\* | 0.887\*\*\* | 0.788\*\*\* |
| FHOM - FROH8 | 0.867\*\*\* | 0.917\*\*\* | 0.899\*\*\* | 0.978\*\*\* | 0.982\*\*\* | 0.817\*\*\* | 0.771\*\*\* |
| FHOM - FROH16 | 0.811\*\*\* | 0.866\*\*\* | 0.863\*\*\* | 0.959\*\*\* | 0.971\*\*\* | 0.674\*\*\* | 0.733\*\*\* |
| Fhat1 - FROH1 | 0.147\*\*\* | 0.096\* | -0.151 | -0.118 | -0.206\* | -0.608\*\*\* | 0.346\* |
| Fhat1 - FROH2 | 0.147\*\*\* | 0.099\* | -0.162 | -0.119 | -0.202\* | -0.605\*\*\* | 0.344\* |
| Fhat1 - FROH4 | 0.137\*\*\* | 0.109\*\* | -0.153 | -0.133 | -0.201\* | -0.584\*\*\* | 0.351\* |
| Fhat1 - FROH8 | 0.141\*\*\* | 0.135\*\* | -0.169 | -0.129 | -0.185 | -0.485\*\* | 0.326\* |
| Fhat1 - FROH16 | 0.167\*\*\* | 0.159\*\*\* | -0.124 | -0.130 | -0.145 | -0.329\* | 0.320 |
| Fhat2 - FROH1 | 0.451\*\*\* | 0.815\*\*\* | 0.520\*\*\* | 0.701\*\*\* | 0.918\*\*\* | 0.776\*\*\* | 0.411\*\* |
| Fhat2 - FROH2 | 0.450\*\*\* | 0.813\*\*\* | 0.529\*\*\* | 0.702\*\*\* | 0.917\*\*\* | 0.773\*\*\* | 0.412\*\* |
| Fhat2 - FROH4 | 0.437\*\*\* | 0.802\*\*\* | 0.511\*\*\* | 0.709\*\*\* | 0.916\*\*\* | 0.754\*\*\* | 0.406\*\* |
| Fhat2 - FROH8 | 0.395\*\*\* | 0.775\*\*\* | 0.499\*\*\* | 0.702\*\*\* | 0.908\*\*\* | 0.662\*\*\* | 0.407\*\* |
| Fhat2 - FROH16 | 0.335\*\*\* | 0.720\*\*\* | 0.422\*\* | 0.686\*\*\* | 0.884\*\*\* | 0.520\*\*\* | 0.396\* |
| Fhat3 - FROH1 | 0.515\*\*\* | 0.530\*\*\* | 0.154 | 0.183 | 0.590\*\*\* | 0.693\*\*\* | 0.851\*\*\* |
| Fhat3 - FROH2 | 0.514\*\*\* | 0.532\*\*\* | 0.141 | 0.182 | 0.593\*\*\* | 0.693\*\*\* | 0.850\*\*\* |
| Fhat3 - FROH4 | 0.491\*\*\* | 0.536\*\*\* | 0.143 | 0.167 | 0.594\*\*\* | 0.694\*\*\* | 0.853\*\*\* |
| Fhat3 - FROH8 | 0.450\*\*\* | 0.549\*\*\* | 0.108 | 0.169 | 0.603\*\*\* | 0.700\*\*\* | 0.836\*\*\* |
| Fhat3 - FROH16 | 0.406\*\*\* | 0.546\*\*\* | 0.101 | 0.159\*\*\* | 0.624 \*\*\* | 0.653\*\*\* | 0.756\*\*\* |
| FGRM - Fhat1 | 1.000\*\*\* | 1.000\*\*\* | 1.000\*\*\* | 1.000\*\*\* | 1.000\*\*\* | 1.000\*\*\* | 1.000\*\*\* |
| FGRM - Fhat2 | -0.719\*\*\* | -0.340\*\*\* | -0.908\*\*\* | -0.504\*\*\* | -0.956\*\*\* | -0.719\*\*\* | -0.340\*\*\* |
| FGRM - Fhat3 | 0.876\*\*\* | 0.869\*\*\* | 0.946\*\*\* | 0.643\*\*\* | -0.053 | 0.876\*\*\* | 0.869\*\*\* |
| FGRM - FHOM | 0.154\*\*\* | 0.183\*\*\* | -0.124 | -0.122 | -0.827\*\*\* | 0.154\*\*\* | 0.183\*\*\* |
| FHOM - Fhat1 | 0.154\*\*\* | 0.183\*\*\* | -0.124 | -0.122 | -0.827\*\*\* | 0.154\*\*\* | 0.183\*\*\* |
| FHOM - Fhat2 | 0.508\*\*\* | 0.824\*\*\* | 0.514\*\*\* | 0.898\*\*\* | 0.942\*\*\* | 0.508\*\*\* | 0.824\*\*\* |
| FHOM - Fhat3 | 0.564\*\*\* | 0.626\*\*\* | 0.194 | 0.664\*\*\* | 0.558\*\*\* | 0.564\*\*\* | 0.626\*\*\* |
| Fhat1 - Fhat2 | -0.719\*\*\* | -0.340\*\*\* | -0.908\*\*\* | -0.504\*\*\* | -0.956\*\*\* | -0.719\*\*\* | -0.340\*\*\* |
| Fhat1 - Fhat3 | 0.876\*\*\* | 0.869\*\*\* | 0.946\*\*\* | 0.643\*\*\* | -0.053 | 0.876\*\*\* | 0.869\*\*\* |
| Fhat2 - Fhat3 | -0.295\*\*\* | 0.170\*\*\* | -0.724\*\*\* | 0.337\*\*\* | 0.345\* | -0.295\*\*\* | 0.170\*\*\* |

