



michele.diiorio@unimol.it

25th Congress

ASPA2023

**Animal Production Science:
innovations and sustainability
for future generations**

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

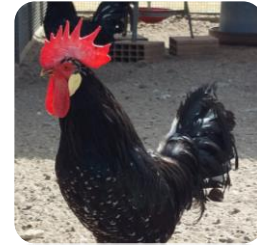
Phenotypic characterization of semen production and quality in Italian chicken and turkey breeds

Michele Di Iorio - Nicolaia Iaffaldano - Giusy Rusco - Emanuele Antenucci - Manuela Madeddu - Luisa Zaniboni - Stefano Paolo Marelli - Silvia Cerolini



BACKGROUND

Native Italian chicken and turkey breeds are an important resources of avian biodiversity



22 chicken breeds



8 turkey breeds

BACKGROUND

Loss of biodiversity

Extensive breeding



populations
native breeds



Intensive breeding



According to **FAO risk categories**, the majority of chicken and turkey breeds were categorized as at risk, and only 5 chicken breeds had population sizes that were categorized as not at risk (Castillo et al., 2021).



BACKGROUND

Conservation of biodiversity in Italian poultry breeds

TuBAvI (2017-2020)

Conservation of biodiversity in Italian poultry breeds: deepening and monitoring

TuBAvI-2 (2021-2024)

- ✓ are dedicated to the safeguard, conservation and valorisation of the Italian poultry genetic resources
- ✓ supplying new data and tools for the implementation of a nationwide conservation program



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

Action 1 – Phenotypical characterisation of Italian autochthonous breeds and species

- Oviposition rate
- Growing performance
- Eggs quality
- Reproductive performance
- Morphological characterisation
- Resistance to diseases
- Environmental stress resilience
- Innate immunity
- Low-input system adaptation
- Semen production



OBJECTIVE

The purpose of this work was to assess the fresh semen quality of different Italian chicken and turkey breeds

MATERIALS AND METHODS

Animals

38
COCKERELS



13
TURKEYS

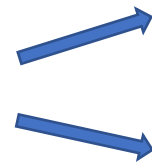


MATERIALS AND METHODS

Quantitative sperm traits



SEMEN COLLECTION



abdominal massage

training period 3 – 6 weeks



VOLUME



SPERM CONCENTRATION

1

Dilution
1:200 (NaCl)

2

Optical density
530 nm

3

N° sperm $\times 10^9/\text{mL}$

MATERIALS AND METHODS

Sperm motility

1

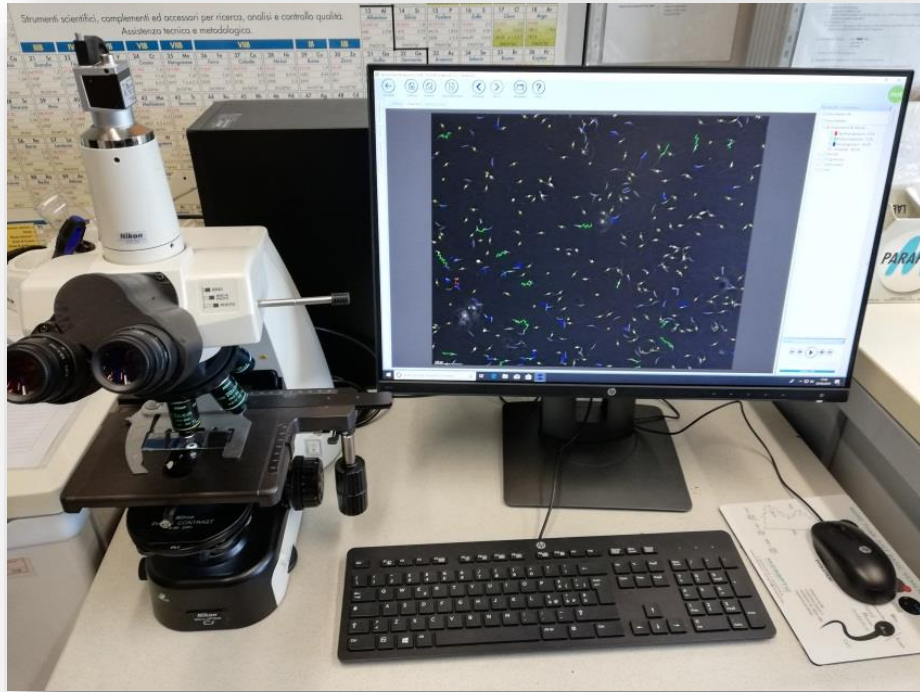
Dilution
 100×10^6 spz/mL

2

Incubation

3

3 μ L
 Leja chamber



CASA-system
 software Sperm Class Analyzer-SCA
 Nikon mod. Ci-L

- ✓ Total Motility (%)
- ✓ Progressive Motility (%)
- ✓ VCL (μ m/s)
- ✓ VSL (μ m/s)
- ✓ VAP (μ m/s)
- ✓ LIN (%)
- ✓ STR (%)



