

CONSERVATION OF BIODIVERSITY IN ITALIAN POULTRY BREEDS:
deepening and monitoring
TuBAvi-2



Breed data sheet

LIVORNO

Gallus gallus domesticus Sp.

Origin and morphological,
genetic, reproductive,
and productive traits



FONDO EUROPEO AGRICOLO PER LO SVILUPPO
RURALE: l'Europa investe nelle zone rurali



MINISTERO DELL'AGRICOLTURA
DELLA SOVRANITÀ ALIMENTARE
E DELLE FORESTE





The presented data were registered in the nucleus populations of White, Black, Gold and Silver Livorno conserved at the University of Perugia (UniPG) and of White and Black Livorno conserved at the University of Pisa (UniPI). The data are presented by colour.

Latest update: November 25th, 2024



Livorno

Gallus gallus domesticus Sp.

Breed data sheet: origin and morphological, genetic, reproductive, and productive traits

Breed origin and development

Name of the breed	Livorno
Synonyms or local names	Livornese
Geographic origin	Central Italy
Geographic distribution	Marche, Lazio, Tuscany and Umbria; spread all over the world in many different colours
Estimated total population size	1841 (Castillo et al., 2021)
Extinction risk status (FAO, 1998)	Not at risk
Any other specific information	Light breed, excellent producer of white-shell eggs

<p>Historical origin</p> <p>Livorno, or Livornese, is a breed originated from central Italy, especially from Tuscany rural areas, where it was largely prevalent, because of its excellent performances, fast growing rates, and marked rusticity. By 1800s, even though it hadn't been recognised as a standardised breed and no poultry association existed in Italy, Livorno had already developed uniform morphological traits. It took its name from the city of Livorno. From here, it sailed in the first half of 1800s to reach the USA. Around 1835, N.F. Ward imported golden coloured chickens, that soon interested the breeders, being beautiful and at the same time excellent egg-layers, with a poor brooding aptitude. In 1868 the white variety, now called "Leghorn" by the American, left for Great Britain, and two years later the golden variety was also imported. Breeders were enthusiastic about the new breed, so much that in 1876 the "Leghorn Club" was instituted, representing the first club of an avian breed in the history of poultry farming. Livorno breed had officially been recognized as a pure breed. Livorno was successful among breeders of every country, that tried to improve it through careful selection, so that, by the half of the XX century, every country had its own Livorno standard. In the following years, the main types were defined: the German Livorno, called <i>Italiener</i>, the American Livorno, the English Livorno and even the Dutch Livorno.</p> <p>At the beginning of the 1900, the high quality of this breed began to be appreciated also in Italy, where Livorno cocks were used to improve egg production in local hens. In the last years of the 1900 some Italian breeders have patiently selected the breed to recover the original Italian chicken.</p>

Qualitative and quantitative morphological traits in adult breeders

Discrete or qualitative traits

Feather morphology	Normal
Feather distribution	Normal
Plumage structure	Abundant plumage, with wide feathers with stiff shaft, adherent to the body. Thick down.
Plumage colours	Prevalent colours: White, Black, Gold (<i>Collo oro</i>), Silver (<i>Collo argento</i>) Other colours: Blue, Fawn, Orange (<i>Collo arancio</i>), White Gold (<i>Collo oro bianco</i>), White Columbia, Barred, Splash
Colour features	Single colour, without sexual dimorphism: White, Black, Blue, Fawn Bi-colour, with sexual dimorphism: White Columbia, Barred, Gold, Silver, Orange, White Gold Bi-colour, without sexual dimorphism: Splash
Chick plumage colour	Yellow, grey, black, striped brown depending on the colour
Comb type	Simple comb , red, well developed and well upright in the male. In the female, it gracefully falls to one side after the second spike without covering the eye.
Comb spikes	Five spikes, regularly formed, wide at the base, with quite deep serrations. Except for the first, the spikes are of equal height and width and form a regular curve. The well-formed blade follows the line of the head without getting too close.
Ear-lobe colour	Pure white to ivory or cream white; oval, medium-sized, smooth, and well adherent to the face
Beak colour	Yellow, with possible blackish traces on the top, especially in the Blue and the Black; medium-lengthed, slightly curved
Iris colour	Red-orange
Muffs	Absent
Beard	Absent
Tuft	Absent
Skin colour	Yellow
Shank colour	Yellow
Shank feathering	Free from feathers
Skeletal variants	-
Other specific and distinct visible traits	-

