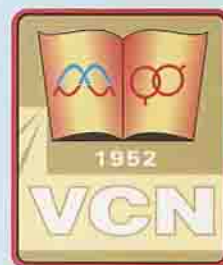




Rare
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Vietnam



**7th RBI Global Conference
on the Conservation of Animal Genetic Resources
“Impact of the Globalisation on the Animal Genetic Resources”
Hanoi, Vietnam, 14 - 18 September, 2008**

CONFERENCE PROCEEDINGS





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**"IMPACT OF THE GLOBALISATION
ON THE ANIMAL GENETIC RESOURCES"**

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IMPACT OF GLOBALIZATION ON LIVESTOCK AND POULTRY GENETIC RESOURCES IN THE WORLD

J.N.B. SHRESTHA^{1*}, S. GALAL², A. DA S. MARIANTE³, A. KOTZE⁴
J.V. DELGADO⁵ AND C. DEVENDRA⁶

¹Dairy and Swine Research and Development Centre, Agriculture and Agri-Food Canada, P.O. Box 90 - Lennoxville Station, 2000 College St., Sherbrooke, Québec, Canada J1M 1Z3; ²Animal Production Dept., Ain Shams University, P.O. Box 68, Hadaeq Shubra 11241, Cairo, Egypt; ³Embrapa Cenargen, Caixa Postal 02372, 70770-900 Brasília DF, Brazil; ⁴Dept. of Genetics, University of the Free State, P.O. Box 339, Bloemfontein, 9300, and National Zoological Gardens of South Africa, P.O. Box 754, Pretoria 0001, South Africa; ⁵Dept. of Genetics, University of Córdoba, Edificio Gregor Mendel, Córdoba, Spain; ⁶130A Jalan Awan Jawa, 58200 Kuala Lumpur, Malaysia

*Corresponding author: shresthaj@agr.gc.ca

Abstract

Globalization is exposing the food security of nations to increased risk from loss of genetic resources which is essential in creating wealth in harmony with cultural patrimony, while ensuring food sovereignty. In the last century, exploiting animals for economic reasons and providing safe and secure supplies of high quality animal protein and minerals for human consumption from fewer livestock and poultry of superior genetics have achieved remarkable success. World-wide trends in utilizing breeding stocks derived from a narrow genetic base of smaller number of breed populations often supplied by multi-national corporations has encouraged competition in global markets transforming family operated farms into agri-business. These activities have increased the risk of extinction from erosion of indigenous landraces, populations and breeds, and depletion of genes within individuals. Furthermore, loss of genetic variation and production performance due to genetic drift is common in populations which have small numbers of male and female parents. The disruption of gene flow and resulting genetic diversity loss which is associated with reduction in fitness and adaptability has been occurring at an alarming rate. The food security of nations may be compromised in the near future, unless domestic animal diversity is conserved. In 2006, 76% of the countries and territories in the world classified as developing (GDP below US\$11,116) shared 85% of the human population and a large proportion of livestock and poultry, and corresponding breed populations. In these countries the majority of the human population rely on livestock and poultry for their livelihood, and specialize in producing low value products for export, therefore, the potential impact from the depletion of genetic resources could be cataclysmic. Endangered domestic animals can be protected from extinction by identifying the sources associated with gene loss and implementing breeding strategies based on quantitative genetic principles in combination with advances in husbandry and disease control measures. Genetic sampling based on DNA extracted from blood, tissue, scat, hair, feather, egg shell membrane provide genetic information through DNA profiling that complement morphological characteristics and pedigree records of domestic animals. Inclusion of issues related to conservation of domestic animal diversity in the curriculum of educational institutes and publishing research findings in popular and scientific journals increases awareness of the issues involved in the management of animal genetic resources. Compensation criterion for breeders retaining populations at risk of extinction can be established using the biodiversity measure of trends among and within-species, and revenue lost from raising animals, perceived less productive. Some potential options for conserving diversity include farm parks and repositories to maintain populations of endangered farm animals, cryo-conservation of germplasm to add value to future breeding, further development of products derived from these animals, promotion and marketing with unique labeling, and policies directed towards endogenous development in favour of poverty alleviation.

Keywords: *Endangered breeds, managing diversity, genetics for conservation planning*

Introduction

Livestock and poultry genetic resources have for centuries provided the human population with such essential products as food, fiber, skin and hides, insurance against crop failure, power for transportation and farming systems, fertilizer, breeding stock, capital, employment and recreation. These resources not only ensure the food sovereignty of nations in harmony with cultural patrimony,

but also sustain trade in goods and services, and prospects for prosperity. Furthermore, culture and traditions of owning and maintaining domestic animals have been indicative of wealth, use for religious rituals, insurance against crop failures, family employment, dowry, barter, and payment in kind during conflicts support sustainable rural development. Small farmers and the landless have, through the ownership of animals and their multi-functionality, enabled survival, in the face of hunger, poverty, and the current food crisis (Devendra, 2007). Discussions on domestic animal diversity are therefore associated with economics, culture, politics, external circumstances, natural selection and genetic response. The importance of conservation of genetic resources was first highlighted in a joint symposium of plant and animal breeders held in 1959, in Chicago, USA (Hodgson, 1961).

In the years following the Second World War, requirements for a wider range of commodities from the rising number of affluent families in the industrialized nations facilitated the transformation of wartime technology and economy of scale to help improve production efficiency in agriculture. At that time, research in corn provided scientists with clear evidence of potential for improvement of productivity from genetic response to selection and hybrid vigour, which led to the development and application of quantitative genetic principles for the commercial exploitation of domestic livestock and poultry (Gowen, 1952). Breeders utilized a narrow genetic base within a small number of outstanding animals to achieve rapid genetic response resulting in the development of livestock and poultry populations that were exceptional in productivity that included economically important morphological characteristics and production performance. Breed populations with superior genetics were widely accepted by the commercial breeders while the quality of animal products produced gained consumer acceptance. The multi-national corporations seized the opportunity to create wealth from increased production efficiency, integrating all aspects of production by providing producers with finance, breeding stock, animal feed, disease control, insurance, promotion, processing, packaging, marketing, and research findings. These activities contributed towards fewer but larger farms that rely on superior livestock and poultry breeding stocks, mechanization and farm buildings, and encouraged competition which evolved into globalization of animal agriculture transforming family operated farms into agribusiness. In the last two decades, there have been national and international attentions drawn towards the depletion of biological diversity which includes domestic animals, decreasing at such alarming rates that may reach critical levels in the near future. This is because livestock and poultry genetic resources which continue to provide a significant proportion of the human diet, are necessary to ensure current and future markets requirements for commodities, trade, fertilizer, breeding stocks, employment and recreation.

Erosion of domestic animal diversity

Globalization continues to encourage propagation of the few high-input-high-output breed populations in meeting the current market requirements for commodities leading to the neglect and abandonment of the well adapted indigenous landraces, breeds and populations, worldwide. There is clear evidence to suggest that the amount of genetic variability in domestic livestock and poultry has been decreasing because of the loss of habitat, erosion of indigenous breed populations and gene replacement. According to the Food and Agriculture Organization of the United Nations (FAO), nearly 800 farm animal breed populations in the world have already become extinct, and among those remaining, about 30% could be considered to be endangered (Scherf, 2000). Galal (2005) estimated the risk status in actual number of breeds, worldwide in different livestock species as 13% in buffaloes, 29% in cattle, 22% in sheep, 27% in goats, 40% in pigs, 23% in asses, 42% in horses and 8% in camels. This was based on the FAO risk criteria for defining an endangered breed population, as those with less than 1,000 females, or 20 males, or total population of 1,200 animals, decreasing and with less than 80% females.

Traditional communities, worldwide have relied on livestock and poultry genetic resources for their livelihood, in order to ensure food sovereignty, alleviate poverty and create wealth, while specializing in producing low value products for export. Developing countries (GDP below US\$11,116 per capita per annum in 2006) comprise of 76% of the countries and territories and share 85% of the human population (The World Fact-book, 2006-2007, estimated in July 2008). These countries while attempting to increase food production have followed the path of the developed countries making substantial strides in increasing production efficiency. Furthermore, the increase in the proportion of farm animals in the developing countries was from 76% in 1980 to 78% in 2006 for horses. Corresponding changes were 68 and 82% for cattle, 100% for buffalo, 59 and 76% for sheep, 96 and 98% for goats, 63 and 77% for pigs, 52 and 77% for chickens, 93 and 95% for ducks, 93 and 99% for geese and guinea fowl, and 12 and 22% for turkey (FAOSTAT, 2006). In 2006, the developing countries accounted for the following percentage of breeds by species: 57% of horses, 74% of cattle,

97% of buffaloes, 63% of sheep, 77% of goats, 70% of pigs, 61% of chickens, 64% of ducks (domestic), 65% of geese (domestic), 89 of guinea fowls, and 61 of turkeys (<http://www.fao.org/dad-is/>; 13/05/2008). The actual loss of breeds may be presumed to be greater than the reported numbers because developing countries have not had the mechanism to identify and document all their domestic animal genetic resources. Although the potential impact of erosion of domestic animal diversity has serious consequences in the world, the loss is of greater magnitude to the developing countries where the majority of endangered breed populations remain indigenous.

Genetics for conservation planning

There is unequivocal agreement among researchers that the colossal amount of genetic variability within domestic animal genetic resources is extremely important to achieve genetic response to selection for current and future market requirements. Important genetic aspects causing the erosion of domestic animal diversity are associated with the disruption of gene flow, narrow genetic base in the founder parents, and population bottle neck from natural and manmade disasters which limit the number of parents in some generations. Most traditional breed populations and landraces that have remained in their habitats for centuries are experiencing urban encroachment. The environmental impact from the destruction of their habitats can compromise the survival of many breed populations, and this situation is more critical in the nomadic pastoralist systems due to the loss of grazing rights and mountain pastures.

The majority of the endangered breed populations, worldwide rely on a small number of male and female parents for their propagation. Due to the small effective population sizes, these populations are subjected to genetic drift and inbreeding depression resulting in recurring loss of genetic variation. Increasing the effective population size in the endangered breeds should be considered as the most important application of quantitative genetic principles towards reducing the loss of genetic variation. The influence of inbreeding and genetic drift in closed populations with small number of male and female parents could benefit from dividing the population into several complementary breeding groups consisting of one male and one female. In the following year, male offspring of the first group may be bred to female offspring of the subsequent group. This breeding protocol could continue until the male descendent of the first group will be bred to the female descendent of the last group under a pedigreed breeding structure. Also, equalizing the number of male and female parents in theory could decrease the variance of progeny numbers per parent while increasing the effective number of parents.

In random breeding, each male parent has an equal chance of mating with a female parent, whereas a pedigreed breeding ensures each male and female parent produce offspring. An estimate of the inbreeding rate in a closed random (pedigreed) breeding commercial population of 50 males and 50 female is 0.5(0.25)% per generation reaching 5(2.5)% in 10 generations; 100 males and 100 female is 0.25(0.12)% per generation reaching 2.5(1.2)% in 10 generations; and 250 males and 250 females is 0.12(0.06)% per generation reaching 1.2(0.6)% in 10 generations. The increase in inbreeding rate of 0.1% per generation may be considered adequate for commercial breeds because the loss of genetic variation is minimal, while it would take 8801(17,606) generations to attain homozygosity. Hill (1982) has suggested that populations with an effective size of more than 100 should be able to sustain genetic responses to selection for economically important traits due to favourable mutations in many loci influencing the trait. Although an effective population size of 500 may be possible in commercial breeding of poultry, this number is impossible to attain in livestock for economical reasons and longer generation interval.

An estimate of the inbreeding rate in a closed random (pedigreed) breeding endangered population of 5 males and 5 females is 5(2.5)% per generation reaching 40(22)% in 10 generations; 10 males and 10 females is 2.5(1.25)% per generation reaching 22(13)% in 10 generations; and 25 males and 25 females is 1(0.5)% per generation reaching 10(5)% in 10 generations. The rate of inbreeding can be reduced by nearly 50% with pedigree breeding demonstrating considerable prospects for minimizing loss of genetic variation. An alternate approach would be to consider a number of breeders with small number of male and female parents of the same breed organized into a breeding group, increasing the effective population size to minimize loss of genetic variation. Software to predict the increase in inbreeding for a variety of specific pre-planned mating allow for a controlled increase in the rate of inbreeding per generation, which can minimize the detrimental influence of inbreeding depression. This could help establish the effective population size necessary to sustain the breed population for a number of years with minimal loss in genetic variability and delay the number of generations to reach complete homozygosity. Further details and description of the genetic aspect of conservation and breeding strategy for conservation of genetic variability (Smith, 1984), and the management of small populations has been published (FAO, 1998).

Re-establishment of endangered populations

An important approach for the re-establishment of the animal, breed, population or landrace in one generation is the cryo-conservation of spermatozoa and embryos of domestic animals for potential transfer to an appropriate donor animal. Brem *et al* (1984) compared the estimated cost of freezing and storing 500 doses of semen from 25 males over 10 years and 100 embryos with about 50 calves expected from 25 females to the estimated costs to a small population of 5 males and 25 females. In light of these estimates the authors recommended the cryo-conservation as a means to sustain genetic variability in endangered animals, and to monitor genetic trends in the main breeds. The actual cost of cryo-conservation would vary on the cost of equipment and facilities, superior genetics, veterinary services to collect, process, fertilize, multiply and freeze germplasm, transfer to commercial females, liquid nitrogen and longterm storage.

An alternative approach to avoid extinction could be back-crossing to a closely related breed for about seven generations resulting in animals with 99% of the original breed. At the same time, if the original genes are of interest, development of a composite breed for a specific objective by complementing the breed at risk with the more productive breeds has merit (Shrestha, 2005). In practice, closely related species have acted as surrogate dams to reproduce implants from zygotes or clones demonstrating considerable potential for endangered domestic animals at the verge of extinction. The re-establishment of a wild population of the Przewalski horse into specific regions in Mongolia based on captive breeding of stallion captured from the wild with domestic mare is an example. This was followed by subsequent breeding to reduce the genetic proportion of domestic mare. Attempts to implant fertilized embryo from the wild Muflon sheep into domestic sheep has achieved success. This approach has potential merit for the expansion of domestic livestock populations at risk of extinction. Details and description of qualitative criteria for prioritising breeds of special genetic importance has been published (Alderson. 2003).

Managing genetic diversity

In order to preserve endangered animals from extinction it is important to identify the sources of interruption associated with loss of habitats and breed populations, as well as genes within individuals and develop appropriate policies and action plans to work towards sustaining domestic animal diversity while resolving the unique status of the breed population. Conservation breeding strategies for domestic animal populations under increased threat of endangerment or extinction need to benefit from the application of historical evidence on the unique status of the animal population, existing scientific knowledge on quantitative genetic principles in combination with advances in husbandry and disease control measures as well as cryo-conservation followed by subsequent propagation of the breed population, without disrupting the cultural integrity, religious rituals, tradition, political affairs and food security among nations.

Complementary historical evidence, cultural heritage, religious rituals, geographical distribution of the habitat, political scrutiny, morphological characteristics, production performance, economic importance, and scientific knowledge have provided critical evidence to establish the uniqueness of domestic animal breeds, populations and landraces (Rodero *et al.*, 1992; Kotzé, *et al.*, 1994; Mason, 1996; Devendra, 1998; Mariante *et al.*, 1998). Historical evidence ranges from archaeological findings of animal remains, rock paintings and folk-lore because record of animals are difficult to find, migration of pastoralists for better grazing lands, tribes for economic reasons and security, settlement following the discovery of new lands, importation of highly productive exotic animals to natural selection. The arrival of the Mongols, Romans, Arabs, and Europeans and their subsequent colonization in the world have had significant influence on the choice, distribution and method for raising livestock and poultry breeds and their role in farming. Domestic animals were an easily portable wealth, source of power, food, fiber and recreation. Rodero *et al.* (1992) have described in detail the history of the primitive Andalusian livestock and their implications in the discovery of America.

In the mid-1900, DNA extracted from blood, tissue, scat, hair, feather, egg shell membrane continue to add to the genetic information through DNA profiling. Also, information on the genome has been complementary to the morphological characteristics and pedigree records available in registered breeds of domestic animals. Domestic animal breeds, populations and landraces that do not have pedigree records benefit from information on molecular marker to help establish genetic relationship and determine level of genomic inbreeding. Scientific studies in domestic animals have included polymorphism, gene frequencies, genetic distances and degree of heterozygosity estimated from immunogenetic markers including blood groups and isozymes, microsatellites and single nucleotide polymorphism in the DNA, sequence variation in the mitochondrial DNA. Significant advances made in the mapping of livestock and poultry genome and worldwide access to information through internet

has potential merit in developing breeding strategies combining quantitative genetic technology and molecular genetics to address important issues in the conservation of domestic animal diversity.

