**Genetic characterization and founder effect analysis of the recently introduced Salers cattle breed population**

D. Gamarra, A. Lopez-Oceja and MM. de Pancorbo

**Supplementary Table S1.** *Allelic Richness per locus and population based on minimum sample size (17 diploid individuals)*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | SAL | BLA | LIM | CHL | DEX | SHL | HER | GAL | BBL | HEC | WAL | MAR | HFR | HOL | DFH | GWH | DLV | MRY | VRB | BRR | WAG | Average |
| BM1818 | 4.412 | 5.567 | 5.255 | 5.401 | 5.718 | 4.961 | 3.799 | 2.773 | 4.421 | 2.949 | 5.083 | 5.000 | 4.046 | 4.378 | 5.317 | 3.979 | 4.995 | 3.986 | 4.353 | 3.404 | 2.850 | 4.412 |
| BM1824 | 4.671 | 3.998 | 3.692 | 3.973 | 3.989 | 2.788 | 4.002 | 3.999 | 3.965 | 3.313 | 4.760 | 2.000 | 4.697 | 4.709 | 3.961 | 5.546 | 4.000 | 3.805 | 3.649 | 4.459 | 3.850 | 3.992 |
| BM2113 | 6.628 | 7.070 | 6.400 | 6.785 | 4.837 | 4.818 | 6.860 | 5.354 | 5.686 | 3.435 | 5.537 | 6.000 | 5.385 | 4.919 | 5.973 | 3.995 | 4.995 | 5.933 | 6.401 | 4.935 | 4.996 | 5.569 |
| ETH10 | 5.139 | 4.464 | 5.834 | 3.496 | 5.130 | 3.000 | 3.965 | 3.750 | 5.341 | 3.000 | 2.755 | 4.000 | 6.000 | 5.843 | 6.048 | 4.974 | 5.918 | 4.303 | 3.787 | 4.321 | 4.550 | 4.553 |
| ETH225 | 4.940 | 4.938 | 4.548 | 3.850 | 4.267 | 4.961 | 5.713 | 5.756 | 5.244 | 4.483 | 4.847 | 5.000 | 5.079 | 5.587 | 5.451 | 3.974 | 3.999 | 4.807 | 5.673 | 4.757 | 3.850 | 4.844 |
| ETH3 | 4.410 | 4.499 | 5.308 | 5.772 | 5.641 | 3.921 | 2.475 | 3.785 | 7.342 | 3.997 | 4.315 | 4.000 | 4.864 | 4.779 | 6.152 | 4.687 | 2.979 | 5.406 | 5.704 | 4.527 | 4.831 | 4.733 |
| INRA023 | 6.662 | 6.480 | 6.283 | 6.346 | 6.993 | 3.758 | 4.409 | 6.936 | 7.023 | 3.948 | 5.111 | 5.000 | 5.438 | 5.180 | 7.241 | 4.953 | 6.331 | 4.655 | 7.277 | 5.429 | 3.700 | 5.674 |
| SPS115 | 3.233 | 4.807 | 5.118 | 4.455 | 6.155 | 3.661 | 5.586 | 5.338 | 3.114 | 1.999 | 4.604 | 4.000 | 4.472 | 4.781 | 4.019 | 3.547 | 1.979 | 2.999 | 4.430 | 3.000 | 5.000 | 4.109 |
| TGLA122 | 5.556 | 7.137 | 7.717 | 7.122 | 4.877 | 4.472 | 6.244 | 5.181 | 6.023 | 5.818 | 4.142 | 4.000 | 7.851 | 7.386 | 7.436 | 4.396 | 6.627 | 6.426 | 8.562 | 5.181 | 4.700 | 6.041 |
| TGLA126 | 3.331 | 4.089 | 4.986 | 2.997 | 3.559 | 2.989 | 4.271 | 2.931 | 4.247 | 4.509 | 3.372 | 5.000 | 4.478 | 4.443 | 4.374 | 3.999 | 4.918 | 4.411 | 5.080 | 5.352 | 3.000 | 4.111 |
| TGLA227 | 7.437 | 7.426 | 7.509 | 8.271 | 6.230 | 4.890 | 6.632 | 7.393 | 6.626 | 5.622 | 7.487 | 6.000 | 8.017 | 7.861 | 7.041 | 4.989 | 6.390 | 7.087 | 6.673 | 7.198 | 5.960 | 6.797 |
| Average | 5.129 | 5.498 | 5.695 | 5.315 | 5.218 | 4.020 | 4.905 | 4.836 | 5.367 | 3.916 | 4.728 | 4.545 | 5.484 | 5.442 | 5.728 | 4.458 | 4.830 | 4.893 | 5.599 | 4.778 | 4.299 | 4.985 |