Colour pattern
White: pure white, brighter in the male. White down.
Black: intense black, with strong green sheen. Grey to black down.
Gold: in the male , head intense gold-yellow, neck hackle gold-yellow, lighter in the end with

black striping and green lustre. Back and shoulders dark brilliant red. Saddle feathers gold-yellow with black striping and green lustre. Flight coverts black with metallic blue/green sheen. Primaries black with narrow brown edging. Secondaries inner colour and tips black, outer colour brown. Breast black with green sheen. Belly and legs black. Tail black with strong green sheen. Greyish down. In the **female**, gold-yellow head, gold-yellow neck hackle with black striping and green lustre. Primaries black, with narrow brown edges with peppering. Secondaries inner colour black and outer colour is brown with peppering. Breast is salmon, darker in the upper part. Belly and legs grey/brown. Remainder of plumage brown-gold, with fine uniform brown peppering. Tail black with the main tail coverts marked like the rest of the plumage.

Silver: in the **male**, silver-white head and silver-white neck hackle with black striping with green sheen. Back, shoulders and coverts white. Saddle hackles silver-white with black striping with green sheen. Main wing coverts black with narrow white edging. Secondaries inner colour and tips black, outer colour white. Breast black with green sheen and no white. Belly and legs black. Tail black with strong green sheen. Down greyish. In the **female**, silver-white head and silver-white neck hackle with black striping with green sheen. Primaries black with narrow silver-white outer edging with peppering. Secondaries inner colour and tips black, outer colour silver with peppering. Breast salmon, darker in the upper part. Belly and legs grey. Tail black with the main tail coverts marked like the rest of the plumage. Remainder of plumage silver-grey with fine uniform black peppering.

Blue: uniform pigeon blue with slight feather edging. Light blue down.

Fawn: intense and uniform golden yellow, very brilliant in the male. Bronze hues in the tail. Intense fawn shafts (darker in the primaries). Fawn down.

Orange: in the **male**, head orange and neck hackle light orange with black striping with green sheen. Back, shoulders, and coverts dark orange/red. Saddle hackles light orange with black striping with green sheen. Main wing coverts black with metallic green/blue sheen. Primaries black with narrow white/yellowish outer edging. Secondaries inner colour and tips black, outer colour cream shading to brown towards the end. Breast black with green sheen. Belly and legs black. Tail black with green sheen. Down greyish. In the **female**, the head dark orange and neck hackle yellow-light orange with black striping with green sheen. Primaries black with narrow light brown outer edging with peppering. Secondaries inner colour black and outer colour light brown with peppering. Breast salmon, darker in the upper part. Legs and belly grey. Tail black with the main tail coverts marked like the rest of the plumage. Remainder of plumage light brown with fine uniform black peppering.

White gold (Pile): in the **male** the main colour is cream white. Head red/orange and neck hackle light gold-yellow, darker towards the end, with cream-white striping. Back, shoulders, and coverts dark carmine-red, lighter towards the saddle. Saddle hackles orange to light orange, with thin cream white striping. Main wing coverts cream white. Primaries cream white. Secondaries inner colour and tips cream white, outer colour reddish-brown. Breast, belly, legs cream white. Tail cream white. In colour-rich animals, light black sprinkles can be found. Down cream white. In the **female**, head light gold-yellow, neck hackle light gold-yellow, with cream white striping. Breast and front of neck uniform intense salmon. Remainder of plumage cream white.

White Columbia: in the **male**, head white, and neck hackle white with wide black striping with green sheen. Saddle hackles white (slight black striping accepted). Tail black with green sheen, with white edging on lesser sickles. Remainder of plumage white. Down light grey. In the **female**, head white, neck hackle white with wide black striping with green sheen. Saddle hackles white (black striping accepted). Primaries and secondaries inner colour black and

outer colour white. Tail black with black coverts with white edging. Remainder of plumage white.

Barred: in both male and female, every feather has a barred marking, with regularly alternating black and very light blue. In the **male**, widths of black and blue bars are the same, in the **female** black bars are wider. Feathers end with black tips.

Splash: in both male and female, plumage is off-white with blue, in some birds black, sprinkles, sometimes uneven, with blue ranging from very light to very dark. At hatching, splash chicks can be confused with white chicks, but the colour is genetically distinct.