\*P <0.05, \*\*P <0.01, \*\*\*P <0.001.

1 FGRM, values of the diagonal elements of the genomic relationship matrix; FROH1, inbreeding coefficient based on runs of homozygosity (ROH) of minimum size of 1 Mbp; FROH2, inbreeding coefficient based on ROH of minimum size of 2 Mbp; FROH4, inbreeding coefficient based on ROH of minimum size of 4 Mbp; FROH8, inbreeding coefficient based on ROH of minimum size of 8 Mbp; FROH16, inbreeding coefficient based on ROH of minimum size of 16 Mbp; FHOM, inbreeding coefficient based on number of homozygous genotypes; Fhat1, inbreeding coefficient based on the variance-standardized relationship minus 1; Fhat2, inbreeding coefficient based on excess of homozygosity; Fhat3, inbreeding coefficient based on correlation between uniting gametes.

**Supplementary Table S7.** Effective population size (Ne) estimated for the seven pig breeds at 50, 25, 12, 6 and 3 generations (gen.) ago, matching the estimated origin of the runs of homozygosity of the considered minimum length classes (1, 2, 4, 8 and 16 Mbp, respectively).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Breeds | Ne | | | | |
| 50 gen. ago | 25 gen. ago | 12 gen. ago | 6 gen. ago | 3 gen. ago |
| Italian Large White | 164 | 136 | 122 | 116 | 112 |
| Italian Duroc | 109 | 88 | 79 | 73 | 71 |
| Italian Landrace | 124 | 85 | 60 | 44 | 31 |
| Apulo-Calabrese | 104 | 67 | 45 | 31 | 21 |
| Casertana | 110 | 65 | 40 | 27 | 17 |
| Cinta Senese | 111 | 69 | 48 | 34 | 24 |
| Nero Siciliano | 195 | 124 | 84 | 54 | 33 |

**Supplementary Figure S1.** Box plots of within-breed averaged sum of length of runs of homozygosity (SROH) ≥2 Mbp, ≥4 Mbp, ≥8 Mbp and ≥ 16 Mbp, calculated across all pigs within breed (ILW, Italian Large White; ID, Italian Duroc; IL, Italian Landrace; AC, Apulo-Calabrese; CT, Casertana; CS, Cinta Senese; NS, Nero Siciliano).

Immagine che contiene screenshot

Descrizione generata automaticamente