25th Congress
ASPA2023
Animal Production Science:
innovations and sustainability
for future generations
Monopoli (Bari, Italy), June 13-16, 2023

Advancement in conservation programs
of Italian poultry genetic resources for rural development

Silvia Cerolini

UNIVERSITÀ DEGLI STUDI DI MILANO
DIPARTIMENTO DI MEDICINA VETERINARIA
E SCIENZE ANIMALI

divas

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50° 25th Congress ASPA2023 Animal Production Science: innovations and sustainability for future generations Monopoli (Bari, Italy), June 13-16, 2023

MINISTERO DELL'AGRICOLTURA DELLA SOVRANITÀ ALIMENTARE E DELLE FORESTE

TUTELA BIODIVERSITÀ AVICOLA ITALIANA

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

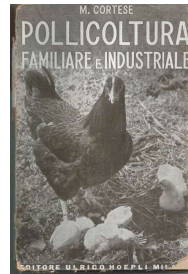divas DIPARTIMENTO DI MEDICINA VETERINARIA E SCIENZE ANIMALI

Italian poultry breeds used for productive purpose up to the first half of 1900
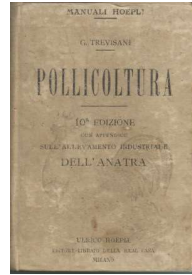
1919 - *Trevisani* reports 45 million birds reared for egg and meat production; products also exported in France, Germany, England, Belgium.

Major productive chicken breeds: *Livorno, Padovana, Valdarno, Polverara, Milanino.*

1946 – *Cortese* still reports rural farming for poultry production. Still reared local breeds.

Major productive chicken breeds: *Livorno, Valdarno, Padovana gigante, Polverara, Ancona, Siciliana, Milanino, Ermellinata di Lucca, Romagnola, Megiarola.*

1960 – 2000 Local breeds completely discarded from poultry sector and reared only in fancy and rural farms.

Census of Italian poultry breeds based on historical literature was published in 2001

IDENTIFICAZIONE E SALVAGUARDIA GENETICA DELLE RAZZE AVICOLE ITALIANE

Alessio Zanon [1][2], Alberto Sabbioni [1]

Species	N. breeds	N. diffused	N. at risk	Extinct
Gallus gallus	53	6	11	35
Meleagris gallopavo	12	1	5	6
Numida meleagris	11	0	5	6
Anas platyrhynchos	8	0	2	6
Cairina moschata	1	0	1	0
Anser anser	5	0	4	1
total	90	7	28	54

Conservation programs of Italian chicken breeds start at local level with the support of public Institutions:

- 2000-2004 *CO.VA.* Activities for conservation and valorization of poultry breeds from Veneto Region. Veneto Agricoltura for Veneto Region.

- 2000 *Riconoscimento, salvaguardia e valorizzazione del pollo del Valdarno.* ARSIA project with UniFI contribution. Valdarnese bianca breed inlcuded in 'Repertorio regionale delle risorse genetiche autoctone animali della Toscana' in 2003 and the Registry of the breed set up in 2005.

- 2012 *CoVAL* Conservation and valorization of poultry breeds from Lombardia region. UniMI with the financial support of Lombardia Region.

- 2018 Conservation of biodiversity in local poultry genetic resources. UniTO with the support of Piemonte region.

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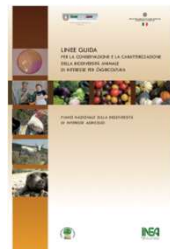Monopoli (Bari, Italy), June 13-16, 2023

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2009 National Plan on Biodiversity for Rural Development (DM 28672 del 14/12/2009).

2012 Guidelines for the conservation and characterization of animal biodiversity for agriculture (DM del 6/07/2012). Aim is to support the development of national actions for conservation of biodiversity in productive sectors, and then safeguard native breeds at risk with positive impacts on environment, conservation of genetic diversity and sustainable agricultural systems.

2014 MIPAAF sets up the Registro Anagrafico Avicoli (DG DISR n. 19536).

2015 Actions on safeguarde and valorization of biodiversity for agriculture and food production (legge n. 194 01/12/2015). Aim is to set up a national network for conservation of biodiversity in agricultural genetic resources at risk: a) national registry, b) national network, c) sito web crea.gov.it, d) permanent committee.

