



PRIMA SCALA-MEDI NEWSLETTER APRIL 2022 ISSUE 01

NEWSLETTER

APRIL 2022 **ISSUE 01**



OBJECTIVES

SCALA-MEDI newsletter provides to readers the main scope of the project and updates them about the last activities during project development.



WHAT'S INSIDE?

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EDITORIAL

Welcome to the first issue of the SCALA-MEDI Newsletter, which is intended for all people interested in livestock biodiversity and adaptation to climate change. In this first newsletter we would like to let you know about SCALA-MEDI objectives and structure (see Annex 1 “SCALA-MEDI in a nutshell” and our website www.scala-medi.eu). The newsletter will be published periodically to keep you posted on project progress. The project started in September 2021 and in the first few months has established standard procedures for field sampling, data collection and laboratory analyses. Some of the choices we made and experience we have gained so far are critically discussed below, in the hope of providing useful information to current or future research projects on similar topics. The newsletter will also introduce you to the project Partners, one country per Newsletter, starting with Algeria, and to their activities within and outside SCALA-MEDI. Finally, relevant congresses, workshops and fairs will be announced in the “Events” section, and a commentary on a paper of particular interest, related to project topics, will be posted in the “Suggested Reading” section.



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SCALA MEDI

IMPROVING SUSTAINABILITY AND QUALITY OF SHEEP AND CHICKEN PRODUCTION BY
LEVERAGING THE ADAPTATION POTENTIAL OF LOCAL BREEDS IN THE MEDITERRANEAN AREA.



PROGRESS

Website

The SCALA-MEDI website has been recently opened to the public at www.scala-medi.eu. This portal is the project reference point for interactions among partners and with all interested people. You are welcome to visit it. There you will be able to find information regarding the project. By visiting the website, you get an overview of the potential of SCALA-MEDI and the added value of the local breeds in the target North African countries, Tunisia, Algeria and Morocco. You will also find information on project progress, recommendations and the technologies used.

SOPs

The development of Standard Operation Procedures (SOPs) for data (phenotypic, socio economic and environmental) and biological sample collection and storage was our first concern. We defined criteria for choosing farms and locations to be sampled, targeting local breeds, avoiding as much as possible the sampling of related animals and targeting different environments. We also set the file format for data collection and defined vocabularies, to harmonize data across countries and create a cohesive dataset.

Questionnaires

We have designed 6 questionnaires for data collection. These will collect information on local sheep and chicken genetic resources and the economic development of local communities. Questionnaires have been developed for several levels of the local sheep and chicken value chains in Morocco, Tunisia and Algeria, to obtain information and opinion from producers (sheep and chicken farmers), veterinarians, hopefully policy makers, points of sale and consumers. We plan face-to-face interviews at each level of the value chain to complete the questionnaires. Questions were designed to cross-verify responses. Information will be anonymized to prevent links between answers and individuals. We organized an on-line briefing on the questionnaires and on how to carry out interviews with teams collecting data, to ensure standardization across each country. Questionnaires will be checked, then cross-validated and data will be entered in the project database.

ODK application

To facilitate and standardize data collection and to avoid data transcription mistakes from paper to computer, we decided to use a phone and tablet-based application. The ODK app was suggested to us by ILRI. We like the way ODK works and have decided to adopt it. ODK is comprised of free and open-source software as was created to replace traditional paper forms used in survey-based data gathering. It is very flexible. It has electronic forms that can upload free text, digital data, numeric answers, GPS information, photos, videos, barcodes, signatures, multiple-choice question responses and audio,



to an online server. Exactly what we needed in SCALA-MEDI. In addition, it is designed to work well in the field as it stores data until network connectivity is available.

What's going on currently?

- Sample and data collection is currently in progress in Morocco, Algeria and Tunisia for Sheep and Chicken. The project database is starting to be populated with the on-farm data collected through ODK application.

- Our partner Nature 4.0 (NAT4.), which is an innovative technology start-up, is contributing a new technology that uses two sets of low-cost micro-sensors, one tracking movements, surface and air temperature, the second embedded in glass droplets to measure subcutaneous temperature and oxygen saturation. The first set is under validation in sheep and in chicken. The sensors will enable recording of standard production and environmental adaptation traits in the field. NAT4 is currently testing the devices which will be initially validated on a study population and in a breeding center and thereafter tested in the open field. The data collected will be associated with heat tolerance and health status in real time (body temperature, blood oxygen saturation, movement, resting time). The production of the sensors on a larger scale is planned after their validation.