Conservation activities

Countries ensuring food sovereignty have realized the increased risk from loss of genetic resources which is essential in ongoing wealth creation in harmony with cultural patrimony. Conservation programs have been developed to address unique issues that cannot be generalized among countries. A number of countries have utilized legal instruments and subsidies to recognize heritage breeds and encourage their conservation, while others have actively invested in cryo-conservation and genomic research. In the past few decades, countries working towards managing genetic diversity in breed and populations potentially at risk have established organizations to coordinate conservation activities. These activities include partnership among governments, industry and non-governmental organizations (NGO's), research to establish uniqueness of genetic resources based on dynamic evidence from archaeology, ancestral knowledge, historical records and biochemical/molecular markers, genetics for conservation planning, community projects, publications, education, conferences and farm parks, museums and repositories.

Promotion of small populations of endangered animals in historical farm museums, community projects, and rare breed organizations illustrate their value in education, cultural history and ecotourism. A network of these organizations should be capable of accumulating literature, publications, breed registry and harbouring nucleus breeding animals of endangered breeds based on scientific principles of quantitative genetics and complementary husbandry protocol. It is also important to publicise the loss of domestic animals diversity and take all measures to protect the habitat from being destroyed, or to create complementary habitats in a secure environment conducive to their survival and subsequent propagation. Also important is the compensation for breeders retaining populations at risk of extinction which have been implemented in UK, in Germany as well as in other countries. It is possible to establish a criterion on the basis of biodiversity measure of trends among and within-species, and revenue lost from raising animals, perceived less productive.

The Nordic Gene Bank of Farm Animals is one of the most advanced conservation institutions (<http://www.nordgen.org/>; 26/6/2008). The United Kingdom has played a leading role in instigating conservation of domestic livestock and poultry populations that have spread to a number of countries in Europe (Anderson and Bodó, 1992). The United States and Canada have been establishing germplasm database of domestic animals and repositories for the long-term conservation of unique, diverse and valuable domestic animal genetic resources (Gerrits and Shrestha, 1995). In South Africa, conservation of early domesticated animals is based on a threefold approach of determining the uniqueness of the domestic animal, establishment of nucleus herds and ecotourism (Kotzé, *et al.*, 1994). In the developing countries faced with a rise in poverty, lack of animal protein to feed the population and the future of many subsistence producers conservation of domestic animal diversity has merit. The solution for the conservation of domestic animal diversity which varies from country to country depend largely on food sovereignty, cultural heritage, research institutions, NGO's, political will and government policy. Presently, a number of countries in the world having realized the importance of conserving domestic animal diversity are working towards their conservation. Conservationists, biologists, geneticists, archaeologists and breeders are working with NGO's.

Conclusions

Domestic animal diversity which is closely associated with economics, culture, politics, natural and artificial selection including sustainable rural development is under threat from globalization because of greater emphasis on lack of food security. The increased awareness of the loss of biodiversity has resulted in significant interest in the conservation of domestic livestock and poultry populations. The access to scientific knowledge and technology on genetics, cryo-conservation, and genomics, which are freely available worldwide, has potential merit for the identification and conservation of unique domestic animal and poultry populations.

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THE GLOBAL PLAN OF ACTION - AN INTERNATIONAL RESPONSE TO THE GLOBAL PRESSURE ON ANIMAL GENETIC RESOURCES

DAFYDD PILLING, IRENE HOFFMANN*, BEATE SCHERF, DAVID BOERMA
AND MITSUHIRO INAMURA

Animal Production and Health Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy.

*Corresponding author: Irene.Hoffmann@fao.org

Abstract

Effective management of animal genetic diversity is essential to global food security and sustainable development, and to the livelihoods of hundreds of millions of people. Diverse roles and production environments have, over millennia, led to the development of great genetic diversity among the world's livestock. At present, the livestock sector is undergoing dramatic changes as large-scale production expands in response to surging demand for meat, milk and eggs. This rapid change threatens livestock diversity – 20 percent of breeds are classified as at risk. It also underscores the importance of retaining a broad portfolio of genetic resources to facilitate adaptation to new challenges – climate change and emerging diseases are among the most prominent.

A key development in response to the global pressure on animal genetic resources was the adoption of the *Global Plan of Action for Animal Genetic Resources*, at the International Technical Conference on Animal Genetic Resources for Food and Agriculture, organized by the Food and Agriculture Organization of the United Nations in 2007. The *Global Plan of Action* is the first ever adopted international framework to promote the sustainable use, development and conservation of animal genetic resources for food and agriculture. It covers four priority areas: characterization, inventory and monitoring; sustainable use and development; conservation; and policies, institutions and capacity-building. The task now facing the international community is to implement the *Global Plan* through concrete action.

Keywords: animal genetic resources, global plan of action, risk status, threats, capacity

Introduction

Animal genetic resources for food and agriculture (AnGR) contribute to the livelihoods of hundreds of millions of people; provide vital options for the future of the livestock sector, rural development and food security; form integral parts of agro-ecosystems and productive landscapes throughout the world; and are part of the cultural heritage of humankind. These roles, uses and values are underpinned by the genetic diversity of livestock populations. Yet this diversity is under increasing pressure.

Growing awareness of the risks facing global livestock biodiversity, coupled with a recognition that the countries of the world are ever more interdependent in their use of genetic resources, have given rise to an international response – a global assessment, *The State of the World's Animal Genetic Resources for Food and Agriculture* (SOW-AnGR) (FAO, 2007a), that has been followed by the first framework for AnGR management adopted by an intergovernmental forum, the *Global Plan of Action for Animal Genetic Resources* (GPA) (FAO, 2007b).

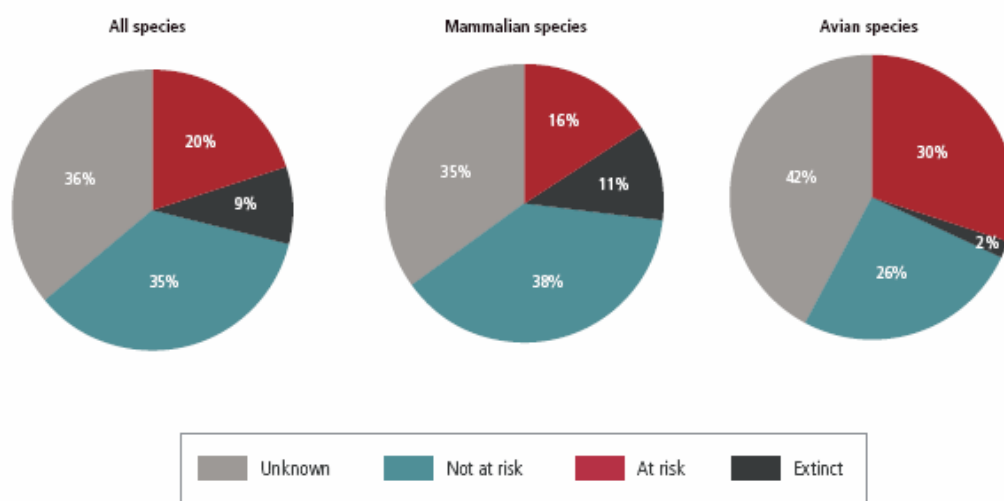
This paper provides a brief background to the GPA – an overview of the risk status of the world's AnGR, threats to AnGR diversity, and the state of capacity in AnGR management. It outlines the process that led to the adoption of the GPA. It then describes the strategic priorities of action set out in the GPA.

The status of animal genetic resources

The term “animal genetic resources for food and agriculture” is used to describe avian and mammalian species that are used, or are potentially of use, for agriculture and food production. A total of 37 species are currently included in FAO's Global Databank for Animal Genetic Resources, the backbone of the Domestic Animal Diversity Information System (DAD-IS) (<http://fao.org/dad-is>). DAD-IS provides the most comprehensive source of information on the population size and structure of the world's livestock breeds. All FAO member countries have the opportunity to use DAD-IS to report on their AnGR (origins and development, uses, special qualities, morphological features, performance

levels, details of conservation programmes, and links to publications can be included in addition to population figures). It therefore has global coverage, and is the source of the population data presented in the SoW-AnGR and in this paper. It is, nonetheless, important to note that these data remain far from complete. The risk status of 36 percent of all recorded breeds is unknown. The shortage of data is particularly acute in some species – rabbits, deer, donkeys and dromedaries, for example. However, it affects all species including the most economically important, such as cattle, sheep, goats, pigs and chickens, and is a significant constraint to planning effective conservation and management of threatened breeds.

Figure 1. Proportion of the world's breeds by risk status category



Source: FAO (2007a).

Figure 1 shows that 20 percent of all reported breeds are classed as “at risk” according to FAO’s risk-status classification.¹ This is in addition to the 36 percent that are of unknown risk status and 9 percent that are already extinct. The status of avian breeds is, in general, rather more precarious than that of their mammalian counterparts. Breed extinctions continue – 62 reported between December 1999 and January 2006. It is also important to recall that “headline” figures for risk status and extinctions do not present the full picture of genetic erosion. Within-breed diversity, which may be threatened by the use of a limited number of sires even when the overall breed population is very large, also needs to be considered. Moreover, current methods of monitoring do not capture genetic dilution of local breeds caused by indiscriminate cross-breeding.

A new classification system for livestock breeds was developed during the preparation of the SoW-AnGR: breeds that are found in only one country (as reported to DAD-IS) are referred to as “local breeds”; breeds that are found in more than one country are referred to as “transboundary breeds”; within the latter category, a distinction is drawn between “regional transboundary breeds” (found only in one region of the world) and “international transboundary breeds” (found in more than one region). The system has proved useful for identifying patterns of exchange and in the reporting of breed risk status.

Threats to animal genetic resources

AnGR diversity is threatened by the rapid changes that are currently affecting livestock production in many parts of the world. Traditional production systems are being marginalized or transformed, and the associated breeds tend to fall into disuse. Changing market demands; competition from large-scale producers; degradation of natural resources or restrictions on access to these resources; changing livelihoods, customs and lifestyles; and the mechanization of agriculture and transport are among the factors driving these developments. Policy measures in the field of AnGR management, and those affecting the livestock sector more broadly, are not always favourable to the sustainable use of genetic resources. In addition to broad livestock-sector trends, acute events such as disease

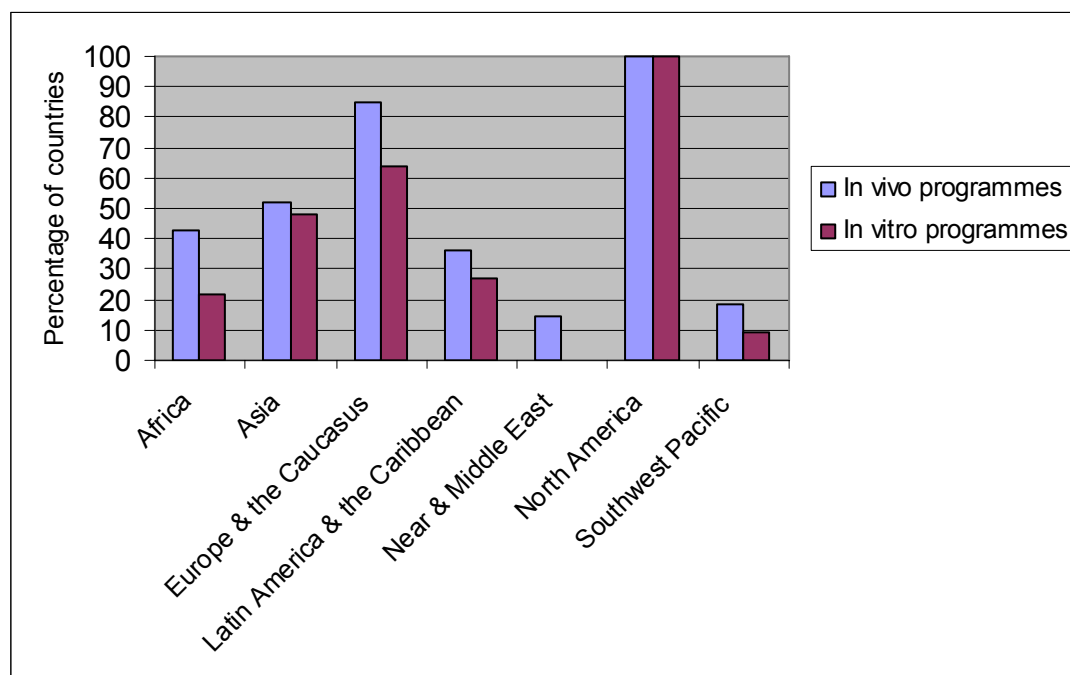
¹ Breeds in which the total number of breeding females is less than or equal to 1 000, or the number of breeding males is less than or equal to 20, or the total population size is slightly above 1 000 and decreasing and the number of pure-bred females is below 80 percent.

outbreaks and disasters and emergencies of various kinds (wars, droughts, floods, etc.) can pose a threat – particularly to small geographically restricted breed populations.

The state of capacity to manage animal genetic resources

The information provided in the Country Reports submitted during the preparation of the SoW-AnGR revealed that capacity to manage AnGR is inadequate in many countries. There is often lack of trained personnel, educational and research facilities, stakeholder networks and coordinating bodies. Forty-eight percent of countries reported that they had no *in vivo* conservation programmes; 63 percent reported that they had no *in vitro* programmes (Figure 2). Structured breeding programmes are a key means to increase output and product quality, improve productivity and cost efficiency, and support the conservation and sustainable use of specific breeds. However, throughout much of the developing world the presence and impact of such programmes is very limited. Access to reproductive biotechnologies is also patchy. The Country Reports indicate great diversity in terms of the extent and nature of national legislation and policies for the management of animal genetic resources. However, it is clear that, in many countries, inadequate regulatory frameworks hamper the effective management of animal genetic resources. Legislation specifically aimed at promoting and regulating breed conservation is rare outside developed regions. At the international level, many legal instruments affect the use, development and conservation of AnGR; most, however, have been developed with little or no attention to these impacts.

Figure 2. Regional distribution of conservation programmes



Source: FAO (2007a).

The development and adoption of the Global Plan of Action for Animal Genetic Resources

The GPA is the outcome of a comprehensive process of reporting, analysis and negotiation. In 1999, the Commission on Genetic Resources for Food and Agriculture (CGRFA) requested FAO to coordinate the preparation of a country-driven report on the state of the world's AnGR. In addition to its technical content, the SoW-AnGR process was to encompass the identification of strategic priorities for action in the field of AnGR management. In 2001, FAO invited all member countries to submit reports describing their AnGR and the state of capacity to manage them at national level. By December 2005, 169 country reports had been received.

In line with the country-driven character of the SoW-AnGR process, a set of strategic priorities for action (SPAs) was distilled from the country reports by the FAO Secretariat, and assembled into a coherent draft document which also took into account the conclusions of a number of consultations, studies and expert meetings. The draft was reviewed by the Intergovernmental Technical Working Group on Animal Genetic Resources (ITWG-AnGR) in December 2006 (FAO, 2007c). Following

further revision of the draft, the CGRFA, at its Eleventh Meeting in June 2007, decided to proceed with the negotiation of a global plan of action based on the SPAs, with the intention that it should be adopted at the first International Technical Conference on Animal Genetic Resources for Food and Agriculture, to be held in Interlaken, Switzerland, in September 2007 (FAO, 2007d). In parallel, the technical SoW-AnGR was drafted, reviewed and finalized, ready for launch at the conference.

The Interlaken Conference and the adoption of the GPA represented a milestone for the livestock sector. The GPA offers a means to increase the overall effectiveness of national, regional and global efforts to promote the sustainable use, development and conservation of AnGR. The GPA consists of three parts: I. a rationale; II. a set of 23 Strategic Priorities (SPs); and III. a section on implementation and financing. The SPs are grouped into four Priority Areas: characterization; inventory and monitoring of trends and associated risks; sustainable use and development; conservation; and policies, institutions and capacity-building. Parts II and III of the GPA are described in more detail below.

The conference also adopted the *Interlaken Declaration on Animal Genetic Resources*. The *Declaration* recognizes that the wise management of AnGR will make a significant contribution to achieving the Millennium Development Goals. It notes the ongoing loss of livestock breeds and calls for prompt action to conserve breeds at risk. It acknowledges that maintaining AnGR diversity is essential to enable the livestock sector to meet current and future production challenges resulting from changes in the environment, including climate change; to enhance resistance to diseases and parasites; and to respond to changes in consumer demand for animal products. It recognizes the enormous contribution that farmers, pastoralists, animal breeders and indigenous communities have made, and continue to make, to the sustainable use, conservation and development of AnGR. By adopting the declaration, governments have committed themselves to implementing the *Global Plan of Action*, to facilitating access to AnGR and to ensuring the fair and equitable sharing of the benefits arising from their use.