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Registro Anagrafico Avicoli includes farming management for **breeding, multiplication and production**.

Chicken, turkey, guinea-fowl, duck, goose and pigeon breeds included into the Registro anagrafico

Gallus gallus	*Meleagris gallopavo*	*Numida meleagris*	*Anas plathyrihyncos*	*Anser anser*	*Columbia livia*
Ancona	Brianzolo	Azzurra di Ghigi	Mignon	Padovana	Ascolano
Bianca di Saluzzo	Bronzato comune	Bianca albina	Germanata veneta	Pezzata veneta	Bergamasco
Bionda piemontese	Bronzato Colli Euganei	Bluetta	Romagnola	Romagnola	Piacentino
Collo nudo italiana	Castano precoce	Camosciata			Reggianino
Ermellinata di Rovigo	Ermellinato di Rovigo	Fulvetta			Romagnolo
Livorno	Romagnolo	Grigia comune			Romano
Mericanel della Brianza	Nero d'Italia	Lilla o Grigio Perla			Sottobanca di MO
Millefiori di Lonigo	Tacchino di PR e PC				Triganino modenese
Millefiori piemontese					
Modenese					
Mugellese					
Padovana					
Pepoi					
Pollo trentino					
Polverara					
Robusta lionata					
Robusta maculata					
Romagnolo					
Valdarnese bianca					
Valdarno					
Siciliana					
Tirolese o Tirolerhuhn					

Allegato 1

DISCIPLINARE DEL LIBRO GENEALOGICO DELLE RAZZE AVICOLE AUTOCTONE

CAPITOLO I - ORGANIZZAZIONE

Art.1

1. Il "*Registro anagrafico delle razze avicole autoctone*" già istituito ai sensi dell'art.1 lettera b) del decreto legislativo del 30 Dicembre 1992, n.529, con D.M. n. 19536 del 1 ottobre 2014 e successive modifiche, assume la denominazione di "*Libro Genealogico delle razze avicole autoctone*" ed è regolato dal presente disciplinare, ai sensi della normativa vigente.

2. Il "*Libro genealogico elle razze avicole autoctone*" è tenuto dall'Associazione Nazionale Coniglicoltori Italiani, di seguito denominata ANCI, ente giuridicamente riconosciuto con D.P.R. n. 272 del 2 marzo 1981 che opera sull'intero territorio nazionale. L'ANCI subentra all'Associazione Italiana Allevatori, originariamente incaricata alla tenuta del "*Registro anagrafico delle razze avicole autoctone*", ai sensi del citato D.M. n. 19356/2014 e successive modifiche.

Art.2

1. Nel quadro delle più generali politiche di salvaguardia della biodiversità animale, il Libro genealogico rappresenta lo strumento ufficiale per la tutela e la conservazione delle razze avicole autoctone con particolare riguardo al mantenimento delle loro caratteristiche e della loro variabilità genetica, promuovendone nel contempo la valorizzazione economica.

2017 MIPAAF includes the poultry sector in the call "**National Rural Development Programme 2014/2022 – Measure 10.2 – Conservation, use and sustainable development of genetic resources in agriculture**" with the support of the European Agricultural Fund for Rural Development

TuBAvI project
Conservation of biodiversity in Italian poultry breeds
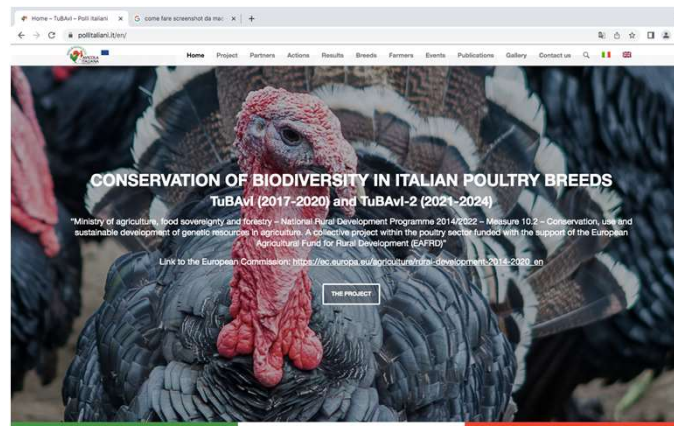
TuBAvI (2017-2024) is a national project dedicated to the safeguard, conservation and valorization of the Italian breeds, mainly in chickens and turkeys, recognized in *Libro Genealogico Avicoli*

TuBAvI is a partnership among 7 Italian Universities engaged in the conservation of biodiversity in poultry species through scientific expertise and the direct management of autochthonous breed populations.