**Supplementary Table S2.** Expected *heterozygosities for the 11 loci in Salers breed and the comparison breeds*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Locus | SAL | BLA | LIM | CHL | DEX | SHL | HER | GAL | BBL | HEC | WAL | MAR | HFR | HOL | DFH | GWH | DLV | MRY | VRB | BRR | WAG | Average |
| BM1818 | 0.324 | 0.640 | 0.662 | 0.694 | 0.767 | 0.732 | 0.624 | 0.481 | 0.490 | 0.535 | 0.555 | 0.722 | 0.582 | 0.617 | 0.715 | 0.588 | 0.789 | 0.655 | 0.653 | 0.584 | 0.535 | 0.616 |
| BM1824 | 0.729 | 0.728 | 0.657 | 0.627 | 0.716 | 0.288 | 0.653 | 0.739 | 0.677 | 0.257 | 0.729 | 0.515 | 0.757 | 0.723 | 0.694 | 0.536 | 0.744 | 0.687 | 0.674 | 0.645 | 0.619 | 0.638 |
| BM2113 | 0.710 | 0.851 | 0.806 | 0.807 | 0.713 | 0.751 | 0.803 | 0.507 | 0.781 | 0.607 | 0.592 | 0.709 | 0.758 | 0.724 | 0.810 | 0.671 | 0.783 | 0.815 | 0.845 | 0.746 | 0.704 | 0.738 |
| ETH10 | 0.714 | 0.733 | 0.775 | 0.232 | 0.743 | 0.620 | 0.696 | 0.430 | 0.664 | 0.669 | 0.303 | 0.544 | 0.633 | 0.684 | 0.777 | 0.660 | 0.803 | 0.656 | 0.571 | 0.666 | 0.385 | 0.617 |
| ETH225 | 0.770 | 0.765 | 0.706 | 0.618 | 0.710 | 0.752 | 0.786 | 0.758 | 0.749 | 0.627 | 0.633 | 0.702 | 0.717 | 0.715 | 0.683 | 0.600 | 0.673 | 0.603 | 0.754 | 0.539 | 0.596 | 0.688 |
| ETH3 | 0.583 | 0.695 | 0.672 | 0.720 | 0.697 | 0.601 | 0.519 | 0.371 | 0.828 | 0.669 | 0.619 | 0.558 | 0.635 | 0.658 | 0.677 | 0.704 | 0.430 | 0.776 | 0.704 | 0.400 | 0.637 | 0.626 |
| INRA023 | 0.731 | 0.777 | 0.794 | 0.734 | 0.782 | 0.575 | 0.573 | 0.787 | 0.818 | 0.681 | 0.714 | 0.774 | 0.763 | 0.746 | 0.839 | 0.536 | 0.761 | 0.612 | 0.810 | 0.667 | 0.458 | 0.711 |
| SPS115 | 0.211 | 0.523 | 0.716 | 0.490 | 0.778 | 0.627 | 0.780 | 0.740 | 0.319 | 0.245 | 0.668 | 0.469 | 0.625 | 0.613 | 0.370 | 0.198 | 0.120 | 0.545 | 0.507 | 0.604 | 0.776 | 0.520 |
| TGLA122 | 0.696 | 0.832 | 0.819 | 0.693 | 0.421 | 0.583 | 0.708 | 0.476 | 0.716 | 0.804 | 0.656 | 0.561 | 0.804 | 0.831 | 0.797 | 0.580 | 0.819 | 0.784 | 0.819 | 0.703 | 0.683 | 0.704 |
| TGLA126 | 0.590 | 0.656 | 0.673 | 0.413 | 0.660 | 0.559 | 0.727 | 0.548 | 0.620 | 0.550 | 0.604 | 0.793 | 0.645 | 0.616 | 0.526 | 0.593 | 0.723 | 0.711 | 0.685 | 0.778 | 0.524 | 0.628 |
| TGLA227 | 0.769 | 0.817 | 0.818 | 0.818 | 0.763 | 0.751 | 0.758 | 0.844 | 0.793 | 0.688 | 0.828 | 0.742 | 0.855 | 0.823 | 0.840 | 0.707 | 0.704 | 0.818 | 0.759 | 0.831 | 0.701 | 0.782 |
| Average | 0.621 | 0.729 | 0.736 | 0.622 | 0.705 | 0.622 | 0.693 | 0.607 | 0.678 | 0.576 | 0.627 | 0.644 | 0.707 | 0.705 | 0.703 | 0.579 | 0.668 | 0.697 | 0.707 | 0.651 | 0.602 | 0.661 |