A further important development took place in November 2007, when at the FAO Conference, the 191 member countries of FAO adopted a resolution endorsing the *Global Plan* and the *Interlaken Declaration*.

Priority Area 1: Characterization, inventory and monitoring of trends and associated risks

A recurrent theme within the SoW-AnGR (FAO, 2007a) is that decision-making in support of effective use, development and conservation of AnGR is hampered by a lack of knowledge. The inadequacy of breed population data is noted above; monitoring of risk status, and the implementation of early-warning and response systems require regular recording of breed population size and structure. There is also a lack of information on breeds' productive and adaptive attributes, their special characteristics such as resistance to diseases or unique products, their genetic distinctiveness from other populations, their main uses, the production environments in which they are kept, their geographical locations, their cultural significance, and the traditional knowledge that may be associated with them.

The strategic priorities within priority area 1 of the GPA seek to address these knowledge gaps. The focus is on the one hand on enabling the establishment of country-based early-warning systems, and where relevant (e.g. in the case of transboundary breeds) promoting international cooperation in these efforts (SP 1); and on the other, on ensuring the intercomparability of data through the establishment of technical standards and protocols for characterization, inventory and monitoring (SP 2). There is a call for information systems for AnGR to be strengthened both at national and international levels.

Priority Area 2. Sustainable use and development

Keeping breeds in use is considered to be the optimal means of ensuring their availability for the future. Developing genetic resources in a sustainable manner can make an important contribution to rural development, poverty eradication and adaptation to the effects of climate change. The three SPs included in Strategic Area 2 of the GPA are focused on these objectives.

Few countries have comprehensive policies to promote the sustainable use and development of AnGR, i.e. they have no overall strategy as to how the AnGR available to them should be managed so as to best achieve national goals for the livestock sector and for development more broadly, while ensuring that the resources needed for the future are maintained. Another important consideration is to ensure that the contributions, rights, interests and obligations of all stakeholders in the use and development of AnGR are taken into consideration. As noted above, many countries lack structured breeding programmes for AnGR. SPs 3 and 4, respectively, call for the establishment or strengthening

of national policies on sustainable use, and national species and breed development strategies and programmes.

Achieving sustainability in the use and development of AnGR requires that a range of environmental, economic and social factors be taken into consideration. AnGR and their utilization need to be understood in relation to the other natural resources with which they interact and in relation to the livelihoods and cultures of the societies in which they are kept. Promoting an “agro-ecosystems approach” to the management of AnGR (SP 5) is a means to address these issues. SP 6 focuses, more specifically, on supporting indigenous and local production systems and associated knowledge systems; actions listed under this SP include: achieving a better understanding of these systems and the drivers of change that affect them; providing improved services to livestock keepers; resolving land tenure issues; promoting exchange, interaction and dialogue between community members and other stakeholders, and promoting the development of niche markets for products derived from indigenous animals.

Priority Area 3. Conservation

Conservation programmes to prevent the extinction of breeds at risk and as insurance against breed losses, are an essential element of strategies for the management of AnGR. As noted above, many countries lack conservation programmes of any kind. Priority Area 4 addresses the objective of strengthening conservation efforts throughout the world.

There are several approaches to conservation – a distinction can be drawn between *in situ* and *ex situ* approaches. A successful conservation strategy will build on the complementarity between these two approaches – one the one hand, allowing for ongoing use of the breeds and their co-evolution with their production environments, and on the other providing a backup source of genetic material that can be drawn upon should the need arise. To this end, SP 7 calls for the establishment of national conservation policies that set and review priorities, assess factors contributing to genetic erosion and formulate policy responses, ensure that appropriate information systems and institutional structures are in place, and catalyse incentives for producers and consumers to support conservation, provided these are consistent with existing international agreements. SPs 8 and 9 relate to *in situ* and *ex situ* conservation, respectively. The focus is on both national and regional efforts. In the case of gene banks, there is a call for the establishment of modalities to facilitate the use of the stored material under fair and equitable arrangements for storage, access and use.

Given the existence of numerous regional and international transboundary breeds, and the potential for cost saving through limiting duplication in conservation efforts, regional and global cooperation is a desirable objective, provided that the need to ensure modalities for the development of shared facilities are accounted for, that countries' sovereignty over their genetic material is ensured, and that such measures are consistent with existing international agreements. SP 10 calls for the implementation of regional and global long-term conservation strategies. The final SP (11) in this Priority Area addresses the development of approaches and technical standards for conservation both *in situ* and *ex situ*.

Priority Area 4. Policies, institutions and capacity-building

As described above, the SoW-AnGR reported that the state of institutional capacity in the management of AnGR is weak in many countries, and that there is a shortage of personnel trained in relevant disciplines. This, in turn, often reflects a lack of awareness regarding the uses and values AnGR and the significance of the threats that they face. National policies and legal frameworks for the management of AnGR are often inadequate. Beyond the national level, there is a need to ensure that the management of AnGR is given due consideration in the development of international legal frameworks and instruments that may affect the sector. Priority Area 4 of the GPA is devoted to policies, institutions and capacity-building.

SP12 calls for the establishment or strengthening of National Focal Points for the management of AnGR. The Focal Points should develop strong links with the various stakeholders involved in the management of AnGR such as the breeding industry, government agencies, civil society organizations and networks, and advisory committees. The Focal Points are seen as a means to promote participation, coordination and synergy in various aspects of AnGR management and in planning the development of livestock production systems.

SPs 13 and 14 focus on enhancing national educational and research facilities and human capacity in the management of AnGR. SP 15 addresses the need for improved international cooperation in information-sharing, research and education. SP 16 calls for international cooperation in capacity-building in developing countries and countries with economies in transition. SP 17 calls for the establishment of Regional Focal Points for AnGR to enhance cooperation in the management of

shared resources and to promote efficiency and cost-effectiveness in activities such as gene banking. SPs 18 and 19 focus on awareness raising at national and international levels, respectively.

SP 20 calls for periodical review and, where appropriate, adjustment, of national policies and regulatory frameworks that affect the use, development and conservation of AnGR, taking into account the need to consider a range of policy objectives and the interests of a range of stakeholders. The particular need to consider the contribution and needs of local communities keeping livestock is noted. SP 21, in turn, calls for review of international policies and regulatory frameworks that affect the management of AnGR or which have implications for access to these resources or the sharing of benefits derived from their use. It is noted that the AnGR is affected both by general frameworks dealing with matters such as economic development, trade standards, environmental protection, food safety and access and benefit-sharing, and by sector-specific agreements such as those related to animal health and foods standards for animal products.

SP22 calls for greater coordination between the work of the CGRFA and other relevant international forums. SP23 calls for greater efforts to mobilize resources, including financial resources, for the conservation, sustainable use and development of AnGR.

Implementation and financing

Part III of the GPA deals with implementation and financing. The CGRFA is called upon to develop modalities for monitoring and evaluating progress in the implementation of the GPA. It is recognized that the main responsibility for implementation of the GPA lies with national governments, but that international networks and collaboration should be encouraged. The essential role of FAO in supporting country-driven efforts and in facilitating regional and international cooperation is acknowledged. There is recognition that “substantial and additional” funds will need to be made available if the GPA is to be implemented successfully, and that international cooperation is required, particularly in support of the efforts of developing countries and countries with economies in transition. Major multilateral and bilateral funding and development institutions are called upon to support the implementation of the GPA. The CGRFA is called upon to develop a funding strategy; this might entail the development of an FAO trust fund.

Conclusions

Following the adoption of the *Global Plan*, countries need to develop national plans and strategies, and implement them. Several countries have reported to FAO that this is underway. FAO supports this development and is currently preparing a manual to provide further guidance. In addition, FAO is preparing technical manuals for a range of areas such as, breeding in medium- and low-input systems, inventory and monitoring, molecular and phenotypical characterization, and animal identification and recording in medium- and low-input systems. At the forthcoming Fifth Session of the ITWG-AnGR, countries will decide on modalities to evaluate progress in the implementation of the GPA and on a format for a status and trends report for AnGR. Strategic planning in the management of the world's AnGR, involving a wide range of stakeholders, will help to ensure appropriate responses to the dramatic changes affecting the livestock sector and to the prospect of global climate change.

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ADAPTATION OF OLD HUNGARIAN POULTRY BREEDS IN SOUTHEAST ASIA - AN ALTERNATIVE WAY OF CONSERVATION

DONG XUAN, K.D.T.^{1,2*} -SZALAY, I.T.^{1,2} - DUC TIEN, P.³ - MINH THU, P.T.³ - DANG VANG, N.⁴

¹Association of Hungarian Small Animal Breeders for Gene Conservation (MGE). Isaszegi ut 208., H-2100 Godollo, Hungary

²Research Institute for Animal Breeding and Nutrition, Division for Small Animal Research, (ATK-KATKI), Isaszegi ut 200, H-2100 Godollo, Hungary

³National Institute of Animal Husbandry, Poultry Research Centre, Thuy Phuong, Tu Liem, Hanoi, VN

⁴Committee of Sciences of the Parliament of Vietnam

*Corresponding author: dothidongxuan@gmail.com

Abstract

Putting in touch the aspects of gene conservation of animal genetic resources (AnGR) with the development of poultry breeding in Southeast Asia, comprehensive studies of local conditions are needed. For the relationship of AnGR conservation and sustainable agriculture Vietnam and Laos are considered in our studies as typical countries of Southeast Asia. A promising way to develop family poultry production in SEA countries is to introduce exotic breeds suitable for local conditions. Adaptation studies of traditional Hungarian poultry breeds (chicken, duck, guinea-fowl and turkey) show that old Hungarian poultry can be reared in Vietnam with real success. They also demonstrate that Hungarian poultry breeds can provide premium quality products for consumers, and therefore are highly marketable. This type of development, however, should consider the conservation approaches of local breeds as well as the maintenance of sustainable ways of production. Based on the results of adaptation experiments, further development of breeding old Hungarian poultry in Southeast Asia mainly in closed systems is a reality in the near future. There are several local poultry breeds that exist in Vietnam as landrace types, however no systems for their breeding and use in production has been elaborated. If proper breeding systems for exotic breeds are set up, it might serve as a good model for the utilization of local breeds too, providing an alternative way for conservation for both local and exotic poultry breeds and varieties.

Keywords: Southeast Asia, AnGR, poultry production, Hungarian breeds, adaptation

Introduction

Sustainable use and *in situ* conservation of animal genetic resources refer to the continuing use of traditional breeds by livestock keepers, as a result of market-driven incentives. Market driven incentives applicable in developing countries include facilitating access to market for traditional products and helping livestock keepers to get their product to market (Seré et al., 2007). However, introduction of exotic animal breeds may threaten local breeds, and varieties in the case of uncontrolled crossings. Their breeding would need a very strict control to avoid loss of local breeds and varieties (physical isolation) (Dong Xuan et al, 2005). Sustainability implies the maintenance of conditions of living for the next generations as we have, and give them the possibility to choose as we can. This includes environment and landscape, traditions and living resources, and includes agricultural genetic resources as well. Sustainable rural development also means production of food and fodder, strategic use of natural resources, generation of income for rural communities and developing of cultural values (Dong Xuan and Szalay, 2003).

Putting in touch the Gene Conservation of Animal Genetic resources (AnGR) with the development of poultry breeding in Southeast Asia, a number of studies on the relationship of AnGR conservation and sustainable development has been possessed. A study of local conditions is indispensable before starting any breeding development. Vietnam and Laos are considered in our studies as typical countries of Southeast Asia.

Review on the relation of poultry genetic resources conservation and sustainable development

As resource for future food production and environmental and socio-economic stability, the animal genetic resources have to be conserved. The maintenance of AnGR diversity in systems is not an easy challenge when intensification of production is to occur for increased food production. The best

way for maintaining the diversity of animal genetic resources is using them for agriculture and food production. The value of animal production can be increased by marketing products more effectively (Nimbkar et al, 2008)

Hungary possesses a rich diversity of old poultry breeds which served peoples' consumption for many centuries. The well-known indigenous poultry genetic resources of Hungary are: Yellow, White, Speckled and Partridge-color Hungarian Chicken, Transylvanian Naked-neck Chicken color varieties, Hungarian Copper and Bronze Turkey, Hungarian Goose and its frizzled variant, Hungarian Duck and Guinea-fowl. Turkey and Guinea-fowl, originated from the tropics of America and Africa are considered as adapted Hungarian poultry species. During the centuries, those breeds formed the backyard population and provided one of the main resources of meat and egg to the people. Beginning with the early 1960, together with the expansion of commercial poultry breeding, Hungarian breeds were replaced by foreign hybrids of both layer and meat type chickens even on small-scale farms (Szalay, 2002). Nowadays the gene reserve stocks of old Hungarian poultry genetic resources are considered as a Hungarian National Treasure. Further information on traditional Hungarian breeds is found on the MGE website (www.mge-hu.com).

In Southeast Asia Poultry Research for Development (PRD) is a tool of poverty reduction for rural poor, if applied for family mixed farms in a sustainable way, including aspects of agro-biodiversity and agro-ecology. Introduction of old Hungarian poultry breeds with regards to the AnGR conservation viewpoint will enhance and strengthen the development of local breeds and maintain sustainability of local agriculture (Dong Xuan & Szalay, 2007).

The question of trading and conserving Animal Genetic Resources (AnGR)

Farming systems and value of the natural resources of Southeast Asia (SEA). Vietnam as a typical country of SEA

Vietnam is situated in a special geographic position. The mainland Vietnam spreads over 1600 km, border with China to the North with Laos to the Northwest, with Cambodia to the southwest, with the Eastern Sea to the east, with a coastline of more than 3260 km (Mai Ly Quang, 2006). Vietnam holds within its boundaries a great variety of the world's richest and grandest natural places, including vast deltas, greatly eroded limestone towers, high-elevation cloud forests, red sand-dune coastal forests, and savanna-like grassland and forest mosaics. Yet Vietnam remains relatively unstudied when compared with other regions of high biodiversity (Sterling et al., 2006).

A typical farming system in Vietnam is an indigenous, integrated method of home production which often combines vegetables, fruit gardening, livestock (poultry, pigs, buffalo/cattle), sometimes fish ponds. VAC is a well-known name in Vietnam as farming system, linking garden (V), pond (A) and shed (C) together. Farmers build their bamboo pigsty above the pond dug at the back of the garden. While the ducks swim and feed in the pond, fishes profit from the feed residues of all. Finally, sewage-water is channeled to the garden as manure. This integrated household farming system functions in a closed circle of alimentation and manure for bringing more income to the smallholders in the countryside without destroying the environment. Poultry is almost never absent in the SEA backyard (Dong Xuan and Szalay, 2003; Dong Xuan et al., 2006).

Characteristics of Poultry Production in Southeast Asia (SEA)

Being the source of about 90% of the poultry production, local chicken breeds remain the predominant source of poultry breeding in Vietnam. Considering the conservation of animal genetic resources as an important mission, a rich diversity of chicken is present in Vietnam, such as Ri, Ho, Dong Tao, Mia, Ac, Tre, Hmong. Ri is the most popular breed, Ho, Dong Tao and Mia are limited to the Red River delta. The Hmong chicken is kept in the Northwest mountainous regions and nowadays preciously conserved in the National Institute for Animal Husbandry, Hanoi (NIAH, 1998). Farms with automatic equipments having sizes in the 8 000–15 000 bird range currently produce about 10% of Vietnam's chicken (VGSO, 2004; Hong Hanh et al., 2007). Vietnam's poultry keeping occur in over of 90% of all household particularly in the northern mountains. (Burgos et al, 2007, Epprechth et al, 2007). While chicken is the most common poultry species in Vietnam, ducks are predominant in the Mekong and River Deltas. Within the livestock enterprises (majority of them are smallholders), poultry production represents an important contribution to rural household income, accounting for almost one quarter of the total income from livestock (Epprechth et al., 2007). Traditional extensive household poultry production – with flock size of less than 50 birds which derive a large part of their diet from free range scavenging in garden or on the neighboring land is the most common production system in

Vietnam (Dinh Xuan Tung and Rasmussen, 2005; Hong Hanh et al, 2007). Regarding poultry breeds, other than chicken and duck, turkey and Guinea-fowl were introduced to Vietnam at the last century (perhaps by the French colonizers) and appear sporadic in some courtyards of the country, sometime as decorative bird, while the Chinese type of goose is even rarer and could only be seen occasionally in certain villages.

The poultry population in Laos consists predominantly of native chickens (over 90% of Laos' total poultry production) kept by smallholders and are raised free-range, nearby their dwellings for meat and eggs. The birds are mostly consumed by the household or sold locally for income (an average village has around 350 chickens, ducks, interspersed turkeys, quail, with negligible amounts of geese) (Grain, 2006). As the main protein sources, local poultry plays significant role in the livelihood of the villagers.