Activities within TuBAvI project

✓ Action 1 - Phenotypic characterization of Italian autochthonous breeds and species

✓ Action 2 - Genetic characterization of autochthonous chicken and turkey breeds reared in Italy

✓ Action 4 - Assessment of conservation indexes, mating plans and breeding management

✓ Action 5 - Assessment of inbreeding and genetic diversity in bird populations

✓ Action 6 - Monitoring of genetic diversity in Italian autochthonous breeds and its assessment

✓ Action 8 - Sperm cryobank of Italian chicken and turkey breeds

✓ Action 10 - Communication and dissemination activities

Conservation status, rearing systems and marketing (2018-2019)

Survey on 121 farms
- 62% for production
- 38% for hobby

Geographical distribution
- 45% North
- 36% Centre
- 19% South

Species reared
- 57% chicken only
- 43% chicken + other species
Turkey is other species most reared

Housing structure
- 9% shed
- 68% shed + outdoor pen
- 44% outdoor pen

Productive purpose
- Farmers: 38% meat, 23% both, 15% eggs
- Fancy farmers: 60% breeders, 20% eggs, 10% meat or both

Marketing
- Meat: 19% sell > 500 birds/year
- Eggs: 39% sell > 1000 egg/year

Population size of chicken breeds

Table 3. Native Italian chicken breed population sizes: summary data for all breeders and divided according to breeder category.

| Variable	All Breeders		Farmers		Fancy Breeders		$\chi^{2\,1}$
	n	%	n	%	n	%	
Italian Chicken Breed	(n = 15,562)		(n = 13,588)		(n = 1974)		
Ancona	379 [G,H]	2.44	208 [I]	1.53	171 [D,E]	8.66	**
Bianca di Saluzzo	874 [D]	5.62	874 [E,F]	6.43	0 [J]	0.00	**
Bionda Piemontese	3400 [A]	21.85	3319 [A]	24.43	81 [F]	4.10	**
Collo Nudo Italiana	-						
Ermellinata di Rovigo	828 [D,E]	5.32	828 [E,G]	6.09	0 [J]	0.00	**
Livorno	1841 [B]	11.83	1340 [C]	9.86	501 [A]	25.38	**
Mericanel della Brianza	140 [K]	0.90	131 [J]	0.96	9 [H,J]	0.46	**
Millefiori di Lonigo	755 [E]	4.85	755 [G]	5.56	0 [J]	0.00	**
Millefiori Piemontese	-	-	-	-	-	-	-
Modenese	20 [M]	0.13	20 [M]	0.15	0 [J]	0.00	**
Mugellese	277 [I]	1.78	92 [K]	0.68	185 [D]	9.37	**
Padovana	1180 [C]	7.58	952 [E]	7.01	228 [C]	11.55	**
Pépoi	899 [D]	5.78	899 [E,F]	6.62	0 [J]	0.00	**
Pollo Trentino	-	-	-	-	-	-	
Polverara	1093 [C]	7.02	1090 [D]	8.02	3 [I,J]	0.15	**
Robusta Lionata	452 [F]	2.90	444 [H]	3.27	8 [H,I]	0.41	**
Robusta Maculata	433 [F,G]	2.78	419 [H]	3.08	14 [H]	0.71	**
Romagnola	369 [H]	2.37	149 [J]	1.10	220 [C]	11.14	**
Siciliana	186 [J]	1.20	41 [L]	0.30	145 [E]	7.35	**
Valdarnese Bianca	398 [F,G,H]	2.56	57 [L]	0.42	341 [B]	17.27	**
Valdarno Nera	59 [L]	0.38	44 [L]	0.32	15 [H]	0.76	**
Tirolese o Tirolerhuhn	-	-	-	-	-	-	
Other local bird populations [2]							
Cornuta di Sicilia	18 [M]	0.12	0 [N]	0.00	18 [H]	0.91	**
Milanino	130 [K]	0.84	130 [J]	0.96	0 [J]	0.00	**
Nostrana di Morozzo	1831 [B]	11.77	1796 [B]	13.22	35 [G]	1.77	**

[1] Chi square test for a single variable between the two breeder categories, i.e., within row comparisons; significance levels: ** $p < 0.01$. [A-N] Observations with different superscripts within the column are significantly different (χ^2-test $p < 0.01$). [2] Breeds not recognized by the Italian Ministry for Agricultural Policies.