SCA
EVOLUTION

Referenzia: 1447 Codice: 1

Data (giornomeseanno): 18/06/2021 Animale: polo

Centro: Laboratorio

Nuovo (18/06/2021 10:46:44)

Concentrazione: 20.78 Milioni / ML 74.45 M/Campione Volume (mL): 2.50
 Diluzione 1:0

Progressione	Totale	%	Milioni / ML	M/Campione
Progressivo (PR)	188	30.08	8.66	22.28
Non-progressivo (NP)	351	56.16	16.72	41.81
Immobile (IM)	86	13.76	4.10	10.24
Totale	625	89.94	29.48	74.33

Velocità	Totale	%	Milioni / ML	M/Campione
Rapido	134	21.44	6.38	16.06
Medio	168	26.88	8.43	21.59
Lento	207	33.12	9.86	24.86
Immobile (IM)	86	13.76	4.10	10.24
Totale	625	89.94	29.48	74.33

Velocità e progressività	Totale	%	Milioni / ML	M/Campione
Rapido progressivo	94	10.24	3.15	7.62
Medio progressivo	124	19.84	5.91	14.77
Non progressivo	351	56.16	16.72	41.81
Immobile	86	13.76	4.10	10.24
Totale	625	89.94	29.48	74.33

Progressione

Velocità

Velocità e progressività

Area Testa	Media	Immobile (M)	Lento	Medio	Rapido	Unità
	47.70	30.51	47.05	52.00	53.37	μ m

Concentrazione	Totale	%
Cellule rotonde	0.81	Milioni / ML
Tracceione circolari	418	85.55 %

Sperm Class Analyzer®

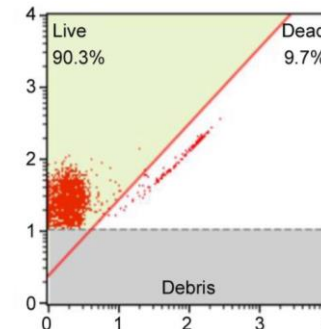
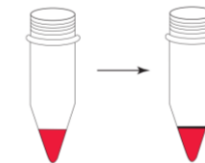
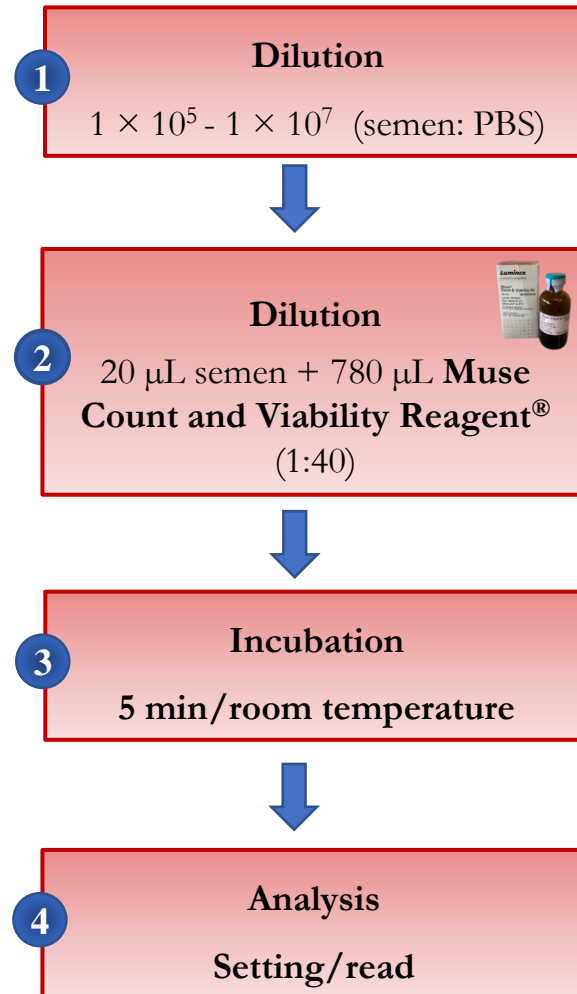
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MATERIALS AND METHODS