Sustainable way of introduction of Exotic Breeds regarding the gene conservation of AnGR

To enlarge choice of poultry breeds and marketable production in SEA, import of exotic breeds offers an option, despite the fact, that introduction of exotic animal breeds may threaten local breeds and varieties in the case of crossing. Development of poultry production can provide a good example. Keeping in small households and often scavenging on neighboring land, the crossing of poultry may occur often and easily. Certain poultry breeds however, would not endanger local breeds directly, if imported breeds have no relatives there, and therefore, no crossings with local breeds can happen ("biological isolation"). Guinea-fowl, goose and turkey to some extent, are suitable for extensive type of farming and can be considered as an example of "biological isolation" and therefore are suitable species to introduce in the country, if gene conservation aspects of local breeds are considered (Dong Xuan et al, 2005). In the case of other species, local breeds should be surveyed and the impact of the introduction on the local genetic resources and their habitats should be fully estimated and evaluated. In order to avoid the erosion of local animal breeds, the most important tasks are to organize on farm conservation at least in certain sub-regions or selected villages through the following steps: (1) on farm survey of AnGR, (2) description of local breeds, (3) organization of the control and subsidy system for the on farm gene conservation. Anyhow, if introduction of foreign animal breeds that might endanger local ones cannot be avoided, or if introduction is of extreme importance, imported animal breeds must be kept strictly isolated ("physical isolation") (Dong Xuan & Szalay, 2003). In any case adaptation experiments of exotic poultry breeds according to the conditions of SEA are unavoidable, including the assessment of their possible impact of local breeds. However, survey and description of local breeds and varieties are of major concern if exotic breeds are introduced.

Assessment of the adaptation of Hungarian poultry genetic resources in Southeast Asia

To study adaptation and breeding opportunities of old Hungarian poultry breeds in Vietnam, collaboration of the NIAH Poultry Research Centre (POREC, Hanoi, Vietnam), the Institute for Small Animal Research (KATKI, Godollo, Hungary – at present ATK) with the participation of the Association of Hungarian Small Animal Breeders for Gene Conservation (MGE) started in the late 1990ies. Since then, a series of adaptation experiments have been completed with excellent livability, reproduction and production results of the breeds in most cases.

To develop high quality poultry meat production in SEA countries, similar for HU-BA (abbreviation of *Hungarikum Baromfi*=*Hungaricum poultry*) system, elaborated for the premium quality production by the use of old Hungarian poultry breeds, traditional farming systems and conservation approaches of local breeds as well as the protection of sustainable ways of production have to be considered (Szalay and Dong Xuan, 2007). There are several local poultry breeds existing in Vietnam as landrace types, however no systems for their breeding and use in production has been elaborated. Based on the results of adaptation experiments, further development of breeding old Hungarian poultry in Southeast Asia in closed systems is a reality in the near future (Dong Xuan et al., 2007). If proper breeding systems for exotic breeds are set up, it might serve as a good model for the utilization of local breeds too. The following sections give short information and some characteristic results of parallel tests in Hungary and Vietnam obtained in adaptation studies of the old Hungarian poultry breeds in Vietnam.

Hungarian Chicken adaptation in Vietnam

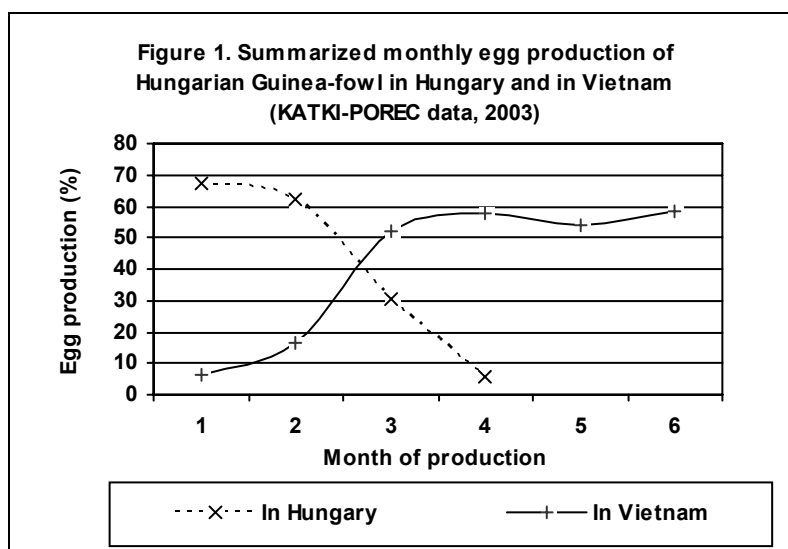
In 1999, 6 breeds and varieties of Old Hungarian chicken were sent by the KATKI Gene Bank (Hungary) for adaptation experiments to NIAH, Hanoi, Vietnam. Selected results obtained in the two year adaptation experiment of imported Hungarian chicken show, that the survival rate of the breeds was relatively high in Vietnam (90.38–97.96% from 0 to 9 weeks, 89.80%–97.87% from 10 to 20 weeks of age). All 6 experimental lines of Hungarian chicken breeds seemed to grow and perform well.

Egg production in Vietnam started 4 weeks earlier, than in the home country and produced more but somewhat smaller eggs, however, to verify the latter traits more experiments are needed. Hatchability was lower in Transylvanian Naked-neck breed in Vietnam. It was concluded, that old Hungarian chicken breeds can adapt well to SEA conditions, however, regarding the market demands, Yellow and Partridge-color Hungarian chicken breeds are suitable for starting a possible breeding program for family farming, if conservation of local breeds is secure.

Hungarian Landrace Guinea-fowl adaptation in Vietnam

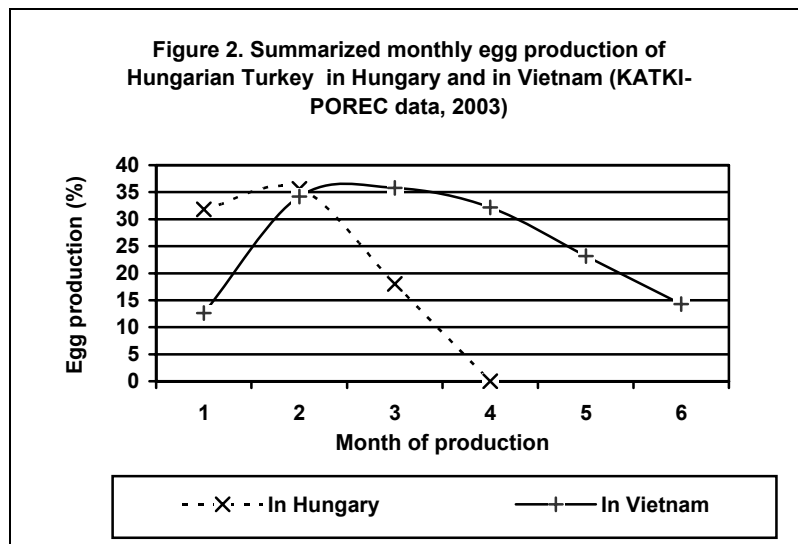
Three HU-BA guinea-fowl lines were imported from KATKI Gene Bank by POREC in 2002 and studied for adaptation in the three subsequent generations (Duc Tien et al., 2007). The research proved the good adaptation of HU-BA Guinea fowl in Vietnam, thus it is rated as one of the specialties in Vietnam with the price of 1.5–2 times higher than other poultry. With a nice shape, easy keeping, high adaptability and high disease resistance, more than 30,000 day-old chicks are sold out to such provinces as Hanoi, Namdinh, Socson, Vinhphuc, Thanhhoa, Yenbai, Danang, etc. by NIAH-POREC (Duc Tien et al., 2007).

Parallel studies in Hungary and Vietnam for the first generation of Guinea-fowl showed higher body weight, earlier start of laying, very different pattern of the persistency of higher egg production (Figure 1), better hatchability and almost similar egg weight data among Vietnamese conditions.



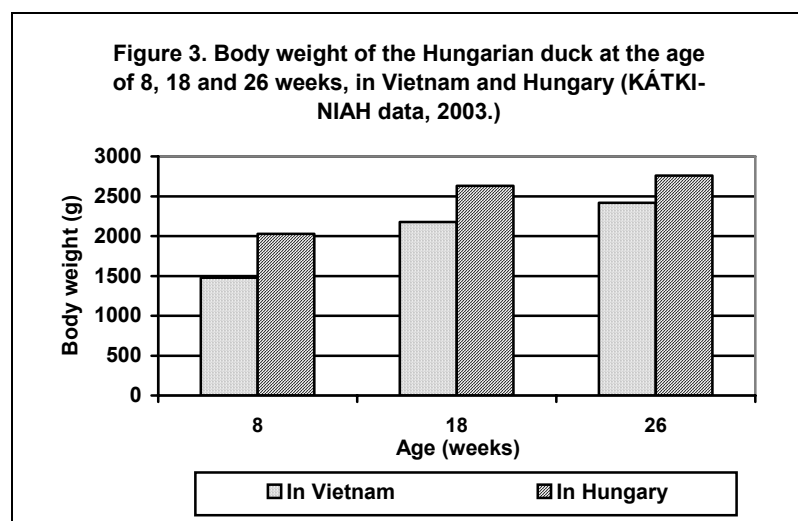
Hungarian turkey adaptation in Vietnam

Turkey keeping in Vietnam and Laos is dispersed, limited in production and low in economics. To restore turkey farming in Southeast Asia, Copper and Bronze breeds of old Hungarian (HU-BA) turkey was sent by MGE to POREC in 2006 for adaptation experiments within the frames of an NGO-NEFE (Hungarian ODA) project. Results are discussed in detail in the final report of the project, which can be found on the MGE website (www.mge-hu.com) (Dong Xuan and Szalay, 2007). Parallel studies in Hungary and Vietnam for the first generation of HU-BA turkey breeds showed similar results to those obtained in Guinea-fowl: higher body weight, earlier start of laying, very different pattern of the persistency of higher egg production – resembling the Guinea-fowl data in both breeds (Figure 2), better hatchability, but lower egg weight data in Vietnamese conditions.



Hungarian duck adaptation in Vietnam

In April, 2003, 720 hatching eggs of the wild-color variety of Hungarian duck was sent by KATKI Godollo poultry gene bank to NIAH VIGOVA duck breeding center, Ho Chi Minh City. Hatchability of eggs after shipping was low, slightly exceeding 50% (42,6-61% for eggs with different weights. Rearing results in Vietnam showed excellent livability until 26 weeks of age with mortality of 1,4%, however, body weight during rearing proved to be significantly lower than the Hungarian records (Figure 3).



Age at first egg was much lower in Vietnam, because of the seasonality of laying in Hungary. Unfortunately, the adaptation experiment could not be finished, due to avian flu, which was detected in the region outside the Breeding Center, and not in the experimental Hungarian duck population. In spite of the body weight data, further studies are needed to determine the adaptability of Hungarian duck in Vietnam. Due to the high importance of duck breeding and high diversity of local breeds in Vietnam, elaboration of a closed breeding system for imported duck breeds must be considered.

Conclusions: possibilities for the future

Based on the results of rearing and reproduction periods of adaptation experiments of Hungarian poultry breeds (chicken, duck, guinea-fowl and turkey), it was concluded that genotypes studied can be reared in Vietnam with real success. Hatching results of breeding eggs shipped to Vietnam indicate that good (maybe somewhat better) results can be obtained in Vietnam than in Hungary. As regards body weight gain, better results can be obtained in Vietnam, than in Hungary, in all species except duck. Livability was found much better in Vietnam in all genotypes studied. As regards reproduction

characteristics, Hungarian poultry breeds start egg production much earlier in Vietnam, and produce more but – due to early start of laying and longer production – somewhat smaller eggs. Adaptation studies also demonstrate that Hungarian poultry breeds can provide premium quality products for consumers, and therefore they are highly marketable. This type of development, however, should consider the conservation approaches of local breeds as well as the maintenance of sustainable ways of production. Based on the results of adaptation experiments, further development of breeding old Hungarian poultry in Southeast Asia mainly in closed systems is a reality in the near future. There are several local poultry breeds exist in Vietnam as landrace types, however no systems for their breeding and use in production has been elaborated. If proper breeding systems for exotic breeds are set up, it might serve as a good model for the utilization of local breeds too, providing an alternative way for conservation for both local and exotic poultry breeds and varieties.

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A MODEL FOR THE CONSERVATION OF INDIGENOUS CATTLE BREEDS IN AREAS WHERE THE PURITY OF SUCH BREEDS HAS BEEN ERODED BY PLANNED OR INDISCRIMINATE CROSSBREEDING.

K A Ramsay* and M J Mamabolo

Department of Agriculture
Private Bag X 138
Pretoria
South Africa

- Corresponding author: keithr@nda.agric.za

Abstract

In many developing areas of the World, indigenous populations of livestock have been eroded by the introduction of exotic breeds. As a result, hybrids often outnumber the remaining pure indigenous populations and this is also compromised by extension promoting the use of less suitable unadapted exotics to 'improve' traits such as milk production.

In many cases, owners and keepers of livestock have persisted (in good faith) with such breeds - despite high maintenance costs, tropical degeneration and stock losses as well as the fact that information on the value of indigenous breeds is often available. Planned and indiscriminate introductions therefore continue - to the long term detriment of the environment, the animals as well as their owners and keepers. Reversing such situations is a challenge that includes changing perceptions on indigenous breeds and finding a way to accommodate pure breeds and hybrids in farming systems that can avoid any forced reduction of productive crossbred animals.

The Makhathini flats – an area of 400 000 ha in Northern Kwa Zulu Natal in South Africa was used to develop a farming system that would make it possible to practice pure breeding within a mixed cattle population.

Consultation with stock owners had shown that the indigenous Nguni and the locally adapted Brahman shared equal preference – but that most of the pure Brahman had been replaced with hardier Brahman – Nguni hybrids.

The model was developed in consultation with stock owner and keeper groups and is based on the management of two main cow herds – namely Nguni and hybrid. These are separated during a short breeding season of 30 days. Afterwards, they return to their respective owner - herds. The short breeding season makes it possible to have two breeding camps that rest during pregnancy – making the same areas available as a calving facility.

Integrated farmer support services will be available to all stock owners and keepers and services will include access to quality breeding bulls as well as markets for purebred Ngunis, hybrids and value – added products

The extra value of pure Nguni breeding stock - as well as products such as tanned hair on hides - will enable owners and keepers to make a more informed decision on the most cost effective breed. Hopefully this will also encourage some to return to pure Nguni as a more viable option. Voluntary conservation of the Makhathini Nguni ecotype through sustainable use.

Introduction

Many developing areas of the world - with populations of adapted indigenous breeds of livestock - have become victims of breed encroachment/ replacement where viable populations of cattle in particular - have gradually been replaced by what can only be described as nondescript hybrids.

In many cases, such hybrids have a larger frame size and are often the first to lose condition and even die during the seasonal dry periods and periodic droughts that characterise many of the developing areas of Sub Saharan Africa

This unfortunate trend is difficult to reverse when local owners and keepers have been subjected to years of negative extension on the potential of their own breeds as opposed to less suitable exotics.

Breed erosion has not had such an impact on small ruminants as the 'improved breeds' are seldom able to survive the elements that often include predators, toxic plants and a range of conditions and diseases that the indigenous goats and sheep have been living with for many centuries

The anomaly of this situation is that indigenous breeds are more than often the best option – particularly where livestock is being kept on communal grazing

Indigenous breeds and local peoples knowledge

With the relatively low level of animal nutrition and management often prevalent in the traditional sector, potentially high producing exotics and crossbreds are unable to perform as well as could be expected under optimal conditions (Ramsay, 1993, Scholtz 1991) and there is sufficient evidence to substantiate the fact that local breeds can be just as efficient as adapted imports or composites and more efficient than unadapted exotic breeds.

In addition, unadapted selective grazers will do far more harm to the veld than indigenous non-selective bulk grazers and selective browsers such as the Sanga cattle breeds of Sub Saharan Africa.

Livestock production off communal Veld is, in fact, often far more important to rural people than crop production (De Lange, 1991) but this is generally overlooked by decision makers who tend to favour crop production in research, extension and support programmes. (Short term window dressing) and are reluctant to consider fodder production as a viable alternative. .

With long term food security in mind, however, it is important to develop farming systems that will be environmentally sustainable as well as acceptable to the owners and users of the resource. It is therefore important to involve the local communities from the onset and to take special note of any traditional knowledge and technologies that may have enabled the people to survive of often limited resources for many centuries.

