

# CONSERVATION AND SELECTION OF LANYU PIGS

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## ABSTRACT

Due to the minipigs are physiologically and anatomically similar to human body and suitable to develop a variety of models for biomedical research, the indigenous minipigs, Lanyu breed, were introduced from Lanyu Islet to Taitung Animal Propagation Station (TAPS), a branch of the Livestock Research Institute (LRI), in 1980. The random mating system was carried out in the conservation herd at early stage and in 2004 the molecular biological techniques were used to find out the detailed genetic relationship among the individuals and applied for population management of conservation herd to maintain genetic diversity. After decades of selection of inbreeding, four minipig breeds, Mitsai (Lanyu 50), Spotty Lanyu (Lanyu 100), Lanyu GPI-CRC-PGD Line (Lanyu 300) and Binlang (Lanyu 400) have been bred and registered officially from 2003 to 2011. Those minipigs were contributed in a number of animal models to simulate and assess the new medical technology developed for clinical application.

**Key words: Lanyu Pig, Selection, Conservation**

## ORIGIN OF LANYU PIG

Lanyu pig is an indigenous mini-pig breed. It originated from Lanyu Islet which locates at the south eastern Taiwan in the Pacific Ocean (Fig.1). It has small erect ears and solid black coat color (Fig.2). Lanyu pig adapts the tropical climate very well, and has strong disease resistance capability. For conserving genetic resource and developing laboratory minipig breeds, four male and sixteen female Lanyu pigs were introduced into TAPS in 1980. The closed population was raised under random mating system to maintain its genetic diversity in the early stage (Lee *et al.*, 1994).

## CONSERVATION OF LANYU PIG

To maintain genetic diversity and avoid the inbreeding regress of Lanyu conservation herd which may occur in closed population kept over 20 years. The molecular biological techniques were used to analyze genetic variation and genetic distance in each individual of the conservation herd. A total of twenty five microsatellite markers which published at the Domestic Animal Diversity Information System of Food and Agriculture Organization in

United Nations were synthesized. After using software CERVUS to analyze genotype data, the average heterozygosity of Lanyu pig population is 0.384. The standard genetic distances between thirty-nine Lanyu pigs were calculated by the software of MSA and the UPGAM method was used to construct the genetic relationship tree based on the standard genetic distance. This well-established genetic relationship of Lanyu pigs could be applied for population management (You *et al.*, 2004). Therefore, part of particular individuals were arranged in five mating groups by according to their genetic variation, genetic distance and different haplotype of mitochondrial DNA, and the offspring's genetic diversity will also be checked and assessed to form a suitable management policy to maintain genetic diversity. For the purpose of promoting efficiency of conservation, the technologies of semen collection, frozen semen production and artificial insemination of Lanyu pig were also established successfully.

## **SELECTION FOR BIOMEDICAL RESEARCH**

The indigenous minipigs, the Lanyu breed, were introduced from Lanyu Islet to TAPS in 1980. After decades of selection of inbreeding, four minipig breeds have been bred and were officially registered from 2003 to 2011(Fig. 3).

### ***Mitsai pig (Lanyu 50 )***

Mitsai pig is a crossbreed of Lanyu and Duroc pig by coat color selection and inbreeding. In F1 65% of hybrid piglets with brown and black stripes coat was observed, and 7.5 % of F2 piglets from brown and black stripes parents exhibited brown-white stripes, then selection program for brown-white stripping phenotype was launched in 1992 with six male and 18 female pigs for one generation per year. The brown-white phenotype increased by generations that 25.3 % in F3, 72.8 % in F4 and 91.9 % in F5. All F6 piglets exhibited brown-white stripes (Wu *et al.*, 1999). Brown-white stripping is a kind of juvenile coat color and will fade gradually when pigs reach the sexual maturity about five months old. Full-sib mating was applied to establish an inbred line, and was registered as a formal pig breed, Mitsai (Lanyu 50), in 2003 (Lee *et al.*, 2003).The gene for brown-white stripping was postulated to be a recessive gene.

### ***Spotty Lanyu pig (Lanyu 100 )***

Lanyu is a native pig breed with a solid black coat color. The conservation herd has been under random mating since 1982. Piglets with white spots were observed from conservation herd in 1993 and the individuals were isolated to avoid possible lethal genetic factors. After investigations on the reproductive performances and test-cross experiment, there was no observed negative effect. The spotty phenotype was validated to be a recessive inheritance (Lee *et al.*, 1998). Selection of spotty Lanyu pig was launched by one generation per year since 1993. From 1994 to 1999, half-sib mating was conducted and the full-sib mating was applied to establish a inbred line (Lee *et al.*, 1999). It was registered as a formal pig breed in 2003 (Lee *et al.*, 2003).

### ***Lanyu GPI-CRC-PGD Line (Lanyu 300)***

The genetic markers, GPI (Glucose phosphate isomerase) and PGD (6-Phosphogluconate dehydrogenase), are usually used as an important index for selection of a new inbred line. The homotypic GPI-PGD line of Lanyu breed of pigs was established in 1992 with genotypes of GPI-BB and PGD-AA (Shiue *et al.*, 1993).and the CRC, Calcium

Release Channel, gene is in one of the linkage groups of the 6th chromosome, which is located between the GPI and PGD genes. CRC-CC Type, Normal type, is free of stress-shock and malignant fever defect syndrome. Therefore, the GPI-BB, CRC-CC and PGD-AA full-sib mating has been conducted for four generations and then was registered as Lanyu pig GPI-CRC-PGD homologue genotype line (Lanyu 300) in 2008.