**Supplementary Table S3.** *Wright F-Statistics (FIT. FST. FIS) and breed differentiation (RST) among 21 breeds.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | FIT | FST | FIS |  RST |
| BM1818 | 0.100 | 0.097 | 0.003 | 0.092 |
| BM1824 | 0.077 | 0.071 | 0.006 | 0.037 |
| BM2113 | 0.147 | 0.138 | 0.011 | 0.126 |
| ETH10 | 0.120 | 0.121 | -0.002 | 0.057 |
| ETH225 | 0.066 | 0.064 | 0.002 | 0.070 |
| ETH3 | 0.077 | 0.076 | 0.001 | 0.096 |
| INRA023 | 0.099 | 0.107 | -0.009 | 0.103 |
| SPS115 | 0.108 | 0.116 | -0.009 | 0.177 |
| TGLA122 | 0.144 | 0.134 | 0.011 | 0.111 |
| TGLA126 | 0.170 | 0.152 | 0.022 | 0.065 |
| TGLA227 | 0.090 | 0.084 | 0.006 | 0.112 |
| Mean | 0.109 | 0.106 | 0.004 | 0.105 |

**Supplementary Table S4.** *Pairwise estimates of genetic differentiation and genetic distances among all the breeds. The FST estimates are above the diagonal and the Reynolds genetic distance is below the diagonal. All estimates of FST were found to be significant (P <0.01).*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | SAL | BLA | LIM | CHL | DEX | SHL | HER | GAL | BBL | HEC | WAL | MAR | HFR | HOL | DFH | GWH | DLV | MRY | VRB | BRR | WAG |
| SAL | \* | 0.060 | 0.081 | 0.133 | 0.128 | 0.203 | 0.134 | 0.163 | 0.081 | 0.224 | 0.098 | 0.103 | 0.125 | 0.139 | 0.119 | 0.183 | 0.134 | 0.111 | 0.083 | 0.137 | 0.251 |
| BLA | 0.061 | \* | 0.025 | 0.084 | 0.069 | 0.154 | 0.075 | 0.124 | 0.051 | 0.161 | 0.067 | 0.076 | 0.073 | 0.077 | 0.055 | 0.136 | 0.068 | 0.055 | 0.049 | 0.075 | 0.152 |
| LIM | 0.085 | 0.026 | \* | 0.106 | 0.088 | 0.134 | 0.092 | 0.122 | 0.074 | 0.202 | 0.079 | 0.076 | 0.098 | 0.103 | 0.070 | 0.159 | 0.079 | 0.069 | 0.066 | 0.089 | 0.156 |
| CHL | 0.142 | 0.088 | 0.113 | \* | 0.117 | 0.215 | 0.153 | 0.170 | 0.089 | 0.200 | 0.098 | 0.148 | 0.127 | 0.128 | 0.074 | 0.194 | 0.113 | 0.098 | 0.075 | 0.078 | 0.216 |
| DEX | 0.136 | 0.071 | 0.092 | 0.125 | \* | 0.150 | 0.082 | 0.152 | 0.101 | 0.172 | 0.133 | 0.096 | 0.101 | 0.112 | 0.088 | 0.152 | 0.097 | 0.100 | 0.080 | 0.100 | 0.182 |
| SHL | 0.227 | 0.168 | 0.144 | 0.242 | 0.162 | \* | 0.171 | 0.193 | 0.204 | 0.289 | 0.204 | 0.200 | 0.169 | 0.181 | 0.175 | 0.253 | 0.198 | 0.194 | 0.175 | 0.214 | 0.242 |
| HER | 0.144 | 0.078 | 0.096 | 0.166 | 0.086 | 0.188 | \* | 0.159 | 0.104 | 0.188 | 0.159 | 0.113 | 0.087 | 0.104 | 0.107 | 0.154 | 0.123 | 0.117 | 0.086 | 0.126 | 0.193 |
| GAL | 0.177 | 0.132 | 0.130 | 0.187 | 0.165 | 0.214 | 0.173 | \* | 0.157 | 0.278 | 0.161 | 0.125 | 0.117 | 0.139 | 0.132 | 0.193 | 0.148 | 0.154 | 0.107 | 0.136 | 0.258 |
