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Germplasm Conservation of Japanese Native Livestock Breeds (Horses, Cattle and Goats)

Taro OBATA* and Hisato TAKEDA

Department of Genetic Resources I, National Institute of Agrobiological Resources (Tsukuba, Ibaraki, 305 Japan)

Abstract

This paper describes the present situation and problems in the conservation of native livestock breeds in Japan. The breeds considered include Japanese native horses, Japanese native cattle and Japanese native goats. To conserve the genetic resources of these breeds, it is important to keep them (1) in the form of live animals and (2) in the form of sperm, oocytes, embryos, cells, chromosomes and genes that can be stored by applying cryogenic techniques. For the Japanese native livestock that are also important members of living 'museums', it may be further desirable to conserve them as live animals. However, it is difficult to conserve all these breeds in a living form due to their low economic value in the market. Therefore, it is necessary to keep these animals for other purposes such as riding horses, tourist attractions in national parks and zoos, educational tools in agricultural schools and experimental animals.

Discipline: Animal industry
Additional key words: animal genetic resources, gene bank

Introduction

In Japan, there are a few indigenous or 'native' livestock. The term native used here does not imply that the stock necessarily originated in Japan, since the majority of these animals if not all, has at one time or another been imported into Japan. The originally imported stock was introduced prior to the Edo era (before 1603), i.e. before the country became virtually sealed off from the outside world and no livestock could be introduced**. This stock is here described as native livestock, because these animals have been present in Japan for a long time and they do not occur elsewhere in the world.

Current Japanese livestock breeds are derived from three groups which can be differentiated by their origin. First, there are various native livestock breeds which were either present in, or introduced to Japan prior to the Edo era, some of which have survived to the present. Secondly, there are dairy cattle, pigs and sheep which were imported from other countries after the Meiji restoration (1868). Thirdly, there are beef cattle which were derived from crossbreeding between the native and the cattle breeds imported after the Meiji restoration.

Japanese native livestock breeds, those in the first category, consist of (a) native horses (Hokkaido pony, Kiso pony, Taishu pony, Misaki pony, Tokara pony, Miyako pony, Yonaguni pony and Noma pony), (b) native cattle (Mishima and Kuchinoshima cattle) and (c) native goats (Shiba and Tokara goats) (Table 1). Fig. 1 illustrates the geographic distribution of these breeds.

This paper describes the present situation and

*Present address : Department of Animal Breeding and Genetics, National Institute of Animal Industry (Tsukuba, Ibaraki, 305 Japan)

**Some native livestock may have been present in Japan prior to the Edo era, but there is no evidence to substantiate such as an assumption.

Table 1. Major Japanese native livestock breeds[1]

Species	Name of breed	Location for rearing
Horses	Hokkaido pony	Hokkaido
	Kiso pony	Nagano
	Noma pony	Ehime
	Taishu pony	Nagasaki
	Misaki pony*	Miyazaki
	Tokara pony*	Kagoshima
	Miyako pony	Okinawa
	Yonaguni pony	Okinawa
Cattle	Mishima cattle*	Yamaguchi
	Kuchinoshima wild cattle	Kagoshima
Goats	Shiba goat	Nagasaki
	Tokara goat	Kagoshima

*National treasure.

Fig.1. Geographic distribution of Japanese native breeds

problems in the conservation of native livestock breeds in Japan.

Description and characteristics of native livestock breeds[2]

(1) **Hokkaido Pony** : Hokkaido ponies are native to the northernmost island of Japan, Hokkaido. They are mainly reared along the Pacific coast of Hokkaido. Their body size is medium and their withers height is 130-135 cm. Because of their strong legs and stamina, they were used extensively for both farm and road work. In order to keep their purity these breeds were registered by the Association of Native Pony since 1979. They are commonly called 'Dosanko'. They are the only native horses whose number has not decreased.

(2) **Kiso pony** : Kiso ponies are medium-sized native horses reared in the basin of the Kiso river in Nagano Prefecture. Since the Meiji era, this breed has been markedly affected by national improvement programs and the number of pure Kiso ponies has decreased appreciably. After 1945, the breeding of Kiso ponies was carried out using the few surviving pure breed ponies and pure Kiso ponies are being conserved by the Kiso Pony Conservation Group. In 1976, the registration of this breed was started.

(3) **Noma pony** : This breed is distributed in Ehime Pref. It is possible that the animals were reared on the islands of the Inland Sea for the purpose of transportation. Their body size is the smallest of all the native horses. They are maintained in the farm park managed by Imabari city, and are used for hobby riding by children.

(4) **Taishu pony** : Taishu ponies are kept on Tsushima Island in Nagasaki Pref. They are smaller than normal horses but they have strong legs and feet. Taishu ponies were very useful in Tsushima for transportation to isolated villages connected only by narrow paths over steep slopes, but they are now seldom used for such purpose. The Taishu Pony Conservation Group in Tsushima plans to use these ponies not only for riding but also as a tourist attraction.