### ***Binlang Pig (Lanyu 400)***

The white minipig breed, Binlang, was selected as laboratory animal for biomedical research. The first white individual was found from the offspring of Spotty Lanyu pig's full-sib line in 2001, and the white herd that was established by backcrossing and isolation breeding for three generations of full-sib mating was then registered as a new breed in 2011. There was a study carried out to investigate the coat color genetics of Binlang pig, and the results showed that the white coat color of Binlang pig was a homologous recessive trait, and it was also not dominant white in KIT (i/KIT1) allele sequencing. The white appearance is especially useful for animal model experiments related to biomedical research such as plastic and transplant surgeries and clinical testing of cosmetics.

The future goals of breeding project is to select **Micropig** which weight at body maturity is between 35 kg and 55 kg from Binlang breed to meet the requirement of models in pharmacology and toxicology.

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Figure 1. Map of Taiwan, showing the locations of Lanyu islet and TAPS.



Figure 2. Lanyu pig (5 months old)

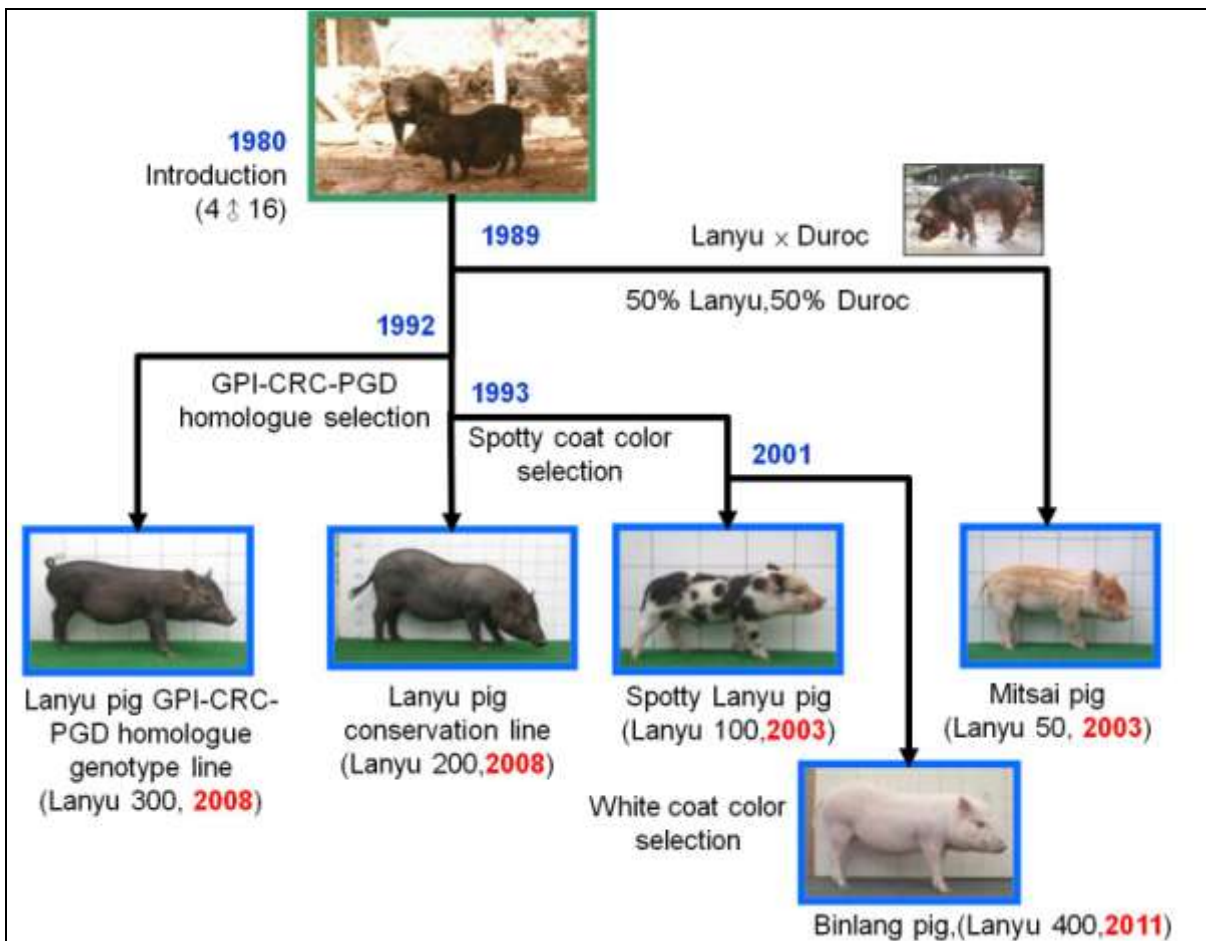


Figure 3. Selection and registration of minipig breeds of LRI.