

National Rural Development Programme 2014-2022

Measure 10.2 – Biodiversity

Project: TuBAvI-2 (2021-2024)

REPORT ON THE ACTIVITIES OF THE THIRD AND FOURTH YEAR

PA UniPG

This report describes the activities performed from May 1, 2023, to March 31, 2024. The activities are described by Action, according to the original programme.

Action 1 – Phenotypical characterisation of autochthonous breeds and species

The action 1 activities were carried out in previous years, the respective data are published in the second annual report year of the project. The Ancona, Livorno (Bianca, Nera, Dorata and Argentata) and Robusta Maculata breeds are currently preserved at the poultry center of the University of Perugia. As in previous years, the best animals for each breed have been selected and therefore each breed is organized into two families with approximately 10-13 females and 3 males. To avoid inbreeding problems, each animal is individually marked with a chip. Through the use of a reader, the chip reports all the information regarding the relationship.

Task 2 Characterisation of the adaptation to low-input breeding systems and evaluation of the performances of the native breeds

The evaluation of the adaptability to extensive farming systems characterized by low-input farming (use of local raw materials, moderate energy and protein intake) and "natural" environmental parameters (temperature, humidity and light) was completed, in particular, the ability to adapt to conditions of high temperatures (heat-stress) typical of the summer season has been evaluated.

Task 3 Behavioural Characterisation

Task 3.1 Behavioural characterisation of the Leghorn breed.

The trial for the characterization of the Leghorn breed (described in the 1st report) started in June 2022 was completed. In particular, the trial produced a total of 12 h of outdoor recording and 12 h of indoor recording using the Noldus XT software.

Task 3.2 Behavioural characterisation of the Ancona breed

The study protocol of this task, as for the previous one, was submitted and accepted by the University Committee of Bioethics (prot n.76527 of 3/3/2022). The trial involves the use of 54 hens and 6 males of white Leghorn, the housing occurred the first week of June 2024 at 14 weeks of age.

The animals were divided into two experimental groups:

- one group was reared indoors: the animals were housed in 3 boxes without outdoor access with a density of 10 animals/m². In each box 9 females and 1 male were housed for a total of 27 females and 3 males. This experimental group act as the control group.
- one group had outdoor access: the breeding area is characterised by the presence of three outdoor parks each with a shelter for the animals in which the following densities were used: external 10 m²/head, internal 10 animals/m², inside each shelter will be placed 2 feeders and 2 drinking troughs. In each pen 9 females and 1 male were housed for a total of 27 females and 3 males.

The experimental test for the characterization of the Ancona breed has been completed. In particular, the behavioral trial was carried out during the months of June and July 2023, during the recordings the minimum and maximum temperatures of the day were noted. The test, as for the previous breed, produced a total of 12 hours of outdoor recording and 12 hours of indoor recording carried out using the Noldus XT software. The test was carried out using the same devices, structures and methods used for the characterization of the Leghorn breed. For this reason, individual devices (bibs) were applied to the individual animals, each outdoor areas and internal boxes had UWB Anchors positioned at the antipodes, 1 UWB Tag positioned in the centre, 1 UWB Gateway, 1 Computer for collecting the raw files and 10 chips placed on the bibs (Figure 1). The software was able to produce a raw report for each animal with a precise recording of the behavior every 2 seconds, detecting its spatial position within the four quadrants of the area and the Cartesian axis (x, y, z), indicating the peck and the distance covered (Figure 2).

Action 2 – Evaluation and identification of genetic resistance traits to diseases in farmed animals.

Task 4: Genetic characterisation of native chicken breeds through the study of polymorphisms in candidate genes involved in heat stress response.

Task 4.1 It was completed during the second year. The results obtained were taken into consideration to plan matings.