Sperm membrane integrity



MUSE®
Cell Analyzer




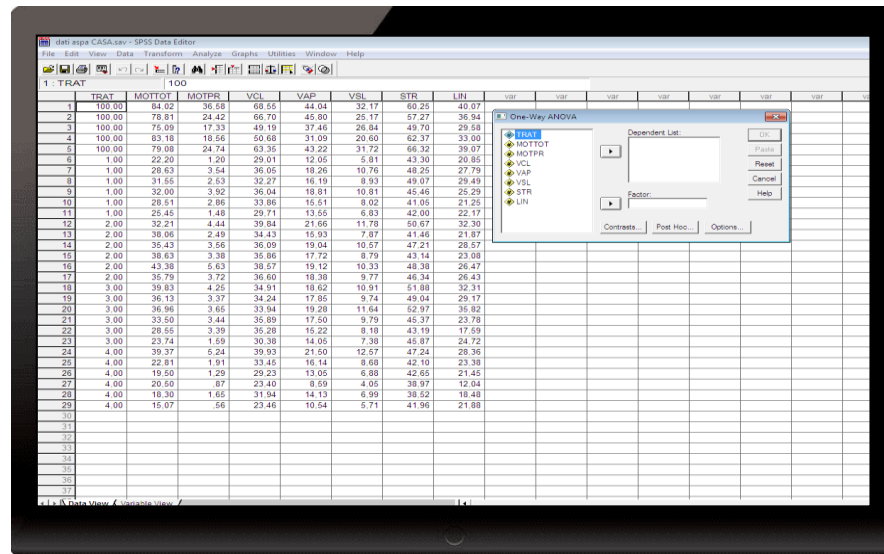
MATERIALS AND METHODS

Statistical analysis

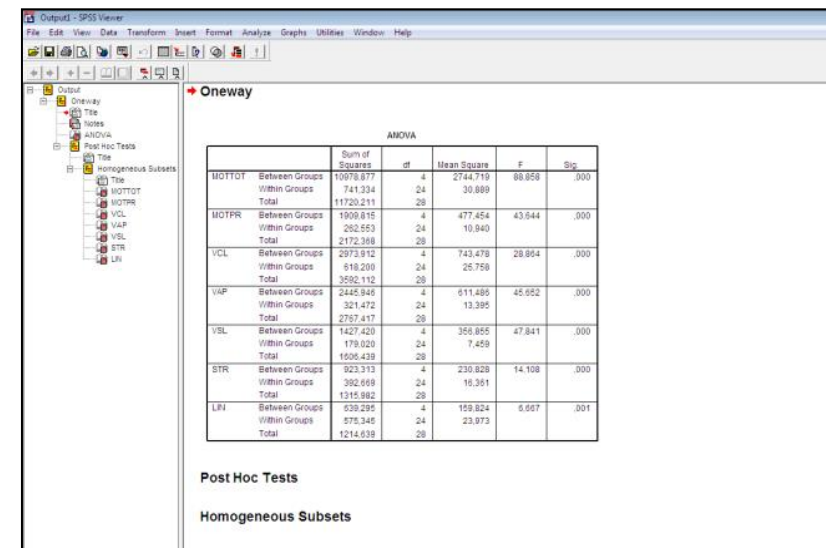
 Sperm quality parameters were analyzed by ANOVA

