

The Origin and Conservation Importance of Native Taiwanese Liudui Black Pigs as Inferred from Molecular Genetics

Yu-Ten Ju¹¹ Animal Science and Technology Department, National Taiwan University

The genetic diversity of pigs is the basis for breeding in the swine industry. Across the world, various domesticated pig breeds have been reared, displaying diverse characteristics according to their environments and human needs. Traditionally, pig breed identification was mainly based rather subjectively on body size and color, as well as growth and reproductive performances. Nowadays, given advancements in molecular biotechnology, species identification is more objective and genetic introgression between different populations can even be detected. As agricultural techniques advanced and urban development and transportation expanded, many new pig breeds were created by crossing breeds from different regions of Europe and Asia. These modern breeds display excellent economic traits but, consequently, populations of important native pig breeds around the world are now in decline, suffer genetic introgression, and even face extinction. In 2004, The Food and Agricultural Organization of the United Nations (ISAG/FAO) highlighted that native livestock are becoming inbred or eliminated, and called on all countries to conserve their native pig breeds, recommending that population genetic analyses should be conducted on pig breeds globally using the same set of genetic markers.

Domestic pigs were domesticated independently in Asia and Europe from the Eurasian wild boar (*Sus scrofa*). The Eurasian wild boar originated on the islands of Southeast Asia. Taiwan is located in Southeast Asia and thus is close to the origin of *Sus scrofa*, contributing to the unique genetic characteristics of indigenous Taiwanese wild boar and pig breeds. Analyses of the mitochondrial DNA (mtDNA) of Taiwan wild boar has revealed two groups displaying significant genetic differentiation, corresponding to the current wild boar population and the wild boar ancestor of Lanyu pigs (a native Taiwanese pig breed), respectively. The mtDNA data indicate that the Lanyu pig was domesticated from a wild boar ancestor in Taiwan.

Unfortunately, since the productive performance of both Taiwan wild boar and Lanyu pig is not ideal, neither are widely used in developing commercial pig breeds. China represents an ancient domestication center for pigs, hosting the greatest number of pig breeds that have since dispersed globally. For instance, early immigrants brought ancestral native Taiwan black pigs (NTBP) from China to Taiwan, where they were then reared and selected in isolation. According to historical documents, such breeds include Dingshuangxi and Taoyuan pigs from the north of the island, and Meinong pigs

in the south. Regrettably, among these, only one mtDNA haplotype of Taoyuan pig was conserved by the Institute of Livestock Research in 1986. Nevertheless, nowadays many pig farms in Taiwan are raising NTBP because of their good flavor profile and prolific reproductivity, accounting for 10% of Taiwan's pork market. Apart from NTBP, other pigs destined for the commercial pork market in Taiwan include the Meishan, Landrace, Yorkshire, Berkshire and Duroc breeds.

Based on historical records, Taoyuan pigs potentially arrived in Taiwan from Guangdong Province, Southern China, between 1877 and 1887, but genetic evidence is lacking. Therefore, our laboratory began researching this and other NTBP in 2009. Our research objectives include surveying the distribution of NTBP across Taiwan, as well as studying their origins, population structures and genetic characteristics. As recommended by the FAO, we are deploying mtDNA and a universal set of 19 pairs of microsatellite markers (SSRs). To date, our results have shown that breeding of NTBP is mainly limited to the Liudui area of Pingtung greatly populated by the Hakka ethnic group, highlighting how Hakka culture has played a key role in the conservation of NTBP in Taiwan. We have detected a total of 21 mtDNA haplotypes from 170 NTBP. Comparing these mtDNA haplotypes with those of Eurasian wild boar and domestic pigs has revealed that most NTBP originated from the Lower Changjiang River Basin in Central China. Moreover, assignment testing and principal component analyses clearly distinguished Taoyuan, Meishan, Berkshire, Duroc, TLRI Black Pig No.1, KHAPS Black Pig, Landrace Yorkshire and Lanyu pigs. Significantly, the NTBP from the Liudui area displayed distinct genetic characteristics, both in terms of unique SSRs and mtDNA haplotypes, and thus we term them Liudui black pigs. Overall then, we argue that the conservation of Liudui black pigs is of considerable importance to Taiwan's swine industry and cultural history, and efforts should be made to restore the population.

Key words: Native pig, Native Taiwan Black Pig, Conservation, Population genetics