Task 4.2 The genomic data were returned by LGCgenomics to our research unit, which performed an analysis of the data, shown in Table 1. The total samples were 700 and 21 polymorphisms (SNP) in the *Heat Shock Protein* codifying genes were analysed for each of them (Table 1). Contrary to the expected, only one SNP in analysis was found polymorphic within animals: *Chen2015_A-69G_hsp70_R*. The following SNP was presented as normal homozygous (T:T) in 98.43% of the animals, as heterozygous (T:A) in 0.42%, and as homozygous for polymorphism (A:A) in 1.14%. The animals showing a heterozygous profile were three in total belonging to the Mugellese and Bionda Piemontese breeds. The animals showing a homozygous profile for polymorphism were 8 in total and belonging to different breeds, among which: Livorno, Modenese, Siciliana and Polverara (Figure 3).

Action 3 – Verification of data consistency

Task 5. Verification of consistency of data and information.

Datasets have been prepared, validated and made available in previous reports.

Action 9 – Dissemination and preparation of thematic technical reports and technical-scientific reports

Task 6. Data processing, dissemination, and reporting

Task 6.1 the collected data was processed to produce intermediate reports, technical data sheets, etc.

Task 6.2 All data collected are disseminated in conferences and meetings of the poultry sector. For this purpose, two abstracts were accepted at the 25th Congress ASPA - Bari 13-16 June 2023 as oral presentation:

- Assessing the motivation of Leghorn hens to access outdoor space and pasture resources.
Diletta Chiattelli, Marco Birolo, Alice Cartoni Mancinelli, Laura Menchetti, Cesare Castellini
- Preliminary validation of Ultra-Wide Band device as an innovative tool to assess chicken behaviour.
Alice Cartoni Mancinelli, Diletta Chiattelli, Laura Menchetti, Gianmaria Bernacchia, Cesare Castellini

The project was also presented as part of the International Congress of the International Society of Animal Genetics (ISAG) held in Cape Town (South Africa) from 2nd to 7th of July 2023:

- The TuBaVi project: an example of biodiversity management in Italian local chicken breeds.
Dominga Soglia, Francesco Perini, Nadia Stoppani, Achille Schiavone, Emiliano Lasagna

Task 6.3 all the data collected in task 5 will be processed with the aim of obtaining a manual including all the parameters characterizing the native Italian breeds Ancona and Leghorn.

References:

- Mancinelli, A. C., Chiattelli, D., Bernacchia, G., Nicconi, C., Torroni, J., Castellini, C., & Roselli, L. (2022, November). Assessment of Ultra-Wide Band device for monitoring chicken behaviour reared free-range. In *2022 IEEE Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)* (pp. 91-93). IEEE.
- Lantinga, E. A., Neuteboom, J. H., & Meijs, J. A. C. (2004). Sward methods. *Herbage intake handbook*, 2, 23-52.