Bianca di Saluzzo

Bionda piemontese
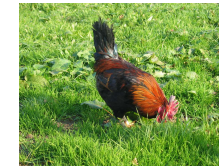
Pepoi

Polverara

Livorno nera

Siciliana

Castillo et al, 2021, *Animals*

Population size of turkey breeds

Table 4. Native Italian turkey breed population sizes: summary data for all breeders and divided according to breeder category.

Variable	All Breeders		Farmers		Fancy Breeders		χ^2 [1]
	n	%	n	%	n	%	
Italian turkey breed	(n = 1010)		(n = 915)		(n = 95)		
Brianzolo	15 [D]	1.49	15 [B]	1.64	0 [D]	0.00	**
Bronzato Comune	445 [A]	44.06	445 [A]	48.63	0 [D]	0.00	**
Bronzato dei Colli Euganei	50 [B]	4.95	0 [C]	0.00	50 [A]	52.63	**
Castano Precoce	-	-	-	-	-	-	
Ermellinato di Rovigo	425 [A]	42.08	425 [A]	46.45	0 [D]	0.00	**
Nero d'Italia	35 [BC]	3.47	0 [C]	0.00	35 [B]	36.84	**
Parma e Piacenza	9 [D]	0.89	9 [B]	0.98	0 [D]	0.00	**
Romagnolo	31 [C]	3.07	21 [B]	2.30	10 [C]	10.53	**

[1] Chi square test for a single variable between the two breeder categories, i.e., within row comparisons; significance levels: ** $p < 0.01$. [A–D] Observations with different superscripts within the column are significantly different (χ^2-test $p < 0.01$).

Castillo et al, 2021, *Animals*

Brianzolo

Nero di Italia

Tacchino di PR&PC

Ermellinato di Rovigo

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Genome-wide diversity and population structure studied through species-specific 600K SNPs array

23 chicken breeds

Table 1. Genetic diversity indices. Number of animals per breed (N), minor allele frequency (MAF), expected (He) and observed (Ho) heterozygosity, and inbreeding coefficient (F_{HOM}). For each value, the standard deviation (SD) is reported.

| Breed	Acronym	N	MAF Mean	MAF SD	Ho Mean	Ho SD	He Mean	He SD	F_{HOM} Mean	F_{HOM} SD
Ancona	ANC	24	0.267	0.242	0.263	0.181	0.274	0.187	0.284	0.100
Bianca di Saluzzo	BSA	24	0.286	0.190	0.339	0.172	0.336	0.151	0.076	0.059
Bionda Piemontese	BPT	22	0.283	0.210	0.325	0.186	0.317	0.164	0.116	0.025
Cornuta Caltanissetta	COR	22	0.267	0.301	0.167	0.162	0.210	0.178	0.545	0.180
Ermellinata di Rovigo	PER	23	0.309	0.321	0.199	0.192	0.220	0.198	0.459	0.044
Livorno Bianca	PLB	24	0.269	0.295	0.205	0.196	0.218	0.186	0.465	0.061
Livorno Nera	PLN	24	0.263	0.279	0.233	0.211	0.231	0.195	0.365	0.062
Mericanel della Brianza	MER	24	0.282	0.268	0.232	0.180	0.261	0.186	0.368	0.127
Millefiori di Lonigo	PML	23	0.281	0.238	0.293	0.199	0.291	0.178	0.202	0.080
Modenese	MOD	24	0.273	0.252	0.260	0.197	0.27	0.181	0.296	0.083
Mugellese	MUG	24	0.284	0.231	0.281	0.182	0.300	0.175	0.236	0.115
Padovana Argenta	PPA	24	0.241	0.331	0.151	0.198	0.146	0.185	0.588	0.098
Padovana Camosciata	PPC	24	0.238	0.303	0.169	0.191	0.179	0.193	0.538	0.095
Padovana Dorata	PPD	24	0.247	0.264	0.219	0.194	0.232	0.187	0.404	0.081
Pepoi	PPP	24	0.277	0.341	0.154	0.191	0.168	0.196	0.579	0.039
Polverara Bianca	PPB	24	0.260	0.261	0.216	0.179	0.248	0.187	0.411	0.052
Polverara Nera	PPN	24	0.257	0.290	0.201	0.193	0.213	0.194	0.454	0.062
Robusta Lionata	PRL	23	0.305	0.345	0.181	0.199	0.185	0.195	0.508	0.039
Robusta Maculata	PRM	24	0.304	0.358	0.157	0.190	0.166	0.193	0.572	0.032
Romagnola	ROM	24	0.271	0.241	0.281	0.197	0.278	0.182	0.235	0.091
Siciliana	SIC	24	0.259	0.361	0.129	0.205	0.123	0.189	0.648	0.034
Valdarnese	VLD	24	0.283							
Valplatani	VLP	20	0.281							
708 Broiler Ross	708	13	0.317							
Eureka	EUK	9	0.329							
Hy-lyne white eggs	HYL	10	0.333							
Isa Brown	ISA	9	0.332							