(5) **Misaki pony** : Misaki ponies are grazing at the national park in Cape Toi in Miyazaki Pref. They are medium-sized native horses and their withers height is 130-135 cm. They are also known as 'wild horses' and they are popular with the tourists who visit the park. In 1953, this breed was designated as a national treasure.

(6) **Tokara pony** : This breed is found on Tokara Islands in Kagoshima Pref. The body size of the pure breeds kept on the islands is medium and the withers height is about 115 cm. They were widely used for cultivation as draft and as a power source for crushing sugar cane. Nowadays, they are also raised on the mainland of Kagoshima Pref. for conservation.

(7) **Miyako pony** : Miyako ponies are reared on Miyako Island in Okinawa Pref. The withers height

is about 120 cm. The number of this breed is the smallest among the native horses. They are used as tourist attraction and educational tools in agricultural schools.

(8) **Yonaguni pony** : This is a minor breed, similar to the Miyako pony. The homeland is Yonaguni Island in Okinawa Pref. The withers height is 110 -120 cm. The grazing system is unique; these ponies are grazing with cattle in the same pasture.

(9) **Mishima cattle** : Mishima cattle are reared on Mishima Island located northwest of Hagi city in Yamaguchi Pref. Since they were not influenced by the breeds imported during the Meiji era, they are considered to have preserved the characteristics of Japanese native cattle. This breed produces high quality meat, with fine marbling, but their growth rate is lower than that of imported breeds. Though they have a good temper for farm work, they are not used for that purpose any more.

(10) **Kuchinoshima cattle** : Kuchinoshima cattle are distributed on Kuchinoshima Island in Kagoshima Pref. This formerly domesticated breed escaped from cattle farms around 1918 and is currently wild. The withers height is about 120 cm.

(11) **Shiba goat** : Shiba goats are small-sized native white goats distributed on Goto Islands in Nagasaki Pref. The withers height is about 50 cm. They have horns but no wattles. They can produce kids throughout the year and the average kid production is about 1.8 per female goat per year.

(12) **Tokara goat** : They are distributed on Tokara Islands in Kagoshima Pref. This breed is considered to have been introduced from Okinawa Pref. Due to the crossbreeding between Tokara goats and Saanen goats, the number of pure Tokara goats is decreasing. They are not prone to hindleg paralysis. No intersex is noted in this breed.

What is the origin of the Japanese native breeds?

Although studies on the origin of the Japanese native breeds have been initiated, no consensus has yet been reached concerning the origin of these breeds. In the case of horses, one hypothesis, based on body measurement data, was proposed in 1958. It was suggested that Japanese and Asian horses could be classified into two groups ; small-sized horses (110-120 cm, withers height) and medium-sized horses (130-140 cm). Small-sized horses were mainly distributed in the southern islands of Japan (south of the Tokara Islands), southern China and the whole of Southeast Asia and medium-sized horses throughout the rest of Japan, Mongolia and Northern China. Based on this information and archaeological evidence of early horses, it was postulated that the small-sized horses were brought into Japan first (sometime between 1,000-200 BC) from the south and the medium-sized horses were introduced later (between 200 BC-200 AD) from the Korean peninsula, and that these two groups of horses became interbred in Japan[1].

However, this hypothesis was not supported by the evidence produced by comparative electrophoretic screening of several native Asian horses. No correlation was found between the body size and the gene constitution of the blood proteins (Fig. 2)[3]. Therefore, it is suggested that the small-sized horses remaining in the small southern islands originated from horses from mainland Japan whose body size decreased due to natural and/or artificial selection on these isolated islands. Furthermore, it was proposed that there was only one route of introduction of horses into Japan, via the Korean peninsula, which was the main route of cultural flow into Japan.

To clarify this issue of origin, genetic research should be further promoted. If a method for the estimation of the correct age could be developed and if DNA samples from the excavated bones of those earlier horses could be analyzed, new information on the origin of these Japanese native breeds could be obtained.

Current activities for the conservation of native livestock breeds

At present, the rearing of many native Japanese breeds is largely undertaken as a hobby by a few individuals who keep a small number of animals for their own interest. Additionally some national parks keep and rear a few breeds. The type of maintenance and rearing varies with the breeds.