 SHEFFE'S comparison test

 Significance was set at $P < 0.05$



	TRAT	MOTTOT	MOTPR	VCL	VAP	VSL	STR	LIN
1	100.00	84.02	36.68	68.65	44.04	32.17	60.25	40.07
2	100.00	78.81	24.42	66.70	45.80	25.17	57.27	36.94
3	100.00	76.09	17.33	49.19	37.46	26.84	49.70	29.58
4	100.00	83.18	18.56	60.68	31.69	20.60	62.37	33.00
5	100.00	79.08	24.74	63.35	43.22	31.72	66.32	39.07
6	1.00	22.20	1.20	29.01	12.05	5.81	43.30	20.85
7	1.00	28.63	3.54	26.05	18.26	10.76	48.25	27.79
8	1.00	31.55	2.53	32.27	16.19	8.93	49.07	29.49
9	1.00	32.00	3.92	36.04	18.81	10.81	45.46	25.29
10	1.00	28.51	2.86	33.86	15.61	8.02	41.05	21.25
11	1.00	25.45	1.48	29.71	13.55	6.83	42.00	22.17
12	2.00	32.21	4.44	39.84	21.66	11.78	50.67	32.30
13	2.00	38.06	2.49	34.43	15.93	7.87	41.46	21.87
14	2.00	35.43	3.56	36.09	19.04	10.57	47.21	28.57
15	2.00	38.63	3.38	35.86	17.72	8.79	43.14	23.08
16	2.00	43.38	5.63	38.57	19.12	10.33	48.38	26.47
17	2.00	35.79	3.72	36.60	18.38	9.77	46.34	26.43
18	3.00	39.83	4.25	34.91	18.62	10.91	51.88	32.31
19	3.00	36.13	3.37	34.24	17.85	9.74	49.04	29.17
20	3.00	36.96	3.65	33.84	19.28	11.64	52.97	35.82
21	3.00	33.50	3.44	35.89	17.50	9.79	45.37	23.78
22	3.00	28.55	3.39	35.28	15.22	8.18	43.19	17.59
23	3.00	23.74	1.59	30.38	14.05	7.38	45.87	24.72
24	4.00	39.37	6.24	39.93	21.60	12.57	47.24	28.36
25	4.00	22.81	1.91	33.46	16.14	8.68	42.10	23.38
26	4.00	15.50	1.29	29.23	13.05	6.88	42.65	21.45
27	4.00	20.50	0.87	23.40	8.59	4.05	38.97	12.04
28	4.00	18.30	1.66	31.84	14.13	6.99	38.52	18.48
29	4.00	15.07	.56	23.46	10.54	5.71	41.96	21.88
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								



ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
MOTTOT	Between Groups	10978.877	4	2744.719	88.858	.000
	Within Groups	741.334	24	30.889		
Total		11720.211	28			
MOTPR	Between Groups	1909.815	4	477.454	43.844	.000
	Within Groups	282.553	24	10.940		
Total		2192.368	28			
VCL	Between Groups	2973.912	4	743.478	28.884	.000
	Within Groups	918.208	24	38.258		
Total		3892.120	28			
VAP	Between Groups	2445.946	4	611.486	42.552	.000
	Within Groups	321.472	24	13.395		
Total		2767.417	28			
VSL	Between Groups	1427.428	4	356.855	47.841	.000
	Within Groups	179.020	24	7.459		
Total		1606.438	28			
STR	Between Groups	923.313	4	230.828	14.108	.000
	Within Groups	302.669	24	12.611		
Total		1225.982	28			
LIN	Between Groups	535.285	4	133.821	5.667	.001
	Within Groups	575.345	24	23.973		
Total		1110.630	28			

Post Hoc Tests

Homogeneous Subsets

RESULTS




Sperm quality traits

BREED	Volume (μL)	Conc ($\times 10^9/\text{mL}$)	TM (%)	PM (%)	VCL ($\mu\text{m}/\text{sec}$)	VAP ($\mu\text{m}/\text{sec}$)	VSL ($\mu\text{m}/\text{sec}$)	LIN (%)	STR (%)	SMI (%)
Bionda piemontese	<u>402 ± 25^a</u> ↑	2.9 ± 0.2^a	87.7 ± 1.9^a	24.6 ± 1.2^a	74.5 ± 3.6^a	46.6 ± 2.1^a	29.1 ± 1.2^a	40.3 ± 0.9^a	63.4 ± 0.8^a	89.2 ± 1.6^b
Mericanel della Brianza	113 ± 9^b	2.3 ± 0.2^b	91.1 ± 3.2^a	27.2 ± 3.2^a	72.6 ± 9.3^a	47.7 ± 5.6^a	30.6 ± 3.5^a	42.7 ± 3.0^a	64.3 ± 2.7^a	<u>96.2 ± 0.9^a</u> ↑
Robusta maculata	146 ± 15^b	1.6 ± 0.1^b	86.4 ± 1.8^a	31.3 ± 1.3^a	75.7 ± 4.2^a	49.9 ± 2.4^a	33.5 ± 1.5^a	46.8 ± 1.4^a	68.7 ± 1.2^a	95.0 ± 0.6^{ab}
Siciliana	153 ± 6^b	<u>3.4 ± 0.1^a</u> ↑	91.2 ± 0.5^a	26.7 ± 0.9^a	66.8 ± 1.0^a	44.2 ± 1.0^a	31.3 ± 0.7^a	43.4 ± 0.9^a	62.3 ± 0.7^a	91.7 ± 0.5^b