A

7 turkey breeds
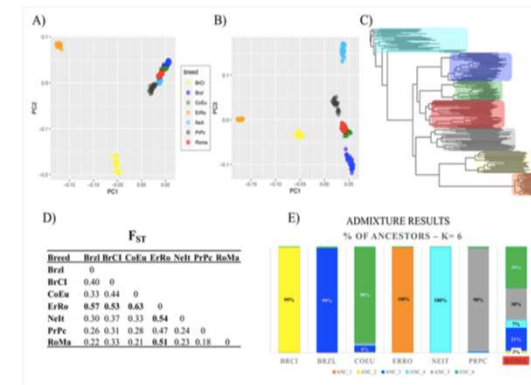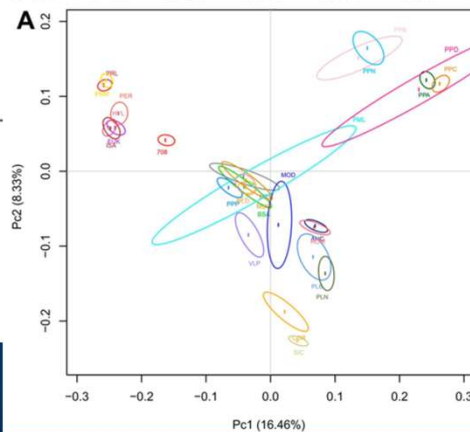
Table 4. Descriptive statistics for inbreeding coefficients F_{HOM} and F_{ROH}.

Breed	F_{HOM} Min	F_{HOM} Max	F_{HOM} Mean (SD)	F_{ROH} Min	F_{ROH} Max	F_{ROH} Mean (SD)
BrCI	−0.105	0.31	0.089 (0.115)	0.159	0.293	0.220 (0.035)
Brzl	−0.49	0.25	−0.074 (0.18)	0.095	0.488	0.308 (0.091)
CoEu	−0.871	0.61	−0.009 (0.411)	0.106	0.666	0.355 (0.153)
ErRo	−0.2	0.25	0.044 (0.118)	0.321	0.455	0.401 (0.03)
NeIt	−0.7	0.6	−0.118 (0.32)	0.011	0.636	0.208 (0.148)
PrPc	−0.264	0.19	−0.014 (0.127)	0.025	0.259	0.126 (0.057)
Roma	−0.119	0.4	0.049 (0.144)	0.067	0.291	0.133 (0.063)