SPOTLIGHT ON ALGERIAN PARTNERS

To achieve the SCALA-MEDI objectives the project involves 17 partners from the Mediterranean area; including three North African countries (Tunisian, Morocco and Algeria) and 2 European countries (France and Italy). In this first

Newsletter we are happy to introduce Algerian partners. Others will be introduced in future issues. Each description found here, has been provided by the corresponded partner and has been published, after small grammatical and syntax revision.

LGMC- USTO

LGMC (Laboratory of "Molecular and Cellular Genetics") is a research laboratory affiliated to the department of "Applied Molecular Genetics" at the level of the faculty of "Nature and Life Sciences" of the University of USTO-MB. It was created in 1990 and was then approved in 2009 by the DGRSDT as a research laboratory. The laboratory includes 4 research teams specialized in different areas of Genetics: Molecular and onco-genetic pathology, Genetics and pharmacogenetics of human diseases, Genetics and cellular physiology of multifactorial diseases, Animal Genetic Resources Management and Improvement. The fourth team aims to characterize and enhance animal genetic resources in Algeria. The team continues to work on this objective and after several studies of characterization and valuation of different animal species, it aims to contribute to the management and improvement of these genetic resources.

<https://lgmc.webnode.fr/>

PPABIONUT

PPABIONUT: (Physiology, Physiopathology and Biochemistry of Nutrition) was created in 2010, it is a laboratory domiciled in the Department of Biology, University of Tlemcen Abou-bekr Belkaïd of Tlemcen, Algeria, the laboratory includes 4 different teams provided by 46 people whose rank differs between professors,



lecturers A and B, assistant lecturers, doctoral students and finally support staff such as engineers and technicians. Research activities are centered on nutrition, which is at the crossroads of many scientific disciplines (medicine, biology, physiology, biochemistry, food sciences). The PPABIONUT was created in order to respond to a few missions such as the acquisition of scientific knowledge necessary for the conduct of research in the field of human nutrition, including knowledge of foods and their health value, a better knowledge of chemical molecules contaminating food such as pesticides and their harmful effects on the state of health, with research and monitoring of the evolution of physiological, biochemical and/or hormonal markers reflecting an alteration in the lives of people consuming the food (fruits and vegetables) contaminated. Thus a determination of the stakes of preventive nutrition in public health with a better knowledge of the role of foods and eating behaviors on physical and intellectual performance, on resistance to infections and in the fight against aging. Recently the laboratory has been enriched by another team whose objective is to provide knowledge in genetics and human health, this mixture gives the laboratory the possibility of bringing together scientific teams capable of supporting masters and doctorates in the field of nutrition, genetics and health.

ITELV

ITELV (Institut Technique d'élevage en Algérie) Technical Institute of Livestock Breeding, Algeria, created on 1999. The Institute is a public institution under Agriculture Minister, with an administrative character and scientific and technical vocations.

The aims of the ITELV are: organization of the multiplication of animal species "conservation of local breeds" by setting selection programs; development of

food processing systems and valorization of farm products; introduction and organization of control models for zoo technical performances and installation of experimental protocols and technical testing technical adaptation.

ITELV work with: universities, farmers; member breeders; breeder associations; popularization agents to give:

- A permanent assistance to the production sector;
- an organization of training and career development;
- An organization demonstration and popularization meetings;
- An elaboration of written and audiovisual supports.

<http://www.itelv.dz/>

EVENTS

The main upcoming scientific events relevant for the SCALA-MEDI project are :

ICAR (*annual meeting of the International Committee for Animal Recording*): May 30- June 3 2022, Montreal, Canada (<https://www.icar2022.ca/>)

WCGALP (*World Congress on Genetics Applied to Livestock Production*): 3-8 July 2022, Rotterdam, The Netherlands (<https://wcgalp.com/>)

ADSA (*annual meeting of the American Dairy Science Association*): 19-22 June, Kansas City, Missouri, USA (<https://www.adsa.org/Meetings/2022-Annual-Meeting>)

EAAP (*annual meeting of the European Association for Animal Production*): 5-8 Septembre 2022, Porto, Portugal (<https://meetings.eaap.org/>)

