**Supplementary Material for:**

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

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**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).