Genetic diversity, molecular kinship, inbreeding, contribution to overall genetic diversity and rate of extiction studied in 17 chicken breeds – microsatellite markers
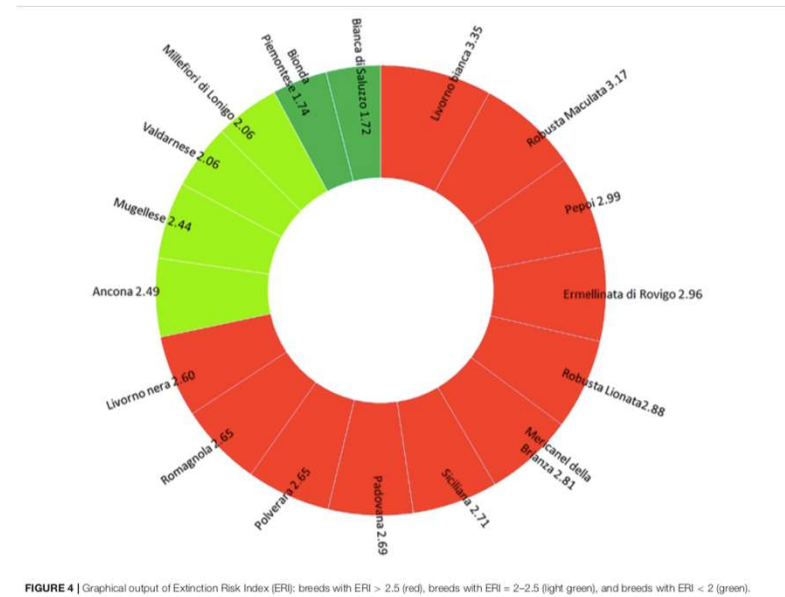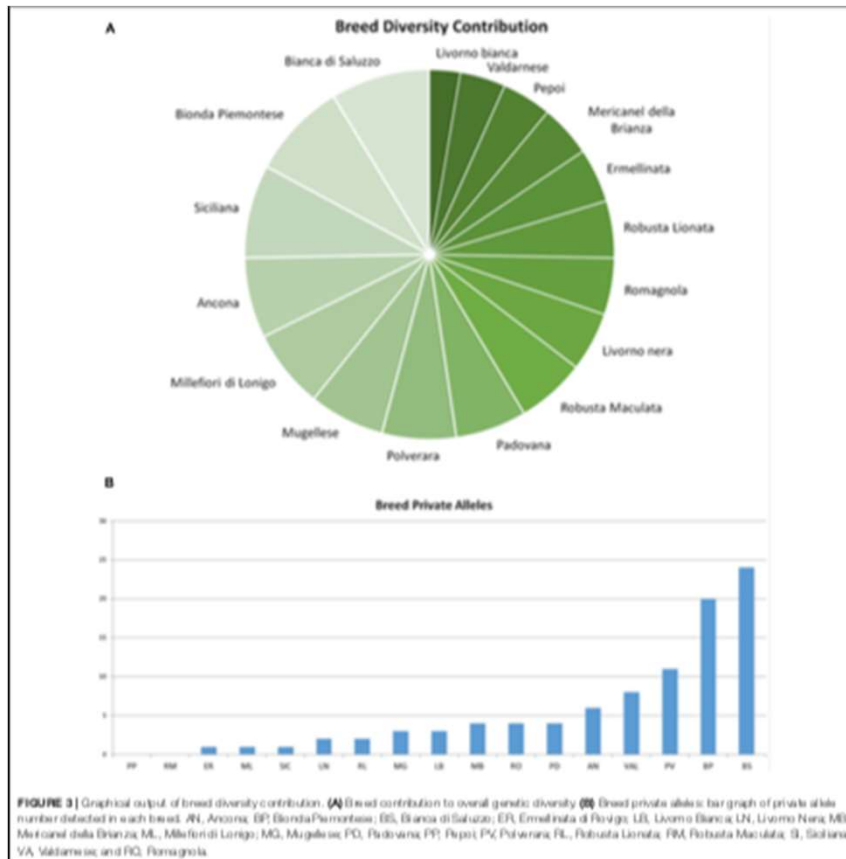
Nucleus populations for biodiversity conservation

| Breed	Conservation Centre
Gallus gallus	
Ancona	UniPI, UniPG
Bianca di Saluzzo	UniTO
Bionda piemontese	UniTO
Collo nudo italiana	UniMOL
Livorno	UniPI, UniPG
Mericanel della Brianza	UniMI
Millefiori piemontese	UniTO
Modenese	UniMI
Mugellese	UniFI
Valdarnese bianca	UniFI
Valdarno	UniFI
Meleagris gallopavo	
Brianzolo	UniMI
Romagnolo	UniMOL
Ermellinato di Rovigo	UniMOL

Aim
- Maximize biodiversity conservation
- Minimize inbreeding
- Record and monitor performance

Breeding – Familiar lines identified after bird genotyping
Mating plans identified by H-indiv and molecular kinship