FIGURES AND TABLES

Figure 1. Operating principle of the system

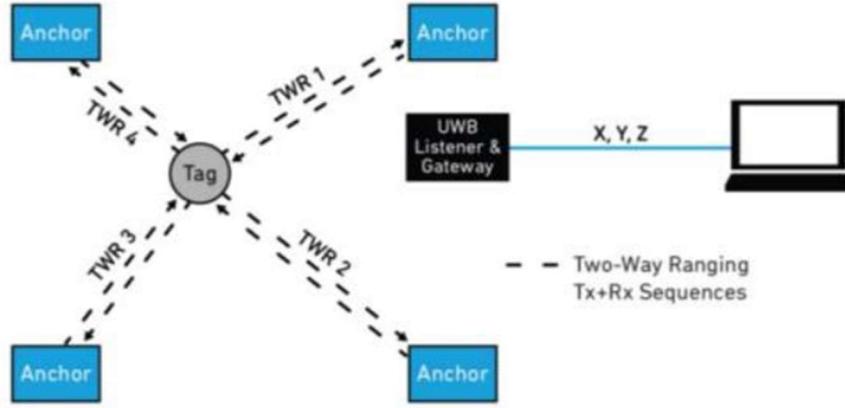


Figure 2. Summary screen of software

ts	x	y	z	time	year	month	day	hour	min	s	check_beccata	distance	quadrante	Q1	Q2	Q3	Q4
0	38.837.488	19.188.728	0.60665834	16.624.494.607.988.700	2023	7	6	9	31	0	0	0.0	1	1	0	0	0
2	40.105.076	16.847.916	0.59732258	16.624.494.625.783.100	2023	7	6	9	31	2	0	0.2661988008441813	1	1	0	0	0
4	41.434.283	13.657.991	0.57025146	1.662.449.464.577.040	2023	7	6	9	31	4	0	0.34557796160163323	1	1	0	0	0
6	41.789.656	10.812.017	0.5456146	16.624.494.666.215.800	2023	7	6	9	31	6	1	0.2868075657615224	1	1	0	0	0
8	41.693.969	0.81450135	0.37376359	16.624.494.685.802.800	2023	7	6	9	31	8	1	0.26687194815081733	1	1	0	0	0
10	41.448.641	0.64917308	0.2636528	16.624.494.705.802.800	2023	7	6	9	31	10	1	0.0	1	1	0	0	0
12	412.728	0.58154219	0.21297792	16.624.494.725.782.900	2023	7	6	9	31	12	1	0.0	1	1	0	0	0
14	41.190.572	0.52896234	0.17358962	16.624.494.746.182.700	2023	7	6	9	31	14	1	0.0	1	1	0	0	0
16	41.278.667	0.39202034	0.077555507	16.624.494.765.782.800	2023	7	6	9	31	16	1	0.0	1	1	0	0	0
18	41.958.408	0.44858956	0.22356136	1.662.449.478.618.300	2023	7	6	9	31	18	1	0.0	1	1	0	0	0
20	43.117.023	0.43759146	0.23172821	16.624.494.805.782.700	2023	7	6	9	31	20	1	0.0	1	1	0	0	0
22	44.302.506	0.39112252	0.21477878	1.662.449.482.632.290	2023	7	6	9	31	22	1	0.0	1	1	0	0	0
24	44.999.809	0.41706851	0.18404558	16.624.494.846.302.700	2023	7	6	9	31	24	1	0.0	1	1	0	0	0
26	45.211.592	0.531948	0.32528543	16.624.494.865.782.800	2023	7	6	9	31	26	1	0.0	1	1	0	0	0
28	46.462.307	0.53636426	0.38650748	16.624.494.885.782.700	2023	7	6	9	31	28	1	0.0	1	1	0	0	0
30	4.736.237	0.56831437	0.35368973	1.662.449.490.576.290	2023	7	6	9	31	30	1	0.0	1	1	0	0	0
32	49.163.442	0.52493954	0.31791022	16.624.494.925.782.700	2023	7	6	9	31	32	1	0.18525652314930494	1	1	0	0	0
34	50.427.766	0.52194512	0.307893	16.624.494.945.802.600	2023	7	6	9	31	34	1	0.0	2	0	1	0	0
36	52.059.374	0.54118228	0.35982922	16.624.494.965.808.900	2023	7	6	9	31	36	1	0.0	2	0	1	0	0
38	53.305.869	0.50882596	0.38790673	16.624.494.986.208.600	2023	7	6	9	31	38	1	0.0	2	0	1	0	0
40	53.845.196	0.44718862	0.29295465	1.662.449.500.576.860	2023	7	6	9	31	40	1	0.0	2	0	1	0	0
42	5.458.921	0.42521772	0.32342219	16.624.495.026.208.600	2023	7	6	9	31	42	1	0.0	2	0	1	0	0
44	55.540.156	0.42185357	0.42871833	16.624.495.046.212.000	2023	7	6	9	31	44	0	0.0	2	0	1	0	0
46	56.253.414	0.51391745	0.55346286	16.624.495.065.771.800	2023	7	6	9	31	46	1	0.0	2	0	1	0	0
48	56.782.613	0.51788521	0.56361091	16.624.495.086.196.600	2023	7	6	9	31	48	1	0.0	2	0	1	0	0
50	56.863.647	0.51612765	0.60695869	16.624.495.106.196.100	2023	7	6	9	31	50	1	0.0	2	0	1	0	0