Supportive Policy and Strategy

South African Animal improvement policy and livestock development strategy support the conservation of indigenous and locally developed (landrace) breeds – quoting from the animal improvement policy

“As a member of the United Nations Convention on Biological diversity, South Africa participates in the global and regional projects that include the SADC/FAO/UNDP project for the management of FAnGR. Conservation through sustainable use is a major part of the program. Policy should therefore support initiatives that are linked to animal improvement”

With supportive policy and strategy in place, and taking the lessons learned from both successful and unsuccessful programs and projects into consideration, it was decided to develop guidelines for the sustainable use of common grazing – paying particular attention to optimal community involvement – and to test these as a model when the opportunity arose.

Using this knowledge along with all evidence in favour of indigenous livestock in integrated systems, it should be possible to develop area- and people - specific sustainable animal agriculture systems capable of improving the existing animal production efficiency in the traditional sector of the Sub- continent and, it can only be hoped that the acquired knowledge incorporating traditional knowledge of local agro-ecosystems and traditional technologies will be shared between all the countries in Sub-Saharan Africa.

Historical Background - Introduction to the Nguni range

In 1950, a committee appointed by the then secretary for agriculture ‘to make a survey of the nature and numbers of indigenous stock in the country and to report on the desirability and means of preserving the stock ‘warned that

‘Unless a concerted effort was made to preserve the purity of the Nguni breed, it would, in course of time, merge with and disappear into a heterogeneous mixture of nondescript native cattle “

And observed that the native stockman appreciates his own cattle and prefers them to the exotic breeds for very good reasons.

The range of the Nguni is shown in Fig.1

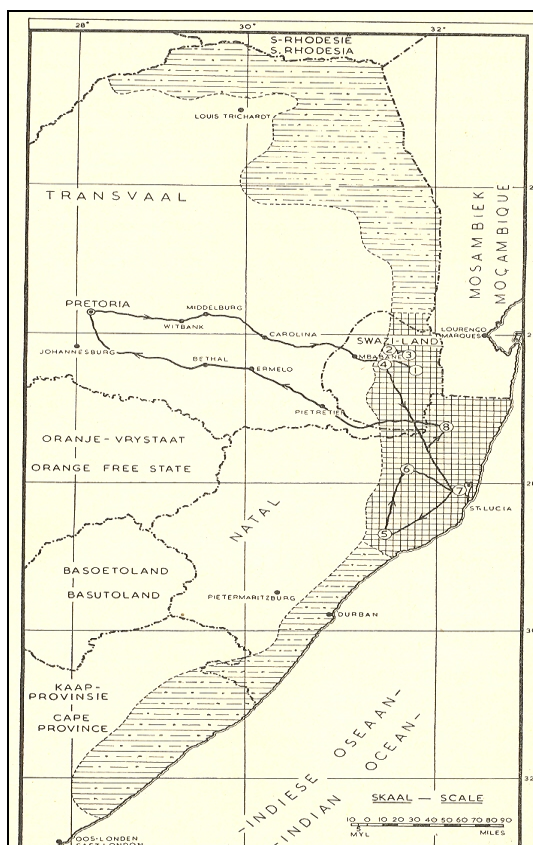


Fig. 1: The range of the Nguni cattle breed in 1950 (Bonsma, et al, 1950)

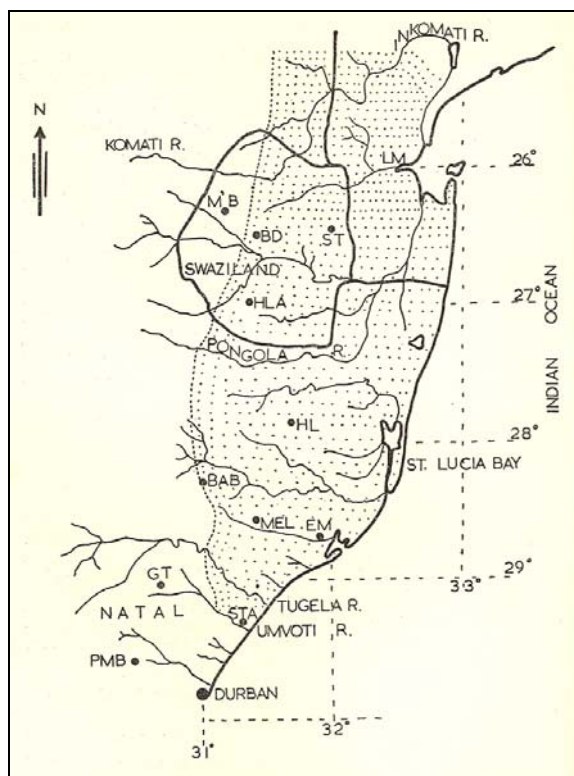


Fig.1: The distribution of Nguni cattle (shaded area) between the Inkomati river in Swaziland and the Imvoti river in Kwa Zulu Natal (Brown, 1955)

This committee recommended that:

- Immediate steps be taken to arrest the deterioration of indigenous cattle in native reserves, consequent upon the infusion of exotic blood and the use of inferior sires
- That a pure bred herd of not less than 500 Nguni breeding stock be established with a view to investigating the potentialities of the breed with regard to growth, production and reproduction and to serve as a the nucleus of Nguni stud cattle.

While attention was given to the second recommendation, very little was done to prevent any foreign infusion

Fortunately, a number of stock owners and keepers in the area persisted with their pure herds and also withstood the temptation to introduce even adapted exotic breeds such as the Brahman.

As a result, pure Nguni cattle are still present on the Makhathini flats despite the fact that there has been a steady increase in the number of hybrids over the past 20 years.

The dynamics of cattle production have not changed much – clearly showing that the local stock owners and keepers have been consistent as far as their reasons for keeping cattle ate concerned.

Table: A comparison of the reasons for keeping cattle in Kwa Zulu Natal, South Africa – 1984 and 2007

Tapson & Rose, 1984	Ramsay , 2007
Milk	Milk
Slaughter	Cash from sales
Lobolo (Cultural Ceremonial Purposes)	Ceremonies (Cultural Ceremonial Purposes)
Cultivation (Traction)	Work/draught (Traction)
Sale / Wealth	Investment – wealth

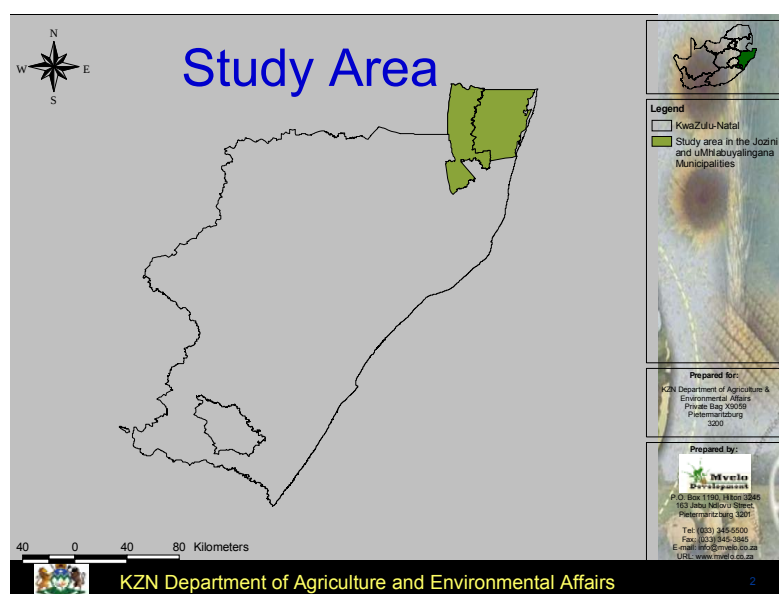
These examples highlight the importance of taking traditional knowledge into consideration when developing sustainable Veld – livestock production systems in consultation with rural stockowners and keepers

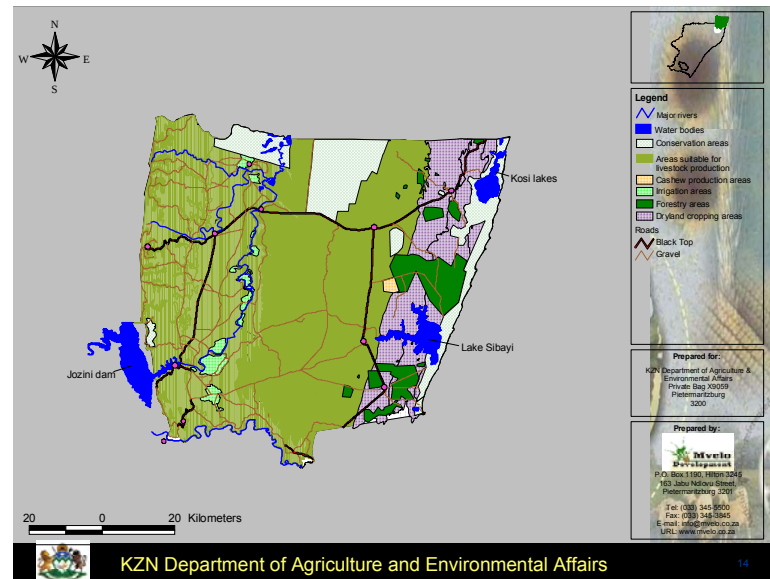
The study area – Maputaland – includes the Makhathini flats and covers an area of 440 953 Ha – of which 407644 ha can only be used for livestock production.

This ratio is fairly similar to National and regional land use figures where up to 80% of the land available for agriculture can only be used for some form of agriculture

The fact that Maputaland was also included in the historical range of the Nguni cattle breed (Bonsmara) and that the area had been part of livestock surveys over the years (Brown, Tapson, Ramsay) made it an idea area to develop a model that could be used to increase the numbers of the original cattle breed without unpopular interventions such as culling and top down schemes and projects that tended to ignore the fact that the cattle population was often more of a non descript/hybrid nature with only limited numbers of animals of the original breed.

Figs. 3 and 4 show the study area and land use





Maputaland has been the subject of a wide range of studies and interventions - but few have been successful and even fewer sustainable – largely because the primary clients and stakeholders were seldom consulted and because planning tended to be done on an ad hoc basis.

The Makhathini Master Plan is arguably the first time that integrated team / area planning principles have been used to avoid repeating past mistakes – to ensure that the beneficiaries are fully involved and that stakeholder / role player participation is optimized to the benefit of all concerned.

As Livestock play an important role in the daily lives of the majority of beneficiaries – and as traditional stock owners and keepers in the area have very sound reasons for their respective animal husbandry practices, it has been possible to facilitate the integration of local practices with modern technology – to plan a framework for the development of a sustainable livestock sector in Maputaland.

The process brought a wide range of subject matter specialists and service providers together to form a dedicated and motivated team that included representatives from all the relevant government departments in Kwa Zulu Natal, relevant departments at National level, Local municipality, Traditional leaders, the private sector and most importantly the two main livestock associations.

The results of this interaction made it possible to carry out surveys that included the natural resources, livestock, water supply, animal management facilities, marketing infrastructure and the all important road network in the area

This information has been used in consultation with beneficiaries and service providers to develop an all inclusive area plan with an added benefit of a modelling process that could be used both nationally and regionally to facilitate a wide range of sustainable systems and livelihoods with far reaching potential as far as food security through the production of food and the generation of income to buy food is concerned.

The Makhathini model has created an opportunity to test these principles and it hoped to use this as a framework to develop a set of guidelines for use with similar area wide planning interventions as a potential lasting solution to the challenge of the commons - to move the users of such resources towards economic and ecologically sustainable livestock farming systems with the capacity to contribute towards National food security by way of animal protein as well as the generation of income to buy food.

Table 2: Feedback from the livestock survey showing key inputs and priorities in order of importance (1-5)

Inputs					
Management inputs	Stock watering	Surplus Male animals castrated 3-6 m - over 12m	Minimal supplementary feeding		
Marketing Channels	Private sale	Auction	Sale to Abattoir		
Stakeholder input on improvement	Sale yards	Access to abattoir	Feedlot	Bred improvement	Removal of Foot and Mouth disease

In order of importance					control fence
Breeds	Nguni	Brahman	Hybrids	Zulu goat	
Reasons for keeping cattle	Milk	Cash from sales	Ceremonies	Work/draught	Investment
Breeds and breeding	Breeds – Nguni, Brahman and hybrids	Largely dependent on own bulls	Natural breeding season	Choice of bulls is largely production related	Identified need for breeding animals
Goats	Not grazed with cattle	Kraaled	Private sale	Regular exchange for cattle	
Animal health	Fairly well serviced Cattle and goats	Some programs followed	Need for Training	Access to stock remedies	

The survey also made use of group discussions as opposed to the conventional individual owner interviews as past experience had shown that this was not only time consuming but also often inaccurate as individuals tended to provide information based on what they thought the interviewer wanted to know

In this survey, animal health officers held group discussions at the 47 dip tanks in the area.

Taking this feedback into consideration, a beef cattle farming system was developed in consultation with two livestock associations that were established to ensure that all stock owners and keepers could be part of the process.

What was very clear was that stock owners and keepers had no intention of disposing of productive females.

This made good sense – animals should be selected for functional efficiency - and pure animals and hybrids existed in sufficient numbers to manage all breeding females in two herds

Management inputs-Farmer support centers

These centers should be seen as a critical success factor intervention and should be established as soon as possible in consultation with the established LA's.

The centers can then be used for the following activities:

- Information (including computer generated information and internet access to marketing and other information)
- Training – all aspects of animal production
- Basic management supplies (dispensary – this can be privatized and run in cooperation with an animal health company
- Cattle sales
- Collection point for weaner marketing
- Breeding service – bulls and AI – based on a mating camp system and on site insemination services

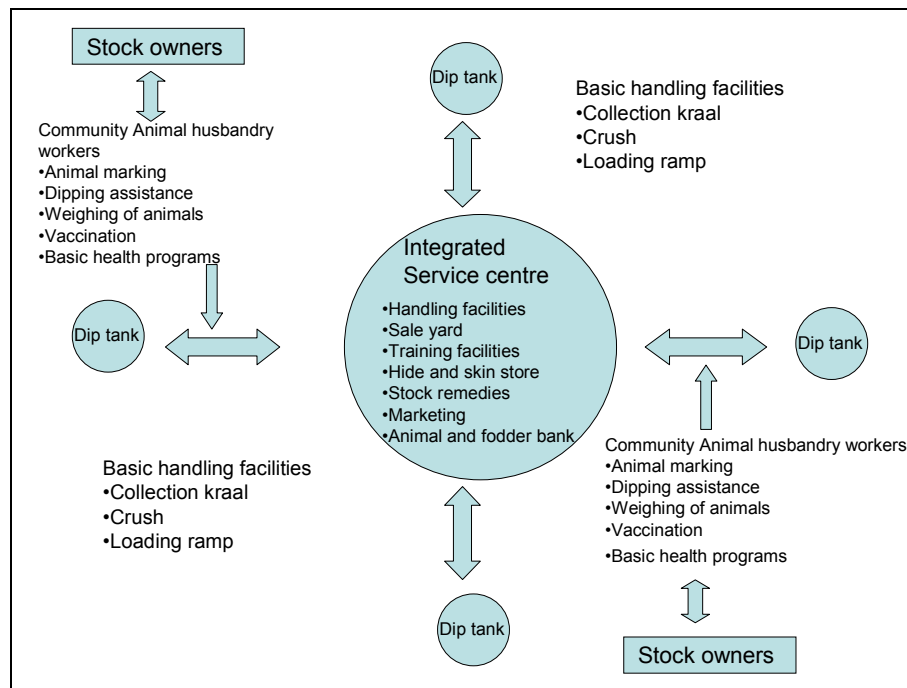


Fig.5: Using an integrated farmer support centre

Managing two herds

This model makes provision for two herds that can be managed as one large cattle project. Linking this to a user friendly management calendar / grid makes it relatively easy for livestock associations to control these resources to ensure that sufficient grazing is available according to the biomass capacity

Other efforts to reintroduce Nguni cattle to such areas have concentrated on a heifer project approach with identified communities/families receiving breeding groups that are both small in size and of questionable purity.

Breeding animals are often sourced outside the areas in question – despite the fact that more typical animals are often available on site

While such efforts may be commendable, they do little to maintain the existing ecotypes and could also be described as the development of herds of nondescripts.

One way in which local breeding material can be identified is to hold regular shows – with prizes for the best bulls and cows. Part of the champion bull prize is the purchase of a number of straws of semen to be collected on site and added to a Biobank for use in herds

Fig. 6 shows the proposed Maputaland beef cattle production network

The overlying principle is to think big – one or two main herds using close to 300 000 Ha of grazing

This principle recognizes all stock owners – from those with less than ten cows to those with herds of 100 and more cows

The reference to cows is used to quantify the number of productive females to be in a position to estimate the possible supply of classes of livestock to the range of marketing channels.