| BBL | 0.085 | 0.052 | 0.077 | 0.093 | 0.107 | 0.228 | 0.110 | 0.171 | \* | 0.199 | 0.117 | 0.095 | 0.078 | 0.086 | 0.063 | 0.134 | 0.089 | 0.052 | 0.041 | 0.083 | 0.196 |
| HEC | 0.254 | 0.175 | 0.225 | 0.223 | 0.189 | 0.341 | 0.209 | 0.325 | 0.223 | \* | 0.262 | 0.231 | 0.212 | 0.217 | 0.161 | 0.243 | 0.200 | 0.206 | 0.173 | 0.227 | 0.257 |
| WAL | 0.104 | 0.069 | 0.082 | 0.103 | 0.142 | 0.229 | 0.173 | 0.176 | 0.124 | 0.304 | \* | 0.153 | 0.131 | 0.135 | 0.122 | 0.227 | 0.146 | 0.114 | 0.118 | 0.103 | 0.218 |
| MAR | 0.109 | 0.079 | 0.079 | 0.160 | 0.101 | 0.223 | 0.120 | 0.133 | 0.100 | 0.263 | 0.166 | \* | 0.106 | 0.122 | 0.097 | 0.134 | 0.119 | 0.115 | 0.081 | 0.122 | 0.245 |
| HFR | 0.133 | 0.076 | 0.103 | 0.136 | 0.107 | 0.185 | 0.091 | 0.124 | 0.081 | 0.238 | 0.140 | 0.112 | \* | 0.009 | 0.069 | 0.127 | 0.094 | 0.081 | 0.054 | 0.097 | 0.172 |
| HOL | 0.150 | 0.081 | 0.108 | 0.137 | 0.119 | 0.200 | 0.110 | 0.150 | 0.090 | 0.244 | 0.145 | 0.130 | 0.009 | \* | 0.066 | 0.144 | 0.108 | 0.085 | 0.061 | 0.102 | 0.169 |
| DFH | 0.127 | 0.057 | 0.073 | 0.076 | 0.092 | 0.192 | 0.113 | 0.141 | 0.065 | 0.176 | 0.130 | 0.102 | 0.071 | 0.068 | \* | 0.130 | 0.052 | 0.062 | 0.029 | 0.068 | 0.169 |
| GWH | 0.202 | 0.146 | 0.174 | 0.215 | 0.165 | 0.292 | 0.168 | 0.215 | 0.144 | 0.278 | 0.257 | 0.144 | 0.136 | 0.156 | 0.139 | \* | 0.164 | 0.138 | 0.104 | 0.158 | 0.305 |
| DLV | 0.144 | 0.071 | 0.082 | 0.120 | 0.102 | 0.221 | 0.132 | 0.160 | 0.093 | 0.223 | 0.158 | 0.126 | 0.099 | 0.115 | 0.053 | 0.180 | \* | 0.089 | 0.068 | 0.080 | 0.212 |
| MRY | 0.117 | 0.056 | 0.072 | 0.103 | 0.105 | 0.216 | 0.124 | 0.167 | 0.054 | 0.231 | 0.121 | 0.122 | 0.084 | 0.089 | 0.064 | 0.148 | 0.094 | \* | 0.026 | 0.040 | 0.191 |
| VRB | 0.087 | 0.050 | 0.068 | 0.078 | 0.083 | 0.192 | 0.090 | 0.114 | 0.042 | 0.190 | 0.125 | 0.084 | 0.055 | 0.063 | 0.030 | 0.110 | 0.071 | 0.027 | \* | 0.055 | 0.194 |
| BRR | 0.147 | 0.078 | 0.094 | 0.081 | 0.105 | 0.241 | 0.134 | 0.146 | 0.087 | 0.258 | 0.109 | 0.130 | 0.102 | 0.107 | 0.070 | 0.172 | 0.084 | 0.041 | 0.057 | \* | 0.219 |
| WAG | 0.288 | 0.165 | 0.170 | 0.244 | 0.201 | 0.277 | 0.215 | 0.298 | 0.218 | 0.297 | 0.246 | 0.282 | 0.189 | 0.186 | 0.186 | 0.364 | 0.238 | 0.212 | 0.215 | 0.247 | \* |

**Supplementary Figure S1.** *L-shaped mode shift graph showing the absence of founder effect in Spanish Salers cattle.*



 **Supplementary Figure S2.** *Evanno method representation to obtain the most likelihood cluster from Structure analysis.*

 