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MPS (The 7th Mediterranean Poultry Summit) , Cordoba, Spain, June 8-10 2022

(<http://www.mpn-wpsa.org/spain2020/>)

WPC (The World's Poultry Congress) , Paris, France, August 7-11, 2022,

(<https://wpcparis2022.com>)

SUGGESTED READING

The suggest paper in this issue is published in Molecular Biology and Evolution: Almas A Gheyas, Adriana Vallejo-Trujillo, Adebabay Kebede, Maria Lozano-Jaramillo, Tadelle Dessie, Jacqueline Smith, Olivier Hanotte. Integrated Environmental and Genomic Analysis Reveals the Drivers of Local Adaptation in African Indigenous Chickens. Molecular Biology and Evolution, Volume 38, Issue 10, October 2021, Pages 4268–4285, The paper is freely accessible at:

<https://doi.org/10.1093/molbev/msab156>

The climate change crisis prompted these researchers to explore the adaptive potential of livestock, with a special focus on local, indigenous breeds due to their ability to survive under harsh conditions. Gheyas and colleagues explored the drivers of local adaptations in African indigenous breed in their paper to disentangling the genetic components of environment adaptation. This is complicated as the various selection pressures are confounded to create the genetic makeup of a given population. The authors approached this problem by combining multiple complementary genomic approaches: ecological niche modelling to identify the main environmental drivers of selec-

tion, selection sweep analysis to determine genome-wide signals of selection, and genotype-environment association to model genomic variation as predicted by the environment. Such a multifaceted approach was applied to 25 Ethiopian village chicken populations. The results provide insights on the mechanics of local adaptation, identifying six key drivers of environmental challenges (related to temperature and water/food availability), and a few, but strongly supported genomic regions under selection for environmental challenges related to altitude, temperature, water scarcity, and food availability.



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Research Master 1989/1994 National School of Agronomy (ENSA_Zootechnics / animal production - Engineer in Agronomy). Principal agricultural engineer since 2011. Academic training (s) / Master of Research in: "Ecology, Environment". Eco-engineering of wetlands, Biodiversity, Bioindicators (2009/2011) University of Angers / UFR sciences Course / Specialty: Practical internship carried out in the Ecotoxicology laboratory at INRA d'Avignon, "Bee and Environment" Unit. Head of Monogastric Department at the ITLV Technical Institute for Livestock 2013-2020.



NACERA Tabet Aoul

WP9 Leader

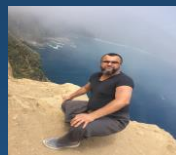
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Diploma of D.E.S. in Genetics-Biology (1989); master degree (Magister) in genetic and biology (1994); PhD in Genetics and Molecular Biology (2006) at the University Es-Senia of Oran. Algeria; lecturer in genetic and genetics engineering at the department of biotechnology, University of Oran 1, Oran, Algeria since 1994; permanent researcher and head of the team on animal biodiversity at the LGMC / USTO-MB.

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SCALA MEDIIMPROVING SUSTAINABILITY AND QUALITY OF SHEEP AND CHICKEN PRODUCTION BY
LEVERAGING THE ADAPTATION POTENTIAL OF LOCAL BREEDS IN THE MEDITERRANEAN AREA.**PAOLO AJMONE MARSAN****Project Coordinator**

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Full Professor of animal breeding at the Department of Animal Science, Food and Nutrition at the Faculty of Agriculture, Food and Environmental Science and Director of the Ph. D. School in the Agri-food System AGRISYSTEM of the Università Cattolica del Sacro Cuore, in Piacenza, Italy. He has been investigating livestock genomics, epigenomics and transcriptomics since 20 years to reconstruct livestock domestication, assess biodiversity for conservation purposes. He has large experience in collaborative research at the national and international level. In particular he has participated as partner in 8 and coordinated two EU projects, GLOBALDIV (GenRes, 2007 -2009)

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Full Professor, Doctor es Sciences in Molecular Biology and Genetics (2009) at University of Es-Sénia, Oran, Algeria; President of the scientific council about the biology department and responsible of genetic training in university of Tlemcen; 2009-2013 team leader of Lab Molecular and Cellular Genetics at the University of USTOMB (Algeria); member and focal point of the EU-funded project ARIMNET2 CA.RA.VA.N. (Toward a Camel tRAnsnational VAlue chain); responsible for the scientific activities of several research projects of national interest (PNR, CNEPRU); currently involved in some bilateral North-South projects; head of the team on Management and Genetic Improvement of Biological Resources; Editor in chief for Genetics and Biodiversity Journal (GABJ).