As the model has been accepted in principle, an implementation plan should be developed in consultation with the stakeholders.

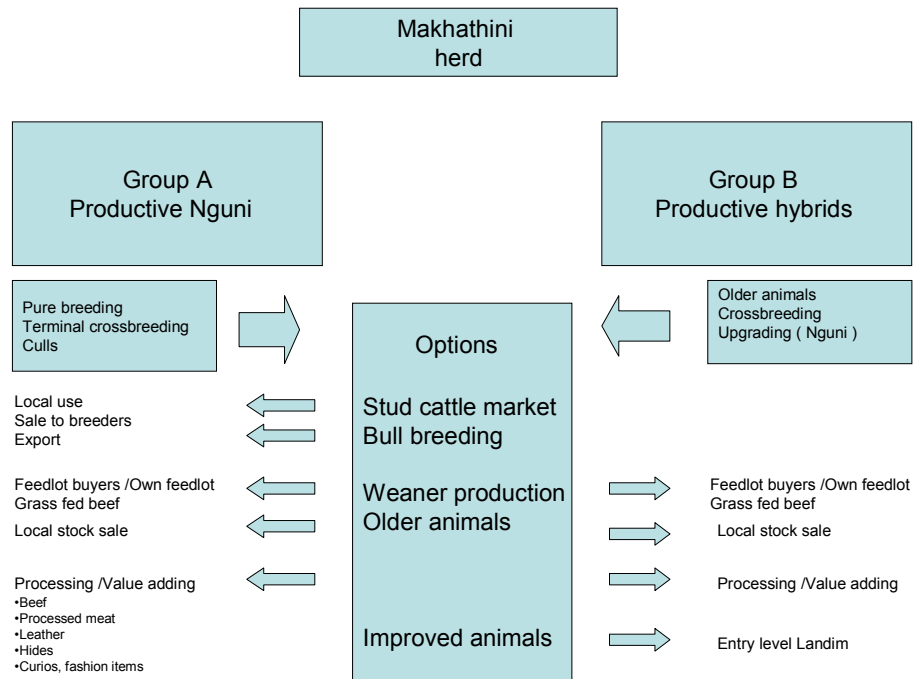


Fig.6: Herd management options where there are two distinctive groups of cattle using the same resource

This should include the following

- Management calendars for the two production systems
- Training schedule for ongoing support
- Breeding material – bulls and AI
- Weaner production models to determine supply



Indigenous breeds are often smaller framed than adapted exotics such as the Brahman and are often perceived to be inferior as a result. In times of drought, however, the larger framed animals are the first to lose condition and even die.

Advantages such as a smaller biomass to maintain are often not that obvious to the owner/keeper fraternity

However, those that have maintained pure herds are clearly aware of the value of their animals.



Hybrids that are the result of crossing indigenous breeds with locally adapted exotica are often functionally efficient and, while they may have a larger biomass, owners and keepers may be hesitant to replace them with smaller framed local breeds without good reason. It is therefore far easier to incorporate such animals in the production system.

Concluding remarks

While there will never be a uniform solution, there is sufficient information based on real experience to develop a framework/ model to reverse the impact of breed encroachment in areas where indigenous breeds of cattle are being replaced by nondescript hybrids.

Such a model should include the following:

- policy and strategy to support any planned interventions – and that this has the approval of all levels of authority
- An effective communication information network to reach all levels making optimal use of all possible channels
- Involvement of local and traditional government as well as farmer associations
- Use the concept of area wide planning to ensure that all stakeholders benefit – including those who do not own livestock
- Resource and market surveys – with full community involvement – taking note of identified needs
- Develop a marketing infrastructure based on community needs and future expansion. This would include interventions such as feedlots, abattoirs and processing plants – provided these are economically viable
- Plan and manage the Veld and the Livestock as one large herd to ensure that all stock owners benefit – irrespective of the number of animals owned
- Make use of a management grid or calendar to develop appropriate Veld – livestock procedures that cover all key activities
- Ensure optimal community involvement in the establishment of infrastructure such as access roads, fencing; dip tanks, handling facilities, etc. The community should also accept responsibility for the maintenance of such infrastructure
- Ideally, the existing community cattle should be used and improved through selection and better management practices
- Indigenous cattle should never be ‘improved’ through crossbreeding with unadapted exotic breeds.

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VIETNAM LIVESTOCK GENETIC RESOURCES CONSERVATION AND EXPLORATION FROM 1990 TO 2007

HOANG VAN TIEU¹, LE VIET LY², LE MINH SAT³, VU CHI CUONG¹ AND VO VAN SU^{1*}

¹National Institute of Animal Husbandry

²Vietnam Animal Science & Technology Association

³Ministry of science and technology

*Contact person: Dr Vo Van Su – Head of Rare animal Genetic Resources Conservation Department National Institute of Animal Husbandry – Tu Liem – Hanoi – Vietnam

Tel: (04) 8.387.238/0989.382.311; Fax : 04.8.389.775; Email: vovansu@hn.vnn.vn

Abstract

Vietnam Livestock Genetic Resources Conservation & Exploration (VLGCE) from 1990 to 2007

Program on VLGCE in period of 1990-2007 was overviewed. Vietnam (VN) is recognized as a rich country not only in biological, but livestock genetic resources (LGR) thanks to diversity in natural conditions, culture and economic systems. Animal production takes 4% of total GDP, but is main living sources of farmers which is 75% of total population.

The most important achievement of the program is to discover at least 30 new breeds / phenotypes, to rescue 7 famous breeds such as I pig in Thanh Hoa, Ba Xuyen pig, Mong Cai pig, Ho chicken, White horse, Dwarf chicken in Yen Bai province, Bau Ben duck in Hoa Binh province.

Achievements are also lied in developing and creating opportunities for mass production of rare breeds like Phan Rang Sheep (herd size was increased from 1000 to 100 000), H'Mong chicken (Which is now available in Ha Noi, Ha Tay, Nha Trang, HCM city, and became new product for gastronomic market), Ac chicken (that was brought from South to North and now it became new product to gastronomic market in North area), Mong Cai pig (this was very famous pigs but was in "danger status).

The important next activities are to establish "National Center for Livestock Animal conservation", increase size of all herds of rare animals upto "FAO-standard" and better exploring of rare animals .

Keywords : *Livestock Genetic Resources; Conservation ; Exploration*

Introduction

From 1990 The National program of Genetic resources conservation was carried out by Ministry of Science – Technology and Environment (now Ministry of Science – Technology). *Project of Vietnam Livestock Genetic Resources Conservation and Exploration* was one component of the program and in charged by National Institute of animal Husbandry (NIAH).

This paper is an overview of the project

Vietnam Animal genetic Resources (VAGR)

VAGR includes 64 indigenous (updated at 12/2007) and some 100 exotic lines / breeds (There were 50 in "Atlas of farm animals in Vietnam" published 2004) in form of: live animals, embryo, sperm and ADN. Animal breeds are listed in Table 1a (Appendix).

Role of VAGR in economic and social life of Vietnam people

Some indicators of role of VAGR in economic and social life of Vietnam people are as following:

Animal production in Vietnam takes 20% of total agriculture production

80 % of people are farmers, and 75% of them do animal production

Only 1% of meat production is exported

80 % meat is produced by local breeds.

75 % eggs is produced by local breeds

1 % milk production is by local breeds

exotic breed maintenance is mainly around big cities

95% farmers have animal production with local breed or crosses between local and exotic.

Drought power supply: at least 60% drought power comes from animals.

Like many other countries, there many festivals concerned to animals.

Vietnam is expected to suffer heavily from environment disasters, so to maintain animals genetic resources to bring different choice to animal production in future.

The main reasons led to loss in animal genetic resources in Vietnam

In 1990, when this project started, it was found at least 4 famous breeds were lost. "I" pig breed was one of lost breeds, it's population was 2 million in 1969 and very popular breed in North Vietnam.

Some most important reasons for losing as follows:

First reason: High performance and "industry" breeds / lines came from western developed countries replace low performance and "non-industrial" indigenous breeds

This reason can be easily experienced in Vietnam. South Vietnam where "Western style economic system: "industrialization", modernization, "centralization" was adapted earlier then North Vietnam. There no much indigenous breeds left in this South, most of animal producers rear some famous exotic breeds: York shire, Berkshire pigs, and Holstein cows. This explains why there are only 20 among 67 indigenous breeds in South areas while 47 in North Vietnam which is less developed .

Some low performance breeds originated from Hungary (Mangalia pigs), Mongolian sheep from Mongol lost, too.

Second reason: inter-breeding between breeds.

Almost local animals are breed by farmer in open areas, so that mating occurs naturally. A lot of breeds – especially chickens, ducks- are crossed lines. In this project a lot of breeds e.g. Dwarf chickens, Ri Chicken... were subjected to select.

Legal documents concerned to Animal genetic resources conservation in Vietnam

1985: Strategy on Genetic Resources conservation issued by Vietnam Government.

1991: Program for Genetic Resources conservation in Vietnam in period 1990-2000 was implemented

1995: Vietnam government joined Biodiversity convention.

1996: Regulation number 14/CP(19/3/1996) on genetic resources conservation

1997: Regulation on Genetic resources issued by Ministry of Science – Technology (MOST) and Environment

2004: State law on Animal livestock

Organization for the National program of Animal Genetic resources conservation

Leader:

Director board of (NIAH) is leader of most of projects, research works on Animal resources conservation in Vietnam.

Assistant

Dept. of Rare Animal and Biodiversity

Supervisors

National Institute of Animal Husbandry (NIAH),

Dept. of Sci. – tech. & Product quality, (Ministry of Agriculture and Rural Development - MARD)

Dept. of Agricultural Sci. – tech. (MOST)

Network

A network of more than 50 organs was established. These organs are: Research institutes, Universities, Associations, Farmers.

International Cooperation organizations

NIAH cooperate with different organisations such as FAO, UNDP, French, Germany, Japan, Hungary in its activities on animal genetic resources conservation.

Some important project / research works on animal Genetic Resources Conservation in Vietnam:

Since 1990 The NIAH started long term project on Animal conservation

1993-1997, project "Conservation and use of animal genetic resources in Asia Pacific" (GCP/RAS/144/JPN).

2000-2001, a project entitled "Conservation of Vietnam livestock breeds which having outstanding economic traits"

2004-2005: Hmong & Bau quyet duck development research work sponsored by Ministry of Science and Technology.

2005-2007: Biodiva project carried out by Vietnam and French

Some most important outputs by The National program of Genetic resources conservation

Rescuing some breeds from losing of next breeds

1 pig in Thanh Hoa

Ba xuyen pig

Mong cai pig

Ho chicken

White horse in Langson province

Dwarf chicken in Yen Bai province

Bau ben duck in Hoa binh province

Develop and create opportunities for mass production of next rare breeds

Phan rang Sheep (herd size was increased from 1000 to 100 000)

Hmong chicken: now available in Ha noi, Ha tay, Nha trang, HCM city, became new product for gastronomic market

Ac chicken was brought from South to North and now it became new product to gastronomic market in North area

Mong cai pig

Detection

More 14 breeds have been detected since 1990

Hmong cattle (Ha giang), White horse (Lang son), Brown pig (Bac me, Ha giang), Tap .na pig (Cao bang), Huong pig (Cao bang), Hmong chick (Son La...), Dwarf chick (Yen Bai), Xuoc chick (Ha giang), Hairy leg chick – Ha giang, 6 toe chick (Lang son), Troi (Quang ninh), Tien yen (Quang ninh), Man (Quang ninh), Dom duck (Lang son).

Take care after 35 breeds which are near to dangerous status and in "less use"

To monitor all local breeds and rare exotic breeds (Burma hog deer...)

Documentation – information system

To make profile for each breed

Website <http://www.vcn.vnn.vn>

To publish 5 books

To publish atlas of animal in VN

Papers in FAO publication, World Watch list.

4 films in TV2 (Chicken, Ducks, Pigs, cattle)

To develop a soft ware to keep records.

Problems

Some breed in narrow areas – E.g. Ho chicken is now kept in only a village. This may be destroyed at any time when disease break out.

Inter mating: Difficult to keep them from inter breeding between unbridled animal in rural areas.

High inbreeding: Some breed have only 2-3 males, such as Brown pigs in Bac Me – Ha Giang.

Small population: by FAO: one breed is danger status once males < 20 and female <1000. But in VN, with expenditure of 0.9 billions VND (60 000 USD) to keep at least 20 -25 breed / year. This is truly small amount.

Is sold at any time: Conservation is operated by NIAH and Farmers. We pay only 20% of total expenditure to farmers to maintain. So farmer may sell these national gene at any time...

Next activities

Establish "National Center for Livestock Animal conservation"
Increase size of all herds of rare animals upto "FAO-standard"
Better exploring of rare animals ...

Appendix

List of 71 indigenous and exotic protected under project "Vietnam Livestock Genetic Resources Conservation & Exploration - VLGRC"

(Upto 30/12/2007) (67 breeds present and 4 breeds disappeared)

Serial number	Breeds	Native home	Date of "discovering" or entering to VLGRC	Recent status	In Atlas of agri-animal breeds in Vietnam
	Vietnam Buffalo	Whole country	<1990		Present
	Yellow Cattle	Thanh hoa	<1990		Present
	H'Mong cattle	Ha Giang	>1990		Present
	U dau riu cattle	Nghe An	>1990		Present
	Co Goat	North Vietnam	<1990		Present
	Bach thao goat	Ninh Thuan	<1990		Present
	Phan Rang sheep	Ninh Thuan	>1990		Present
	Sika deer	Ha tinh	<1990		
	Hog deer (Burma)	Burma	>1990		
	Burma sample deer	Burma	>1990		
	Samba deer	Highland of South Vietnam	<1990		Present
	White horse	North mountain	>1990		Present
	Colored horse	Thai Nguyen	<1990		Present
	Vietnam grey rabbit	Many areas	<1990		Present
	Vietnam black rabbit	Many areas	<1990		Present
	I (fat) pig	Nam dinh	<1990	Lost	Present
	I rough pig	Nam dinh, Thanh Hoa	<1990		Present
	Mong cai pig	Quang Ninh	<1990		Present
	Lang Hong pig	Bac Giang	<1990	Lost	
	Ba Xuyen pig	Soc trang	<1990		Present
	Thuoc Nhieu pig	Long an	<1990	Lost	
	Phu Khanh pig	Khanh Hoa	<1990	Lost	
	Muong Khuong pig	Lao Cai	<1990		Present
	Meo pig	Nghe An	>1990		Present
	Soc pig	Buon Me thuot,Dak Lak	>1990		Present
	Co pig	Nghe An	>1990		
	Son vi pig	Vinh Phu	<1990	Lost	
	Van Pa pig	Quang Tri	>1990		Present
	Tap na pig	Cao Bang	>1990		Present
	Brown pig	Ha Giang	>1990		
	Huong pig	Cao Bang	>1990		
	Sao va pig	Nghe An	>1990		

Serial number	Breeds	Native home	Date of "discovering" or entering to VLGRC	Recent status	In Atlas of agri-animal breeds in Vietnam
	Ha Lang pig	Cao Bang	>1990		
	Ri chicken	North Vietnam	<1990		Present
	Ho chicken	Bac Ninh	<1990		Present
	Mia chicken	Son Tay	<1990		Present
	Dong tao chicken	Hung Yen	<1990		Present
	Ac chicken	Vinh Long	<1990		Present
	Dwarf chicken	Yen bai	<1990		Present
	Tau Vang chicken	Long an	>1990		Present
	H'Mong chicken	Sơn La	>1990		Present
	Van Phu chicken	Vinh Phu	<1990	Lost	
	North Vietnam Tre chicken	North mountain	>1990		
	South Vietnam Tre chicken	West south of Vietnam	>1990		
	To chicken	Thai Binh	>1990		
	Troi chicken	Quang Ninh	>1990		
	Tien yen chicken	Quang Ninh	>1990		
	Quy phi chicken	China	>1990		
	Man chicken	Quang Ninh	>1990		
	Feather leg chicken	Ha Giang	>1990		
	Xuoc chicken	Ha Giang	>1990		
	Smooth feather chicken	Ha Giang	>1990		
	Six toes chicken	Lang Son	>1990		
	Wild chicken	Many areas	>1990		
	Japan quail (Coturnix)	Japan	>1990		
	Ukraina chicken	Ukraina	>1990		
	Hac Phong chicken	Quang Ninh	>1990		
	GT chicken	Ha Tay	>1990		
	GF chicken	Ha Tay	>1990		
	Red pheasants	Many areas	>1990		
	Co duck	Ha Tay	<1990		Present
	Bau ben duck	Hoa Binh	<1990		Present
	Bau quy duck	Nghe An	<1990		Present
	Ky lua duck	Lang Son	<1990		Present
	Moc duck	Binh dinh	>1990		Present
	Dom duck	Lang Son	>1990		
	Trau muscovy duck	Red River delta	<1990		
	De muscovy duck	Red River delta	<1990		
	Co goose	Red River delta	<1990		
	Pigeon (dove)	Whole country	<1990		Present

<1990: Before 1990, >1990: After 1990.

