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Communique



East Africa training workshop on reproductive and surrogate technologies for biobanking and restoration of indigenous chicken genetic resources

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**Centre for
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Genetics and Health**



I. Introduction

An East African training workshop on reproductive and surrogate technologies for biobanking and restoration of indigenous chicken genetic resources was held from 04–09 September 2023, in Entebbe, Uganda. Organized by the [Centre for Tropical Livestock Genetic and Health \(CTLGH\)](#) – [International Livestock Research Institute \(ILRI\)](#) in collaboration with the [National Animal Genetic Resource Centre and Data Bank \(NAGRC&DB\)](#) of Uganda, this workshop was part of the implementation of project 1.5 (Biobanking of indigenous chicken breeds) of CTLGH2.0. The project has the general objective of preserving African and Southeast Asian indigenous poultry biodiversity for subsequent use to enhance resilience and productivity and support future response to new breeding requirements of the tropical poultry industry.

Workshop participants included experts in poultry biotechnology, breeding and conservation and managers of the African Union – Animal Resources Seed Centres of Excellence (AU–ARSCoEs). The aim of the training was to improve the capacities of these specialists and introduce them to new techniques in conservation and revival of local poultry genetic resources.

Avian stem cells have been a promising tool for biotechnology. One of the key topics at the workshop was efficient production and propagation of chicken primordial germ cells (PGCs) in vitro, which represents a useful system for the study of the biology of local and locally adapted chicken ecotypes. Long-term PGC cultures are presently seen as one of the most promising tools for maintaining avian genetic biodiversity across Africa without moving the genetic material from their regions of origin.

The ability of chicken PGCs to form functional gametes after long-term culture is crucial in developing a cell-based system for the conservation and genetic improvement of the chicken genome. To successfully propagate avian PGCs, it is important to understand the mechanisms of how they arise and the genetic pathways that regulate germ cell survival, proliferation and migration in the early embryo. During this workshop, participants were acquainted with techniques in isolation of circulating PGCs from the blood, blastoderm and gonads, and then cryo-conservation.

The first two days of the event consisted of hybrid presentations and discussions, with online participants from across Africa, and physical attendance of trainees from Kenya (02), Ethiopia (02), Tanzania (01) Rwanda (01) Burundi (01), Cameroon (01) and Uganda (13). The training was facilitated by Christian Keambou Tiambo (scientist, ILRI), Christine Kamidi Muhonja (visiting scientist, Kenya Agricultural and Livestock Research Organization [KALRO] and ILRI) and Jackson Franco Mubiru (head of the Assisted Animal Reproductive Technologies at NAGRC&DB, Uganda).

II. Workshop program

Topics covered during the theoretical training included:

- Introduction to NAGRC&DB, African Union InterAfrican Bureau for Animal Resources (AU-IBAR)/ARSCoE, ILRI Uganda and CTLGH
- Diversity of East African poultry genetic resources and biobanking priorities
- Techniques of fertile egg collection, processing, packaging and shipping
- KALRO chicken breeding program: implementation of long-term breeding and conservation programs for indigenous chicken in Kenya
- Basics of chicken embryology and PGC development

- Potential of PGC technologies for conservation of genetic resources and development of local poultry entrepreneurship in East Africa
- Egg incubation for stem cell isolation
- PGC isolation in targeted chicken lines or breeds, from circulating blood, blastodiscs and gonads
- Cell culture techniques for propagation of PGCs
- Characterization of PGCs, PGC chimera production and reciprocal crosses evaluation
- Circulating primordial germ cells (cPGC) freezing and thawing
- cPGC chimera production and evaluation
- Gene-edited surrogate chicken host technology
- Access and benefit sharing (ABS) and Nagoya Protocol compliance for movement of animal genetic resources (AnGR) in East Africa

The practical and wet lab training mainly consisted of PGC isolation from circulating blood and blastoderm and from embryonic gonads. The cryopreservation of isolated gonads was done at -20°C, -80°C and finally -196°C.

III. Workshop proceedings

As an introduction, the workshop participants were taken through the process of chicken egg formation and the different parts of the chicken female reproductive tract. During the training, the embryological development progression from oviposition to 21 days of incubation was shared through video and pictures.

Participants observed the anatomical changes from the white spot (blastodisc) of an unfertilized egg, to the blastoderm of a 4–6 hr incubated fertilized egg, the blood vessels of a 50–60 hour incubated fertilized egg, and the appearance of the mesonephros and gonads for both male and female chicken. They gained better understanding of the PGCs and biobanking technology that allows the preservation of poultry genetic biodiversity.

The trainees were guided on the process of gonad isolation and biobanking and each of them demonstrated enthusiasm and gained knowledge and foundational skills in opening up the birds for gonad isolation. A total of 173 pairs of indigenous Ugandan chicken gonads were isolated from embryos and cryopreserved in the East Africa Animal Resource seed centre of excellence. The biobanked ecotypes are from northern (40), central (80) and eastern (53) Uganda.

Workshop attendees got better insight into the PGC/PSC and surrogacy technology and acquired practical knowledge and hands-on skills in chicken PGC isolation and cryopreservation. Conservation actions were effectively started and successfully run by the trainers using the AU-ARSCoE.

IV. Expected impacts

There is a tremendous opportunity for the use of the AU-ARSCoEs to conserve chicken genetic material, as well as all other indigenous livestock genetic resources across the African continent. It is expected that the workshop participants will successfully implement the conservation actions started at this training in their respective countries. This poultry intervention should be a precursor

to similar interventions in piggery, small ruminants and cattle as part of African solutions to African challenges.

V. Conclusion

Participants felt that the workshop was very timely and informative, and that it made them feel considerably up to the task of developing the regional community of practice for biobanking. The final report of the workshop should serve as advocacy for each country with AU-ARSCoE, CTLGH and ILRI's bilateral and multilateral partners for the development of East African local poultry conservation programs and value chains for better livelihoods.

Acknowledgement

The East African workshop was the first regional training on avian reproductive and surrogate biotechnology in sub-Saharan Africa organized through South-South Cooperation. It was jointly supported by ILRI and CTLGH through their Poultry Cellular Resources, Functional Genomics Tools and Biotechnologies unit in collaboration with the African Union Development Agency-NEPAD (AUDA-NEPAD), the African Union – Inter African Bureau for Animal Resources (AU-IBAR) through AU-ARSCoEs and the host institution, NAGRIC & DB at Entebbe, Uganda.

Adopted on 9 September 2023 in Entebbe, Uganda.



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