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The University of Tlemcen is the only Algerian university ranked in the Times Higher Education 2017; it is 1st in national rank, 74th in the Arab rank and 801st at the world level. The research activities of the **PPABIONUT laboratory** are at the crossroads of many scientific disciplines : genetics, medicine, biology, physiology, biochemistry, food sciences, as well as socio-economics. Field data collection, phenotype recording and analysis of genetic data is commonplace.

The PPABIONUT team has over 90 paper in biodiversity managed and genetic studies on sheep and chicken and will ensure an effective translation of the scientific results of the SCALA-MEDI Project, also thanks to the support of the house of en-

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ITELV is a public institution created in 1999, from the merger of ITEBO and ITPE. It organizes breeding and selection programs of several animal species for "conservation of local breeds", development of food processing systems and valorization of farm products and testing technical innovation, technological transfer in an environment popularization and distribution of acquired results.

The laboratory of Molecular and Cellular Genetics is a research laboratory was created in 1990, it aims to characterize and enhance animal genetic resources in Algeria. Since 2009, several studies have been carried on different species: sheep, chicken, cattle, horses, camels and bees.



Annex 01

SCALA-MEDI Project In a nutshell



EXECUTIVE SUMMARY

SCALA-MEDI will optimise the sustainable use and conservation of local genetic resources from the Mediterranean region, focusing on adaptation to climatic conditions and consumer preferences. Sheep and chicken are the most important livestock species in the Southern Mediterranean countries. They are reared in marginal areas of the Northern Mediterranean. and are the basis of the local diets.

SCALA-MEDI will characterize local sheep and chicken populations in three North African countries, Tunisia, Algeria and Morocco, for their phenotypic, genotypic and epigenetic diversity. This Information will be used to define adaption traits to establish selection objectives and investigate the genetic and epigenetic control of these traits. The project will develop indexes that will include adaptation, diversity and consumer preferences which will be used in pilot



breeding programs for the improvement, valuation and conservation-by-use of these populations.

Climate change is a major risk for food security in Northern Africa. The improved resilience of sheep and chicken farming stemming from the SCALA-MEDI project will increase food security by ensuring sustainable production of local eggs, meat and milk. Establishing reliability in supply will ensure fair market prices for both producers and consumers, increasing accessibility to high-quality protein that is fundamental for a balanced diet and enhanced human health.

SCALA-MEDI is funded by the Partnership for Research and Innovation in the Mediterranean Area (PRIMA) programme which is supported by the European Union Horizon 2020 Framework Programme for Research and Innovation. The project has 17 partners, 5 from Italy, 3 from Algeria, 2 from France, 3 from Morocco and 4 from Tunisia (see Table below).

SCALA-MEDI OBJECTIVES

- 1) To characterise genetic and phenotypic diversity of local animal genetic resources, paying particular attention to survival traits and genetic variants that enable animals to adapt. This is of key importance for the resilience of the entire farming system to breed flocks better adapted to changes in climate, feed availability, disease challenges and extreme events (heat, flood, etc.).
- 2) To develop animal breeding and in situ biodiversity conservation strategies, using traditional methods and those modern genomic technologies which can feasibly be

applied in low-income economies, to manage biodiversity, productivity and adaptation traits in order to promote the use of local genetics. These breeding strategies will be tested in a sheep nucleus flock and in breeding centres for chickens.

3) To explore epigenetic responses to environmental stress that link the genome with its phenotypic expression in different environments. Ways to include epigenome information in breeding schemes will be explored.

4) To promote the in-vivo conservation of valuable genetic diversity by identifying the differentiated products from local breeds that can be exploited to increase value and sustainability.

5) To reinforce the Mediterranean scientific network, to transfer technologies and experience within and between Southern and Northern Mediterranean countries, including fostering networking between genebanks.