Some well-known indigenous animal breeds in Vietnam

	
H'mong cattle (also North highland cattle) – available in many provinces like Hagiang, Sonla, Baccan, Nghean	U dau riu cattle – available in Nghe an Province, big size and well adapted in dry season effected by Laos wind
	
Phan Rang sheep (in Ninh thuan province) – the unique sheep breed in Vietnam living under hottest, driest areas in Vietnam	Bach Thao goat (Ninh Thuan) – this is unique milk goat in Vietnam
	
Co goat - living in many areas in Vietnam and its meat is one of types meat most preferable in Vietnam	Ac chicken - Small bird: < 0.5 kg. Black meat and born in Long an province - used for “traditional medicine

	
Dong Tao chicken – an unique chicken type famous for big leg.	Ba xuyen pig - This animal was very important animal for farmers in Mekong delta good resistant against mosquito.
	
I pig : This animal was very important animal for farmers in Red delta till 1969 when its herd size was 2 million.	Mong cai pig :This animal is used in many rural areas in Vietnam for crossing thanks to highest born number and easy to rear
	
Vanpa pig – in Quang tri province . Small size (mini pig) and well adapted in hot – dry areas and having “wild” habit.	Bau quy duck - in Nghe an province Most tasty meat duck type in Viet nam
	
Hmong chicken: Black born and meat, is considered as “medicine chicken”	Moc duck – in Binh dinh province The best layer duck type in middle part of VN

FURTHER FINDINGS OF A SOUTH AFRICAN NATIONAL LIVESTOCK SURVEY: COMMUNITY – BASED RESOURCES

J. BESTER^{1*}, K.A. RAMSAY² AND M.M. SCHOLTZ¹

¹Agricultural Research Council: Livestock Business Division, Private Bagx2, Irene, 0062, South Africa,

²Department of Agriculture, Private Bagx138, Pretoria, 0001, South Africa

*Corresponding author: jbester@arc.agric.za

Abstract

The FAO/UNDP/SADC Project RAF/97/032 was initiated in the SADC region to address the problem of the erosion of indigenous livestock breeds in the region. A national livestock survey was carried out as part of this project. Questionnaires designed by ILRI and the University of Zimbabwe covered the collection of demographic data together with the characterisation of livestock breeds, their production and health and breeding management. In South Africa, the focus of the sampling was on the communal areas of the subsistence, small scale and emerging farmers, the repository of the bulk of indigenous breeds. Existing knowledge about these animals was scanty and largely unsubstantiated in the past. In contrast, information from the commercial sector was readily available. The results of the initial analysis on demographic and cattle data were presented at the RBI global congress held in 2005. This presentation covers the results of the sheep, goat, pig and chicken species. The status of indigenous breeds that have been improved and developed for the commercial and niche markets are no longer threatened, while many of those that have been left in their natural state were shown to be facing extinction due to replacement and cross breeding.

Keywords: FAnGR, survey, characterisation, analysis

Background

During their historical, protracted journey down the length of the African continent with migrants, the indigenous breeds of South Africa became hardy and disease tolerant. The erosion of these indigenous livestock breeds in southern Africa is cause for concern as the animals have potential as well-adapted, alternative breeds for the farmers of the future. In addition, they represent a valuable contribution to the rich biodiversity of the region. Due to their declining numbers, it has become necessary to assess their status in order to conserve them and to develop their economic potential.

Introduction

The FAO/UNDP/SADC Project RAF/97/032 was initiated in the SADC region to identify, characterise, and stimulate the conservation and improvement of the farm animal resources in the southern African region. Anticipated outcomes included the maintenance of biological diversity and the creation of sustainable livestock systems with the potential to improve food security, rural livelihoods and incomes.

During 2003 a livestock survey was carried out in South Africa as part of the SADC project. Although designed to collect information regarding livestock from all the farming sectors of the country, the South African survey focused primarily on the communal sector where least information was available. Information was collected at breed level in the commercial, stud and communal sectors together with data on their production and management systems and health issues. Additional information was collected on the demographics of the sampled population.

Results of the detailed analysis of the demographic and cattle data were presented at the 6th Global Conference on the Conservation of Domestic Animal Genetic Resources. Briefly South Africa is the second largest in the SADC region covering 1,219,090 square km with eight biomes. Vegetation, climate and population density are very variable. The farming sector is clearly delineated into a commercial, small scale (developing) and communal sector. Livestock breeds are similarly diverse with both indigenous breeds and exotic breeds imported by colonists.

Materials and Methods

A sample frame was designed to accommodate the heterogeneous sample set and to limit the expense of travel. The design was based on the input variables of biomes and urban/rural/deep rural enumerator areas. Areas chosen were the enumerator areas (EA's) used in the South African population census of 1996 and were identified by fusing the census information onto the biomes. Weighting was applied to the communal areas where available information was scanty and unreliable. The clustering of the selected areas reduced the travel expenses. The format of the survey questionnaire was supplied by the University of Zimbabwe and ILRI who designed the survey protocol and the database. Enumerators were trained at three centres drawing on a mix of Provincial and ARC personnel. A total of 93 enumerators were trained countrywide, provincial personnel coming from either agricultural or animal health departments. A field guide of indigenous breeds and the exotic breeds having most influence on them was distributed to enumerators. A pilot study identified problems that required attention. The survey began in April 2002 after a pilot study and ended in December 2003.

Data entry ran concurrently with data collection and was completed shortly after the last questionnaire was submitted in mid December 2003. Initial analysis was carried out by the University of Pretoria. Descriptive statistics were calculated for the data and were presented in tables and graphs. The analysis also included inferential statistics aspects in which the enumerated data were used to estimate true population numbers. Error estimates were calculated for the population estimates taking into account the budget and framework limitations. Demographic information was compared to that of STATISTICS SA Census 2001 in order to confirm the representivity of the survey data. Where applicable, different data fields were combined to give a more comprehensive analysis e.g. production system and province. Further analysis was carried out by the Agricultural Research Council.

Results and Discussion

Questionnaires from a total of 398 randomly/purposively selected enumerator areas yielded an 86.4% return, giving a total of 2570 completed questionnaires. The overriding proportion of farmers sampled belonged to the communal sector. The results of the goat, sheep chicken and pig analysis of farms in communal areas are presented in this paper. The number of communal farms per species sampled can be seen in Table 1.

Table 1 : Number of farms sampled per livestock species

Species	Number owners
Goats	388
Sheep	230
Chickens	1260
Pigs	52

Goats

At a provincial level 34.5% of the goat keepers were in the Eastern Cape, 23.9% in Limpopo, and just over 16% in KZN and North West Provinces. Goat keepers were well represented in the survey with 277 (71.4%) ownership as a primary species and 111(28.6%) as a secondary. The total number of goats sampled was 9280. Over all the livestock sectors goats were owned by 35.6% of households. The number of goats owned per keeper was generally small with 56.8% owning fewer than ten goats and 14.1% owning 10-15. Men and women shared the responsibility of activities such as buying, selling and health management except in the case of herding. Here men took 46% of the responsibility, women 15% and boys 31%. Herding was once the sole domain of a son of the household but recently introduced compulsory education is changing the traditional pattern.

Goats were mainly used as a form of cash or investment (43.7%) and only 26.5% for meat. Product development in this sector is almost entirely lacking. Only 4.7% of the households milked goats or made use of their products despite the recent development of technologies for tanning skins and the production of cheese and cashmere (Roets, M., 1997). Goats continue to play an important cultural role in rural areas with 18.7% being kept for this use. The low herd numbers and the lack of product development indicate that these animals are a greatly underutilized resource.

The lack of product development was echoed in management. Health issues were not seen as important. Only 63.9% of the goats received treatment, 51% with antibiotics 11.3% with vaccines and 13.5% with traditional treatments. Of the recorded diseases, tick borne diseases (39.5%), blue tongue (14.4%) and scab (9.8%) were most common. Despite the high prevalence of tick born disease,

dipping was not generally practiced with only 30.5% of the owners either dipping or hand dressing. The lack of health management resulted in high mortalities

Goats were generally herded together with cattle in communal grazing areas and at night 68.4% were protected against predators and theft in kraals. Raats (1997) found that milk production in goats dropped radically after the first 30 days in a new camp. The practice of keeping the goats in the same communal area for an extended period will have the same effect and it is possibly the resultant lack of milk production that prevents dairy product development. This may also be compounded by a lack of supplementation, as crop residue was the sole supplementation and was provided by only 31.1% of the farmers. Good quality water was freely available and was generally available less than 5 km from the house.

This lack of management resulted in a high mortality, particularly of kids and females (18.1% and 15.9% of all exits respectively). Overall, mortality accounted for 36.8% of exits, selling 34.8% and slaughter 19.8%. Stock theft also had an appreciable effect at 12.3%. Predation may have been an additional cause of mortality but was not mentioned in the questionnaire.

Replacement and crossbreeding with exotic breeds was evident. Of the pure bred bucks, 54.7% were indigenous veld goats and 12.2% Boer goats. However, a surprising 14.4% were Angora goats. This was also reflected in the pure bred herds (72.5%, 14.2% and 12.4% respectively). It appears that Angora goats are farmed commercially rather than being kept in small numbers as a form of investment, as the average herd size was 101.9 against the indigenous veld goat 9.5. Angora farming was concentrated in the Western and Eastern Cape provinces. Crossbreeding with Angora goats was not popular with only 6% of mixed breeds showing admixture. Boer goats were used more extensively for crossbreeding purposes, with 27% of the breeds showing admixture. Additionally, 78% of the Angora farmers reported a rise in their herd numbers. It appears that breeding with Angora goats is more controlled and, as the majority of Eastern Cape farmers are communal farmers, shows that an improvement in management practices has given rise to a thriving industry.

Sheep

A total of 230 communal farmers included in the survey owned sheep, 105 (54.4%) as a primary species and 125 (45.6%) as a secondary. The total number of sheep sampled was 4223 divided equally between the primary and secondary farmers (44.9% and 55.1% consecutively). Most communal sheep owners were found in the Eastern Cape (65.7%) while others were found to a lesser extent in the NW province (13.3%), KwaZulu-Natal (7.6%) and the Limpopo Province (5.7%). Sheep farming was generally extensive (85.6%) and was carried out as a form of cash generation (70.8%) or for meat for home consumption (21.1%). It can be inferred that communal sheep owners tend to be small scale commercial producers although the average flock size was only 18.4. It was notable that, in the E Cape where communal and small scale farmers participate in the wool sheep and production development programme of the ARC and the wool industry, that the flock size was larger at an average of 29.0 sheep.

Ownership was the sole prerogative of the head of the house (98%). The spouse was involved in the purchase and selling of sheep but herding was the domain of the males as was breeding (98%), shearing (76%) and health (76%). Hired help was used for feeding and shearing. In the Eastern Cape there was evidence that hired help herded the sheep rather than the schoolboys but 29% of the herding was still carried out by boys in KwaZulu-Natal and 20% in Mpumalanga and Limpopo provinces. There was more use of paddocks for grazing in the KwaZulu-Natal, Gauteng and Limpopo, probably to prevent stock theft.

The level of management was low, with only 25% of the farmers providing supplements, usually in the form of crop residue or minerals. Water was freely available and came mainly from rivers (70.8%). In contrast to the goats, only 17% of the sheep were not treated for ailments. Treatment, largely by government veterinarians or extension officers, was mainly for sheep scab (50%), tick borne diseases (18.6%), intestinal parasites (10.5%) and blue tongue (7%). There was a tendency to use antibiotics, irrespective of the disease, probably because they were more readily available. Only 21% of the communal farmers vaccinated their sheep but treatment for ectoparasites was more common with 61.5% of the farmers either dipping (31.3%) or drenching (40.6%) with the balance either spraying or using pour-on treatments. Similarly, 67% drenched to control internal parasites.

Of the communal owners, 80% castrated their sheep either to control breeding or to improve meat quality. Culling of both males and females was for size, conformation or old age. Fertility was not a real issue (9.6%) neither was poor performance (5.8%).

Bad management had a marked effect on production. Entries were generally lambs rather than bought animals but in the communal sector the average births/farm was only 4.2 against the small scale sector's 61.9 and the commercial 679. Losses due to mortality and theft were excessive. Of the

recorded exits, 58% were due to death or theft and only 41.6% were sold or slaughtered. Losses were highest in lambs (44.9%) followed by the females (29.5%).

Rams were usually owner bred (75%) and mating was uncontrolled (96%). Breeds included a high proportion of woolled sheep (Dohne Merinos and Merinos 71.6%) and Dorpers, a locally developed mutton breed (20%). There was evidence of extensive erosion of indigenous breeds countrywide since very few pure breed Zulu or Pedi sheep were found in the rural areas and no indigenous Afrikaner sheep were sampled in the survey.

Table 2 : Sheep breeds found in the communal centre

Breed	Percentage
Dohne	80.7%
Dorper	10.9%
Merino	5.9%
Pedi	0.8%
Zulu	1.7%

Chickens

During the survey 1509 households owning chickens were sampled of which 1260 were in communal areas where 28 040 chickens were recorded. This was only 2.8% of the total number of chickens sampled across all farming sectors, the low percentage being due to the inclusion of several intensive chicken farms in the commercial sector. The ownership of large numbers of chickens in the rural areas was rare, the majority of farmers owning fewer than 20 chickens (81.1%) with an average flock size of 22.3. Farmers were mainly concentrated in the former homeland areas in the Limpopo, KwaZulu-Natal, Eastern Cape and North West provinces. Production was mainly backyard (86.2%) with the chickens being allowed to roam freely in open areas near the house. There was only minimal intensive and free range (confined space) production (3.5% and 7.8% respectively). Meat production was most important (37.4%) as was a source of cash and investment (25.3%). Chickens continued to play an important role in cultural practices (16.4%) but were seldom kept for breeding.

Unlike other farm species, ownership was more the woman's domain and in half the households, she owned the chickens. She also sold the eggs and provided health care for the chickens. Most of the chickens lacked housing but a third roamed free and had some form of shelter. Chickens were largely fed on kitchen waste (55.1%) with home made rations providing the balance. Only 1.2% of the farmers hatched eggs in incubators which raises the question as to why recent innovative incubators are not more popular.

Health care and services were generally lacking with only 38% of the farmers having access to extension officers and government veterinarians. Newcastle disease was the most often recorded disease (81.8%) with chicken pox and Infectious Bursal Disease responsible for a further 9%. The high incidence of Newcastle Disease was certainly due to the recorded lack of vaccination, and to the large number of carrier birds that survived the disease. Traditional treatments for this disease often included the use of aloe juice. Car oil, peach leaves, chilli and soap water were other popular remedies. Only 11% of the farmers treated their chickens for ectoparasites, usually with spray.

Most of the annual entries were bought rather than bred. Of the exits 18.8% and 42.8% of the adult males and females died due to the general lack of management, thus jeopardising any hope of profit. The majority of their males were sold (58.5%). Females were not sold to the same extent (17.9%) and were presumably kept for egg-laying or breeding purposes. Private, local sale accounted for 99.1% of sales indicating a lively local trade. Of the remaining exits, 21.6% of the males and 33.4% of the females were slaughtered as seen in Table 3.

Table 3 : Exits of chickens in the communal sector %

	Males	Females
Died	18.8	42.8
Sold	58.5	17.9
Slaughtered	21.6	33.4
Exchanged	0.1	0.1
Donated	0.7	3.0
Stolen	0.4	2.7

Cockerels were kept almost exclusively for breeding (98%) and were chosen for their size and conformation. The remaining 2% were used for socio cultural purposes. Mating was uncontrolled. The majority of cockerels (64.5%) were indigenous breeds, namely Ovambo, Koekoek or Venda. A further 27.9% were nondescript. Of the purebred, exotic cockerels only the New Hampshire was recorded. These breeds and the naked neck (a gene rather than a breed) were those most identified in the mixed breeds. Size, shape and hardiness were the traits most appreciated by the farmers, making indigenous, hardy breeds an obvious choice. Flocks consisted of an average of 3 adult males and 12.6 females. The average number of eggs laid per cycle varied from low, with 12% of the farmers reporting 0-9 eggs per clutch, to 10-19 eggs per clutch (74%), which is close to the norm. Unfortunately the number of broodiness periods or clutches was not recorded.