Figure 3. Genotypes for SNP *Chen2015_A-69G_hsp70_R*

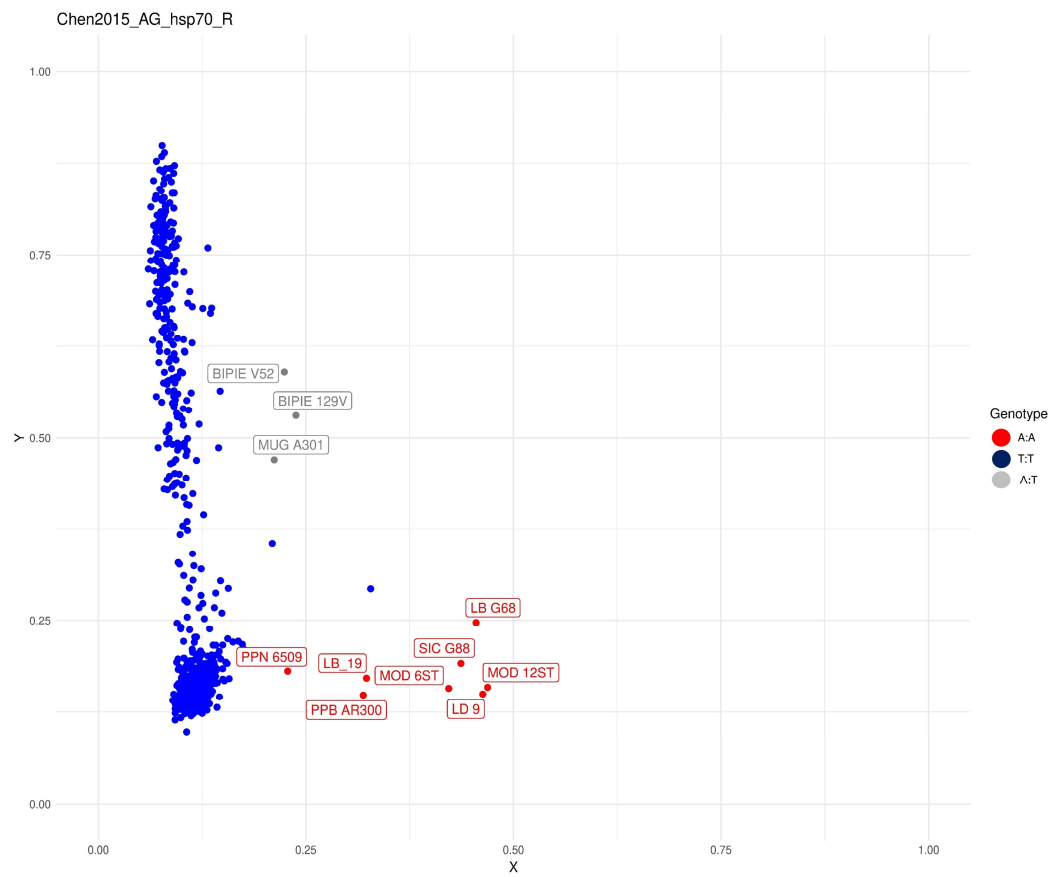


Table 1. SNP frequencies

SNP_ID	Homozygous Normal (%)	Heterozygous (%)	Homozygous Polymorphism (%)
Aryani_370AG_hsp70	100	0	0
Aryani_388_hsp70	100	0	0
Chen2013_C141GA_hsp90b	100	0	0
Chen2015_A-69G_hsp70_F	100	0	0
Chen2015_A-69G_hsp70_R	98.43	0.42	1.14
Gan2015__hsp70_3779	100	0	0
Irivboje_C134T_hsp90aa1	100	0	0
Irivboje_A160T_hsp90aa1	100	0	0
rs1059582168_hsp70	100	0	0
rs732827798_hsp70	100	0	0
rs733684618_hsp70	100	0	0
rs734719010_hsp90aa1	100	0	0
rs734804788_hsp70	100	0	0
rs736704575_hsp70	100	0	0
rs737092218_hsp90aa1	100	0	0
rs737911174_hsp70	100	0	0
rs738664200_hsp70	100	0	0
rs738805332_hsp90aa1	100	0	0
rs738839226_hsp90aa1	100	0	0
rs740875190_hsp90aa1	100	0	0
Wan2017_6798GA_hsp90b1	100	0	0