Phenotyping - Morphological, reproductive and productive data collected for several generations
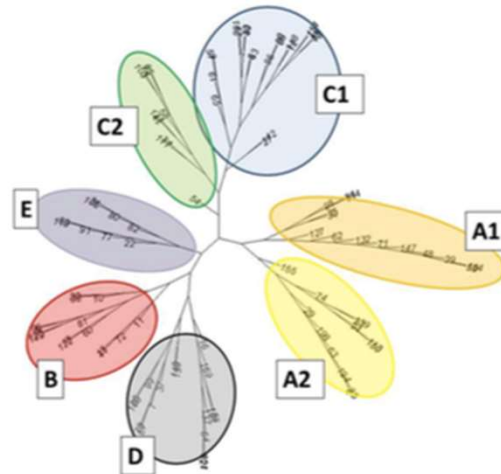
		A	B+C	D+E+F	G
ME129	A	0,83	0,72	0,71	0,68
ME131	A	0,83	0,69	0,67	0,62
ME150B	A	0,84	0,69	0,68	0,63
ME122	B	0,68	0,76	0,70	0,63
ME125	B	0,73	0,80	0,73	0,67
ME138	B	0,66	0,76	0,67	0,61
ME148B	B	0,69	0,75	0,71	0,63
ME152	B	0,70	0,77	0,69	0,64
ME112	D	0,74	0,72	0,77	0,69
ME119	D	0,72	0,71	0,73	0,67
ME121	D	0,72	0,69	0,74	0,67
ME139	D	0,70	0,65	0,72	0,58
ME141	D	0,71	0,69	0,74	0,66
ME156	D	0,66	0,67	0,73	0,58
ME137	E	0,71	0,69	0,75	0,67
ME140	E	0,67	0,70	0,77	0,67
ME147B	E	0,70	0,72	0,74	0,67

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All data organized in breed technical forms available online
www.pollitaliani.it

- Breed origin and development
- Morphological qualitative and quantitative traits
- Genetic index in nucleus population
- Reproductive traits
- Oviposition and egg traits
- Growth traits
- Slaughter traits
- Mortality

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approfondimenti e monitoraggio
TuBAvI-2

AVICOLA ITALIANA

Scheda tecnica di razza

LIVORNO

Origine e caratteri morfologici, genetici, riproduttivi e produttivi

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Chicken Breed	Body weigtht male (g)	Body weight female (g)	Egg production (n/year)	Fertility (%)
Ancona	2163	1820	160	90
Bianca di Saluzzo	2823	1964	132	85
Bionda piemontese	2596	2082	165	85
Ermellinata di Rovigo	3437	2322	180	87
Livorno	2545	1660	170	87
Mericanel della Brianza	1023	748	72	60
Millefiori di Lonigo	2820	1990	155	87
Mugellese	1095	704	115	94
Padovana	2575	1890	200	94
Pepoi	1860	1290	170	73
Polverara	2250	1675	125	89
Robusta lionata	3950	2750	165	81
Robusta maculata	4220	2830	155	86
Siciliana	1883	1428	94	77
Valdarnese bianca	3010	1786	195	77

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Ex situ in vitro technique
Italian semen cryobank of autochthonous chicken and turkey breeds

Activities

2017-2019 - Identification of species-specific semen freezing/thawing reference procedures

2019-2020 - Drafting Standard Operative Procedures (SOP) for the implementation of semen cryobank

2020-2024 - Storage of semen doses from Italian chicken and turkey breeds

Breed	Semen doses
Gallus gallus	
Ancona	13
Bionda piemontese	179
Bianca di Saluzzo	196
Livorno	166
Mericanel della Brianza	44
Mugellese	9
Pepoi	535
Polverara	4
Robusta maculata	170
Siciliana	435
Valdarnese bianca	4
Valdarno	4
Meleagris gallopavo	
Bronzato comune	13
Ermellinato di Rovigo	11
Romagnolo	50

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Conclusion

Chicken and turkey Italian breeds confirmed to be a relevant reservoir of genetic variability.

Network of breeding poultry centres established, and phenotipic and genetic data on nucleus populations available.

Priority is to routinely implement conservation activities: confirm, support and further develop TuBAvI breeding management.

Future planning for multiplication farms is required in order to develop niche chain and market.

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Thank you for your attention