Quantitative traits

Parameters	Male (average)			
	White	Black	Gold	Silver
Body weight (g)	2461	2294.8	2503	2197
Body length (cm)	44.3	45.5	45.2	44.2
Chest circumference (cm)	36.0	34.6	35.0	34.5
Shank length (cm)	11.5	11.5	11.6	11.5
Shank diameter (cm)	1.5	1.4	1.39	1.36
Wing span (cm)	50.2	49.4	48.3	48.3

Parameters	Female (average)			
	White	Black	Gold	Silver
Body weight (g)	1629	1801.5	1685	1674
Body length (cm)	38.3	40.5	41.0	40.0
Chest circumference (cm)	32.3	32.0	32.4	32.5
Shank length (cm)	9.6	9.1	8.75	8.70
Shank diameter (cm)	1.2	1.2	1.18	1.10
Wing span (cm)	42.4	43.5	42.2	42.5

Genetic traits

Characterisation of the breed with Single Nucleotide Polymorphisms (SNPs)

Molecular marker	Affymetrix Axiom 600K Chicken Genotyping Array
Laboratory that performed the analyses	Department of Agronomy, Food, Natural Resources, Animals and Environment (DAFNAE) University of Padua
Analysed parameters	MAF: minor allelic frequency Ho: observed heterozygosity He: expected heterozygosity F _{HOM} : inbreeding coefficient

White						
Anno		N**	MAF	Ho	He	F _{HOM}
2019	Mean	24	0.269	0.205	0.218	0.465
	SD*		0.295	0.196	0.186	0.061
Black						
Anno		N**	MAF	Ho	He	F _{HOM}
2019	Mean	24	0.263	0.233	0.231	0.365
	SD*		0.279	0.211	0.195	0.062

*SD: standard deviation; **N: number of samples

Characterisation of nucleus populations with microsatellites and mating plans

Molecular marker	Microsatellites (26 markers)
Laboratory that performed the analyses	Laboratory of Animal Molecular Genetics Department of Veterinary Science (DSV) University of Turin
Analysed parameters	Ne: effective number of alleles Na: observed number of alleles I: Shannon diversity index H-Ind: individual variability index Ho: observed heterozygosity (average H-Ind) He: expected heterozygosity F: fixation index P: average kinship index
Indexes used to schedule mating plans	H-Ind P

White									
Year		UniPG nucleus population							
		N**	Na	Ne	I	Ho	He	F	P
2023	Mean	13	2.10	1.70	0.55	0.40	0.35	-0.15	0.69
	SE*		0.09	0.08	0.05	0.04	0.03	0.04	0.00
Year		UniPI nucleus population							
		N**	Na	Ne	I	Ho	He	F	P
2020	Mean	43	1.857	1.374	0.353	0.171	0.224	0.118	0.771
	SE*		0.143	0.102	0.076	0.039	0.052	0.079	0.003
2022	Mean	48	2.73	1.46	0.47	0.23	0.27	0.14	0.73
	SE*		0.29	0.08	0.06	0.03	0.04	0.05	0.00

*SE: standard error; **N: number of samples

Black									
Year		UniPG nucleus population							
		N**	Na	Ne	I	Ho	He	F	P
2023	Mean	13	2.00	1.54	0.46	0.31	0.30	-0.07	0.72
	SE*		0.09	0.06	0.04	0.03	0.03	0.05	0.01
Year		UniPI nucleus population							
		N**	Na	Ne	I	Ho	He	F	P
2020	Mean	77	2.571	1.807	0.638	0.426	0.408	-0.029	0.609
	SE*		0.173	0.121	0.072	0.055	0.047	0.055	0.003
2022	Mean	73	3.42	2.00	0.76	0.41	0.44	0.07	0.61
	SE*		0.24	0.13	0.07	0.04	0.04	0.04	0.00

*SE: standard error; **N: number of samples

Golden									
Year		UniPG nucleus population							
		N**	Na	Ne	I	Ho	He	F	P
2023	Mean	11	2.77	2.04	0.72	0.35	0.42	0.14	0.59
	SE*		0.16	0.12	0.06	0.04	0.03	0.06	0.01

*SE: standard error; **N: number of samples

Silver									
Year		UniPG nucleus population							
		N**	Na	Ne	I	Ho	He	F	P
2023	Mean	10	1.88	1.50	0.40	0.27	0.25	-0.10	0.75
	SE*		0.13	0.08	0.05	0.04	0.03	0.06	0.01

*SE: standard error; **N: number of samples

Reproductive and productive quantitative traits

Oviposition, brooding and incubation data

	White	Black	Gold	Silver
Age at sexual maturity of hens (weeks)	24	24	24	24
Length of first oviposition cycle (weeks)	56	55	Not available	
Average annual egg production per hen*	168	129	170	170
Average clutch size (min-max)	Not available			
Clutch interval (days)	Not available			
Incubation length (days)	21	21	21	21

*As measured during the first year of age, per family line

Egg-quality traits

Parameters	First oviposition cycle			
	White*	Black**	Gold°	Silver°°
Egg weight (g)	56.7	56.3	47.6	47.5
Shell colour	White			