RESULTS



Sperm quality traits

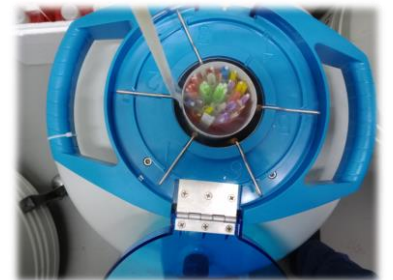
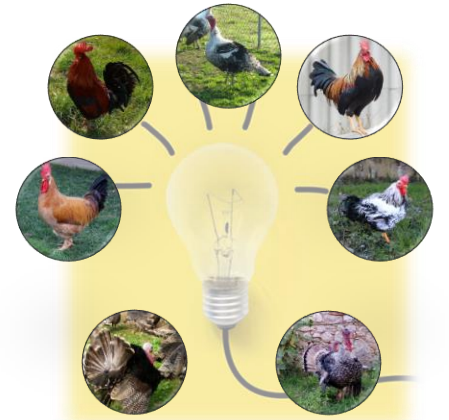
BREED	Volume (μL)	Conc ($\times 10^9/\text{mL}$)	TM (%)	PM (%)	VCL ($\mu\text{m}/\text{sec}$)	VAP ($\mu\text{m}/\text{sec}$)	VSL ($\mu\text{m}/\text{sec}$)	LIN (%)	STR (%)	SMI (%)
Romagnolo	200 ± 28^a	5.9 ± 0.4^a	79.1 ± 2.1^a	24.2 ± 2.5^a	64.0 ± 3.0^a	35.0 ± 2.6^a	22.4 ± 2.1^a	27.6 ± 1.7^a	48.4 ± 1.6^a	92.9 ± 0.9^a
Bronzato comune	157 ± 18^a	5.5 ± 0.4^a	79.9 ± 3.2^a	25.6 ± 2.6^a	64.8 ± 3.1^a	35.8 ± 1.6^a	22.7 ± 1.1^a	29.5 ± 1.3^a	50.2 ± 1.4^a	<u>93.7 ± 1.1^a</u> 
Ermellino di Rovigo	128 ± 10^a	6.1 ± 0.3^a	73.8 ± 0.8^a	17.0 ± 1.2^a	63.0 ± 1.8^a	29.2 ± 2.9^a	16.7 ± 3.2^a	22.2 ± 4.4^a	41.6 ± 4.9^a	88.7 ± 0.8^b

CONCLUSION

For the first time, the results provided a phenotypic characterization of semen production in Italian avian breeds

These knowledge are useful in predicting the fertilizing ability of each donor

The quality of fresh semen is an important prerequisite for the implementation of a successful freezing protocol

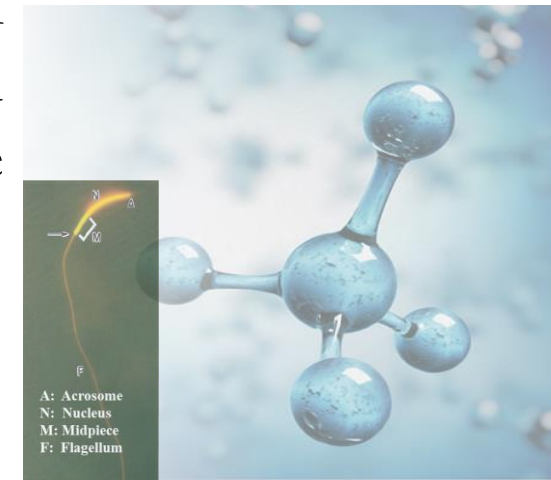


FUTURE PERSPECTIVES

The semen production and quality in other autochthonous chicken and turkey breeds



Further studies are planned to evaluate the main structural components of the sperm membrane, such as the lipid composition and protein profile, to obtain a more comprehensive overview





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THANK YOU FOR YOUR ATTENTION