PROJECT ORGANISATION

To achieve these objectives, SCALA-MEDI is organised into 9 Work Packages (WPs)

WP1 is dedicated to the management of the project. **WP2** will collect farming system and environmental data, phenotypes and samples. Samples will be used for molecular analyses in **WP4**. **WP3** will collect and produce socio-economic data related to local products, value chains and existing infrastructures for local product promotion. **WP5** will store and harmonise data and set up bioinformatic pipelines for data analyses. **WP6** will analyse phenotypic and genomic diversity using landscape genomics to identify adaptation relevant genes and the epigenomic response to environmental challenges and **WP7** will develop genome-informed selection indexes and establish



breeding programs to test indexes for improved production, adaptation and conservation. **WP8** will integrate these analyses and develop decision-making tools. **WP9** will be dedicated to technology transfer, information sharing, dissemination and capacity building

PROJECT ACTIVITIES

SCALA-MEDI will characterise genetic and phenotypic diversity of sheep and poultry on private farms in Algeria, Morocco and Tunisia. The environmental conditions and husbandry system in which they are reared will be recorded and used to identify genes that are important for adaption using a landscape genomics approach.

Data will be collected from **private farms** and **field samples** will be collected from 17 sheep breeds and 15 chicken populations from a wide range of climates and agro-environments in Algeria, Morocco and Tunisia. The samples will be used for the molecular and phenotypic analyses to characterise the diversity of gene pools. At least 50 samples per breed/population will be collected, with no more than 5 samples from unrelated animals collected at each sampling site. Sampling site information collected will include: i) geographic coordinates; ii) climatic data; iii) farming systems; and iv) flock management.

Phenotypes recorded on field samples will include standard production and environmental adaptation traits (e.g. growth rate, reproductive efficiency, milk yield in dairy sheep, morphology, plumage, skin colour and comb size in chicken). In addition SCALA-MEDI will measure detailed phenotypes using novel robust micro-

sensors to collect data on traits associated with heat tolerance and health status in real time

Genomic data will be produced for 2400 sheep and 1500 chicken field samples using the “IMAGE001” SNP panel which contains 10,000 single nucleotide polymorphic (SNP) markers per species. The SNP data will be combined with and environmental information using the landscape genomics approach to detect DNA variations associated with adaptation.

Epigenomic data will be collected to assess the impact of the climate on the expression of genetic potential of individuals and to identify putative adaptation related genes. Whole genome site-specific methylation by Reduced Representation Bisulphite Sequencing (RRBS) on blood and skin biopsies of all sheep of the Study Populations in Tunisia and Italy and using LUMA high throughput technology to assess overall genome-wide methylation of blood samples from all sheep and chicken samples.

Scala Medi project data will be used to ensure that local populations adapt to changing climatic and socio-economic needs and hence their preservation.

Breeding Strategies will be developed taking into account breeding and management goals to promote sustainability and the needs of the North African value chain. Indexes will be established using traditional phenotypes, the latter will include adaptation and biodiversity parameters.

In-vivo conservation of genetic resources is the most effective and sustainable conservation approach. SCALA-MEDI will evaluate



options to increase the use and value of the local breeds to support the sustainability of local livestock and promote food self-sufficiency. In addition **SCALA-MEDI** will develop appropriate, low cost, tools for ex-situ conservation to safe-guard pure populations. Training will be given in the latest cryo-conservation technologies and a network of local genebanks will be created and linked with European genebank.

IMPACT

SCALA-MEDI will enhance collaboration between scientists and stakeholders in the Mediterranean area, by exploiting knowledge developed by the project to combine best genotype/environment/management conditions of farming local breeds.

SCALA-MEDI generate genetic and epigenetic information and production data on sheep and poultry, and novel phenotypes on response to environmental stress for local sheep breeds and village chickens in Morocco, Algeria Tunisia, Italy and France. Analyses of these data will give a deeper understanding of the way an individual adapts to changes in their environment and the genetic and physiological processes involved, leading to the adaptation of breeds to the changing Mediterranean environmental conditions. The project will use this information to develop breeding strategies for farmers to optimise the use of local breeds and to match genetic and epigenetic with environment.

SCALA MEDI PARTICIPANTS

Participant No *	PI name	Organisation	Country
1 Coordinator	<i>Paolo Ajmone-Marsan</i>	Università Cattolica del Sacro Cuore (UCSC)	Italy
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17 Partner 16	<i>Haïfa El-Hentati</i>	National Gene Bank of Tunisia (NGBT)	Tunisia