*Total n. of measured eggs: 1543; **Total n. of measured eggs: 351

°Total n. of measured eggs: 100; °°Total n. of measured eggs: 100

Parameters	Second oviposition cycle			
	White*	Black**	Gold°	Silver°°
Egg weight (g)	57.5	56.9	55.6	55.5
Shell colour	White			

*Total n. of measured eggs: 2456; **Total n. of measured eggs: 448

°Total n. of measured eggs: 100; °°Total n. of measured eggs: 100

Parameters (sample measurement)	Average			
	White	Black	Gold	Silver
Egg weight (g)	56.3	56.4	55.6	55.5
Shell weight (g)	5.8	5.6	7.7	7.8
Albumen weight (g)	34.6	31.9	29.8	29.8
Yolk weight (g)	16.6	18.9	18.0	17.9
Egg Shape Index*	73.2	71	73	74

* Egg Shape Index (ESI) = short diameter/long diameter x 100

Reproductive traits

Incubation parameters	First oviposition cycle*			
	White	Black	Gold	Silver
Fertility (% produced eggs)	95.3	96.4	81	80
Hatchability (% fertile eggs)	73.8	70.2	87	88
Hatchability (% produced eggs)	77.6	67.3	70	70

*Per family line

Incubation parameters	Second oviposition cycle*			
	White	Black	Gold	Silver
Fertility (% produced eggs)	75.9	81.1		
Hatchability (% fertile eggs)	73.1	61.9	N.a.**	N.a.**
Hatchability (% produced eggs)	55.4	51.3		

*Per family line

**N.a.: Not available information

Body weight and growth data

Age (weeks)	Males - Average weight (g)			
	White	Black	Gold	Silver
0 (hatching)	37.4	39.5	32	32
8	741.4	714.7	739	740
12	1285.2	1278.2	1281	1280
18	1532.5	1633.0	1643	1642
26	2056.6	2178.9	1941	1940
30	2323.7	2418.4		
34	2523.2			

Age (weeks)	Females - Average weight (g)			
	White	Black	Gold	Silver
0 (hatching)	37.8	40.7	28,5	28
8	607.5	607.5	630	640
12	986.4	995.4	1180	1185
18	1172.9	1257.6	1440	1490
26	1499.2	1636.6	1650	1630
30	1575.5	1735.7		
34	1728.3			

Mortality

Age (weeks)	Average (%)			
	White		Black	
	Male	Female	Male	Female
0-1	0	0	0	0
1-8	4.3	0	0	0
8-20	0	0	2.8	1.1
20-70	0	3.0	0	2.3

Slaughter data

Parameters	Males (average)			
	White	Black	Gold	Silver
Slaughter age	168	168	140	140
Live weight (g)	2028.7	2168.0	1830	1830
Eviscerated carcass weight (g)	1433.2	1448.3	1171	1144
Eviscerated carcass yield (%)	70.6	70.0	64.0	62.5

Parameters	Females (average)			
	White	Black	Gold	Silver
Slaughter age	176	-	140	140
Live weight (g)	1728.7		1600	1580
Eviscerated carcass weight (g)	1062.6	N.a.*	992	988
Eviscerated carcass yield (%)	61.5		62.0	62.5

*N.a.: Not available information

Rearing traits

Breed type	Mediterranean chicken, rustic, lively, and strong
Growth speed (precocious vs tardive)	Tardive
Feathering speed (precocious vs tardive)	Precocious
Broodiness	Low or absent
Parental care attitude	Yes
Ease of breeding	Easy
Male:female ratio for breeding	1:8
Tolerance or resistance to diseases and parasites	Not available
Tolerance to extremes of temperature	Not available
Reported uses (meat, eggs)	Primary: eggs Secondary: meat

Livorno male and female

White



Experimental Poultry and Rabbit Farm, UniPG



Experimental Poultry and Rabbit Farm, UniPG



Poultry Breeding Farm
Podere Le Querciole, UniPI



Poultry Breeding Farm
Podere Le Querciole, UniPI

Black



Experimental Poultry and Rabbit Farm, UniPG



Experimental Poultry and Rabbit Farm, UniPG



Poultry Breeding Farm Podere Le Querciole,
UniPI



Poultry Breeding Farm Podere Le Querciole,
UniPI

Gold



Experimental Poultry and Rabbit Farm, UniPG



Experimental Poultry and Rabbit Farm, UniPG

Silver



Experimental Poultry and Rabbit Farm, UniPG



Experimental Poultry and Rabbit Farm, UniPG

Bibliography

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Project coordinator

Prof. Silvia Cerolini
Department of Veterinary Medicine and Animal Sciences
University of Milan
Email silvia.cerolini@unimi.it
www.pollitaliani.it