For horse breeds, breed associations and conservation groups are active in conserving them with subsidies from national and local governments. In the case of cattle, for one of the native breeds (Mishima cattle) there is an association to conserve

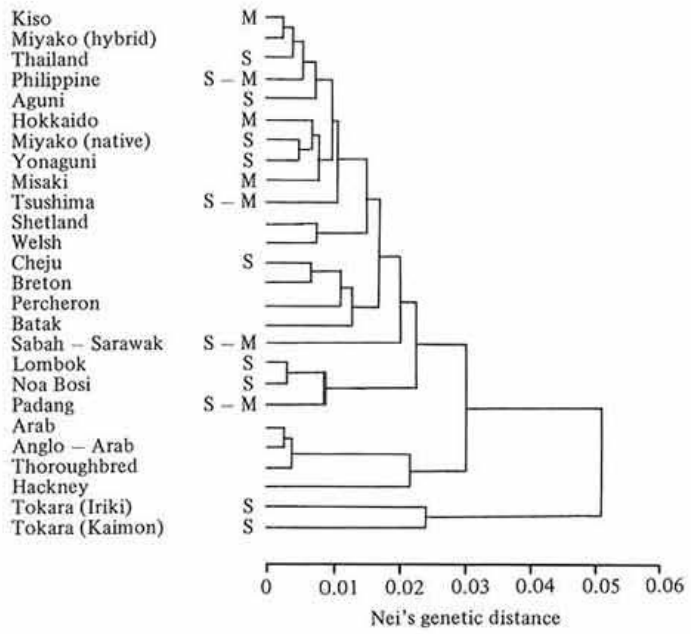

Fig. 2. Dendrogram of the genetic distances among 26 horse breeds of Asia and Europe[3]
S : Small-size, M : Medium-size.

them which operates on the island but for the other breed (Kuchinoshima cattle) no such association has yet been established. In the case of goat breeds, several laboratories in agricultural research institutes keep and rear them to supply experimental animals. In the area of their original distribution, however, the number of goats has markedly decreased.

It is difficult to conserve all of these animal breeds in a living form, due to their low economic value in the market and the limited range of uses. Other problems in this respect are as follows:

(1) Since all of the native livestock are presently being reared by elderly people, the rearing techniques may be lost when the people die.

(2) Most of the native livestock are presently reared by a few farmers who keep a small number of animals. One problem in the maintenance of small groups of live animals is the prevention of inbreeding and genetic drift which may induce changes in gene frequency.

(3) Most of the native livestock are kept by private individuals as a hobby, and not for the conservation of genetic resources. Individual farmers who keep these breeds require subsidies to enable them to continue these activities. Obviously, under such circumstances the survival of these breeds is at risk.

Suggestions for future activities

To conserve the genetic resources of native livestock, it is necessary to keep them (1) in the form of live animals and/or (2) in the form of sperm, oocytes, embryos, cells, chromosomes and genes that can be stored by applying cryogenic techniques. Each method has some advantages and disadvantages.

Cryogenic samples which are collected and frozen can be permanently preserved and, except for accidents within the storage system, they remain available under the same conditions as those at the time of sampling, any time in the future. Although it is expensive to initiate frozen collections, once they have become established, the cost associated with equipment maintenance, such as liquid nitrogen supply, is low. In the MAFF (Ministry of Agriculture, Forestry and Fisheries) gene bank project, we are attempting to collect the sperm of all these native animal breeds and store it by applying

cryogenic methods[4].

Live animal conservation has a number of advantages over frozen cryo-preservation for the following reasons : (1) cultural-historical reasons, (2) the opportunity to investigate topical or new traits in the population any time, and (3) maintaining people's awareness of the existence of the breeds and interest in the frozen materials. For the Japanese native livestock, it may be further desirable to conserve them as live animals. Especially cryogenic storage does not fulfill any aesthetic and cultural needs unlike live animal conservation, as such animals with unique features can be seen by people. Presently many children from urban areas are not familiar with primary food production and have little or no opportunity to interact with animals. The conservation of native livestock as live animals may fulfill such needs.

Discussion

Since the late 1940s, considerable changes have taken place in the status of the different breeds of livestock in Japan. Very few breeds of livestock, with a high economic value, have dominated the stock in Japan, resulting in either the extinction of some breeds or in relegating them to the level of trace populations consisting of many native livestock breeds reared in local areas. In olden times there may have been many more native livestock breeds than at present, and some may have become extinct due to their lack of economic value. Nevertheless, the current breeds are derived from that greater stock. However, several genetic characteristics of some of these breeds may have been transmitted to the native livestock breeds that currently exist in Japan. While some of these breeds are not presently economically viable their valuable genetic resources should be conserved. For example, the Duroc boar, which was not listed in the statistics of livestock population prior to 1972 now accounts for about 50 % of the pig population in these statistics, suggesting that this breed displays attributes which were not deemed or found to be economically valuable at that time but were subsequently reassessed.

Genetic variation, both between and within breeds, is a valuable resource for animal breeders. In future, due to the changes in the conditions of livestock production and animal products, the genetic variation present in these breeds may become either highly valuable or, indeed, critically important.

As many native livestock have played an important role in the history and development of their area of origin, these breeds should be conserved. As regards the Japanese native livestock, it is important to train people who are interested in native livestock. To reduce inbreeding in a small population it may be desirable that individual farmers become organized in associations to control the breeding of the animals. Such associations which maintain the same pure breed need to appeal to public opinion to obtain appropriate subsidies for production along with programs of conservation.

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