Pigs

This was the least popular of the livestock species sampled, possibly because of religious constraints. A total of 187 farmers owned pigs, 32 (17.1%) as a primary species and 155 (82.9%) as a secondary. Numbers were likewise low in the communal sector and only 878 pigs were sampled in total, 399 with the primary farmers and the balance of 479 with the secondary. Pig ownership was most popular in the Limpopo province (41.9%) followed by the North Western and Eastern Cape provinces at 29.0% and 12.9% respectively. Many pigs foraged around or near the household (40%), or were farmed semi-intensively (37.1%) with the remainder being left to forage extensively. They were generally housed in stalls (68%) or in the backyard (11%). Here they were generally fed kitchen waste (58.3%) or bought rations or concentrates (29.2%). They were given minerals and concentrates more often than other livestock species (10.4%). Good quality water was available from municipal sources (66%) the rest coming from dams, boreholes or rivers. Pigs were kept mainly as a source of cash and investment (42%), for meat (39%) and for cultural purposes (9%). Very little use was made of their fat or manure. Ownership was largely the prerogative of the head of the house (66%) and his spouse (33%) and activities were shared between them except for herding and feeding where the children often assisted.

Pigs were not castrated. Entries consisted largely of the birth of piglets, with a very limited number of males and females being bought. It was not surprising, considering the lack of health management, that mortality was very high. In total, 20% of the pigs died, mainly piglets, 37.7% were sold and 14.5% were stolen. Those sold, were usually sold privately (69.8%) or to the abattoir (20.9%). If pigs were culled it was generally because of a lack of size (29%), to a poor performance and conformation or to old age. Boars were mainly kept for breeding (77.8%) or for fattening (14.8%) and were selected for their size and performance. Breeding was uncontrolled (86.7%), prolificacy was at 7.76 piglets per litter (although many died) and the farrowing interval was 5.2 months. There was a dearth of data on the source and breed of purebred boars. The purebred boars recorded were either bred or bought with the majority being Large White or SA Landrace. Data on the breed and age structure was submitted on a total of 136 pig herds. Of the purebred herds reported, 81 (67%) were Kolbroek pigs and 27 (22%) were Windsnyers. Both these breeds are indigenous breeds and were probably selected for the hardy traits that enable them to survive in their environment. Kolbroek pigs also had the most influence on mixed breeds (23.9%) although there was evidence of the use of the SA Landrace and Large White for crossbreeding purposes at 7.8% each. The largest proportion of crossbreeds was nondescript (28%). The Duroc also had a significant influence (10.2%) which was surprising considering the lack of recorded Duroc boars in the communal sector. However, data also showed that the Duroc was popular in the small-scale/emerging sector and it is possible that the boars were being borrowed by communal farmers for crossbreeding. The herd structure showed that the majority of pigs were adult females and that the boar to sow ratio was 1:8.

Conclusion

South Africa is facing a future where access to natural resources is liable to be limited by climate change, rising population numbers and a greater demand for high grade protein as a result of increasing affluence. These combined pressures may burden the commercial livestock sector to such an extent that it can no longer meet demands. The challenge facing the country is to commercialise production and product development in the communal areas where there is a lack of management and an erosion of the low-maintenance, adapted livestock breeds that are the best option for improving production. The South African national livestock survey highlighted this lack of management. Levels of health and nutrition, in particular, resulted in mortalities high enough to reduce profit margins to a minimum. In addition, a lack of product development was evident despite the existence of technologies suitable for communal areas.

Replacement of local, adapted sheep breeds has reached a critical level countrywide and many were not sampled during the survey. Goats fared better and, although there was considerable evidence of crossbreeding, substantial numbers of purebred unimproved veld goats remain. Chickens too, showed signs of erosion by exotic breeds but the production of exotic breeds and commercial hybrids is largely restricted to the commercial sector. Pig farming was limited in the communal areas with an appreciable number being local, adapted breeds although there was considerable crossbreeding with exotic breeds.

Owners of livestock in the communal areas were often keepers rather than farmers. Although livestock was used for meat, it was often equally important as a form of investment or cash generation and it may be that ownership is already fulfilling their requirements. However, an initiative in the Eastern Cape showed that, despite reduced levels of management, keepers of sheep in communal areas had become commercial farmers. The average number in these flocks was higher than the national average and was continuing to rise. A similar scenario was seen with Angora goat farmers in the same province where evidence of controlled breeding resulted in an improved flock size and a low level of crossbreeding with the indigenous veld goat. This improved management holds hope for the future.

The survey confirmed that initiatives to raise production in the communal sector should continue and that the numbers of local adapted breeds should be monitored.

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HOW LIVESTOCK FROM RURAL KEEPERS CAN ACCESS THE SEED STOCK INDUSTRY

M. M. SCHOLTZ*

ARC-Animal Production Institute, Private Bag X2, Irene 0062, South Africa

*Corresponding author: GScholtz@arc.agric.za

Abstract

The majority of livestock in the rural areas of developing countries are indigenous types that are not well defined as breeds as perceived by the developed world. In sharp contrast to stud breeding where uniformity is emphasized, they often show a variety of colour and colour patterns. The animals in this important sector have remained largely uncharacterised and face the risk of genetic dilution due to indiscriminate crossbreeding, breed replacement and neglect. With the likelihood of global warming, these adapted genotypes can play a very important role in future. In South Africa, a system has been implemented that allows this livestock to enter the seed stock industry. The system uses the principles of upgrading for the initial development of a herd book for indigenous breeds. However, it differs in that F1 does not refer to animals that are 50% pure, but rather to those that represent the breed phenotypically but lack pedigree information. The development of such breeds should be supported by impact assessments and performance recording. Two examples will be used to demonstrate this process. The first is the indigenous Nguni breed of cattle that has been successfully developed into a seed stock breed and the second involves the challenges of developing a seed stock industry for

some of the indigenous goat breeds of South Africa. Breed societies can play an important role in securing the future of indigenous breeds in developing countries, since they can act as their modern custodians. The breeds can even be genetically improved so long as selection is not undertaken out of context. However, artificial norms and breed standards should be avoided since they have the potential to alter the breeds drastically.

Keywords: indigenous breeds, seed stock, breed societies

Introduction

There is a very important difference between Africa and India on the one side, and colonial continents such as the Americas, Australia and New Zealand on the other. These continents lacked indigenous livestock and relied entirely on imported material to establish a livestock industry. Africa, in contrast, was richly endowed with a large number of indigenous livestock breeds (Scholtz, 19880).

Colonists often regarded the performance of African indigenous livestock as inferior with little improvement potential, albeit that the animals were valuable to the African man as they provided for most of his needs (Matjuda, 2005). An additional status value attributed to the animals resulted in too many cattle being kept and overstocking became the order of the day (Scholtz, 1988).

A second reason for this perception stemmed from the variety of colours and colour patterns often encountered among animals of the same breed. These wide ranges of colours and colour patterns were in sharp contrast to the general tendency in the seed stock industry where uniformity was emphasized. As a result, the seed stock industry was unable to identify the most emphasized artificial breed standards (Bonsma, 1980), and regarded these animals as an indiscriminate mixture of breeds (Scholtz, 1988).

For many years the performance of indigenous livestock of Africa was regarded as inferior. It was only when the results of research and performance recording were published that the value of breeds such as the Nguni was acknowledged. This resulted in an interest in the breed from commercial farmers and led to the establishment of a breeder's society in 1986. However, it was a challenge to establish a herd book without official pedigrees. This article describes how the principles of upgrading were initially used to develop a herd book until the recognition of the Nguni as an established breed in 1996.

The same interest is currently being shown in some of indigenous goat genotypes, where commercial breeders wish to develop them as seed stock breeds. However, since the recognition of the Nguni, a new Animal Improvement Act (Act 62 of 1998) has been promulgated which requires an impact study before any new breed can be introduced or recognized in South Africa. This article also describes the proposed process that will be followed with the goats.

Materials and Methods

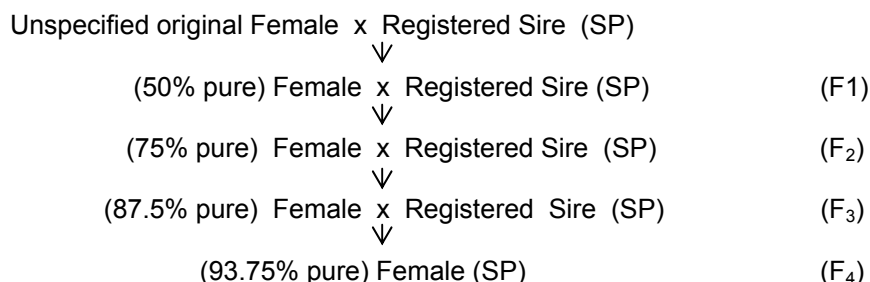
The Nguni example

By the 1970's, commercial breeders had already started to show interest in the Nguni as a result of the performance of the breed.. At this time the only source of Ngunis was in remote tribal areas where the influence of imported exotic breeds was less prevalent (Hobbs, 2006). In the 1980's, the commercial sector showed an accelerated interest in the Nguni and in August 1983 the breed was recognized as a developing breed under the old Livestock Improvement Act (No 25 of 1977). The Nguni Breeder's Society was established in 1986. At that stage there were about 3 000 Nguni females in a few well managed commercial herds, mostly on government farms. However, the Nguni in the communal areas was under severe threat, mainly due to crossbreeding with the Brahman (Scholtz, 2005 a). During this period there were no effective mechanisms in place to control the acquisition of Ngunis and, in many cases, the original custodians were exploited by commercial farmers in order to acquire their animals, for instance two Brahman heifers would be exchanged for one Nguni heifer.

With a Breeder's Society in place, but with no pedigree information, it was a challenge to establish a herd book (Scholtz and Ramsey, 2007). The usual techniques, namely top crossing or upgrading (Dalton, 1980) were not applicable to the Nguni. To top cross, breeders return to the original source of the breed for new genetic material. In the case of the Nguni this was not possible as there was no herd book.

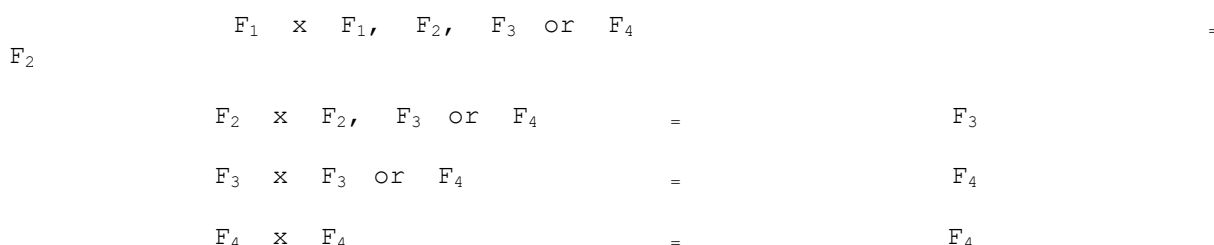
To upgrade a breed it is changed to another by continued crossing. It has been widely used throughout the world where stock was upgraded by a number of crosses with registered Studbook Proper (SP) sires to a specific breed. It is commonly accepted that four generations of crossing with a registered sire (SP) will result in purebred status.

An upgrading programme is as follows:



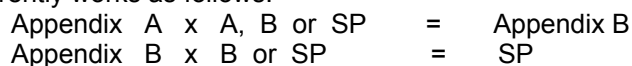
These principles were adopted in the initial development of a herd book for the Nguni. In contrast to normal upgrading where the F₁ is 50% pure, the F₁ referred to animals that were phenotypically Nguni but lacked pedigree information. In cases where the farmers had pedigree information, animals were accepted as F₂, irrespective of the number of pedigree generations (Scholtz and Ramsey, 2007).

The development process was as follows:



In 1996 the Nguni was recognized as an established or developed breed and the system changed from an F rating to an appendix and SP (Studbook Proper) system. All F₁ and F₂ animals that met the breed standards were classified as Appendix A; F₃ animals as Appendix B; and F₄ animals as SP.

This system currently works as follows:



The indigenous goat example

The indigenous veld (veld being natural grazing in South Africa) goats of Southern Africa have been associated with rural keepers for centuries but are subject to erosion as a consequence of the development of the Boar goat and the mohair industry. However, in the recent years there has been a revived interest in the production potential of the unimproved indigenous veld goats. Some of the acclaimed attributes are:

- Exceptionally high fertility
- Extraordinary mothering ability
- Good milk production
- Non seasonal breeding pattern
- Strong herd instinct
- Outstanding adaptability
- Disease tolerance
- Low maintenance costs
- The ability to graze and browse on a wide variety of plants
- The ability to walk long distances comfortably

During 2006 a number of interested breeders applied to the Registrar of Animal Improvement to declare the "Natural African Veld Goat" as breed in terms of the Animal Improvement Act (Act 62 of 1998). The Registrar welcomed this application as "a step in the right direction and a long awaited development". However, a number of issues remained to be clarified including (1) the name of the breed, (2) whether all the unimproved Southern African goat genotypes could be regarded as one breed and (3) how to substantiate the claims made in respect of the breed. Additionally, the Animal

Improvement Act (Act 62 of 1998) requires an impact study before the breed can be recognized. More information on an impact study of this nature can be obtained from Pilling (2007).

Results and discussion

The Nguni example

The interest shown in the Nguni by the seed stock industry resulted in the emerging and small scale sector showing a revived interest in the breed. It is now generally accepted that the published research and performance results saved the Nguni from the possible threat of extinction. This indigenous breed is now, numerically, the second largest stud beef breed in South Africa. The stud animals currently consist of over 41 000 females (June 2008), with an estimated 1.8 million Nguni type animals in South Africa. This clearly demonstrates the important role a Breeder's Society can play in *in situ* conservation.

At present, very high quality Nguni genetic material is still available among the cattle of South Africa's communal black farmers. However, until now, there was no easy way to facilitate the entry of this genetic material into the seed stock industry. Recognizing the value of such genetic material while considering the possibility that it may be contaminated with exotic blood, the Nguni Cattle Breeder's Society, in collaboration with the ARC, developed a process of First Registration to cater for animals from this source. First Registration (FR) refers to phenotypically Nguni animals entering the Nguni register for the first time, for example a communal farmer who has been keeping Nguni cattle for decades, or a commercial farmer who has been farming with Ngunis and now wishes to become a Stud Breeder. This system also caters for emerging black farmers who wish to become Nguni Stud Breeders and enter the Seed Stock Industry.

This system work as follows:

First Registration (FR)		x		FR, A, B
or SP	=	App A		
(Phenotypic Nguni)				
App A		x	A, B or SP	= App
B				
App B		x	B or SP	= SP

Restriction is placed on the sale of First Registration animals in order to ensure that they not only look like pure Ngunis but also that they breed and perform as pure Ngunis and meet the minimum breed standards. Secondly, it ensures that First Registration animals remain in the ownership of emerging farmers for a significant period and that they are not exploited by established seed stock breeders who wish to acquire good quality animals.

The indigenous goat example

According to Rege, Yapi-Gnaore and Tawah (1996) the sub-Saharan African goat genetic resources can be divided into five distinct types:

- Developed indigenous breeds (including the Boer goat, the Kalahari Red and the Savanna goats recognized as breeds in South Africa)
- Mohair goats
- Short-eared, twisted -horned indigenous goats
- Short-eared, small-horned indigenous goats
- Lop-eared indigenous goats

Following a study of literature (Campbell, 1995 and 2003; Epstein, 1971 and Ramsay, Harris and Kotze, undated) and the author's own observations, it was concluded that the indigenous veld goats of southern Africa should be divided into three distinct genotypes and maintained as separate recognized breeds. These different genotypes and their natural distribution areas are:

- Short eared (ears erect as those of dairy goats) with twisted horns found in the north-eastern parts of South Africa (Limpopo and Mpumalanga provinces), Swaziland, Mozambique and Zimbabwe.
- Short-eared goats with small horns found on the east coast of South Africa in the province of KwaZulu-Natal.
- Lop-eared goats found in the western and central parts of South Africa (Eastern Cape, Northern Cape and the north-western regions) together with other southern African countries such as Botswana and Namibia.

It is recommended that these three genotypes be recognized as three separate breeds after an impact study to confirm claims about their attributes. Claims concerning milk production (Boyazoglu,

1998), adaptability, maintenance and grazing and browsing on a wide variety of plants (Raats, 1998) have already been confirmed to some extent. However the claims concerning fertility, mothering ability and non-seasonal breeding remain to be substantiated.

If one or more of these genotypes are recognized as breeds under the Animal Improvement Act, the whole process should be simplified from the original concept of stud breeding. A simplified recording system should be developed that will also allow communal and emerging farmers, the custodians of these goats for many centuries, to participate in breeding and supplying seed stock animals (benefit sharing). It is proposed that the minimum requirements for stud animals should be that they:

- exhibit specific breed characteristics
- have no functional defects
- have a recorded birth date (within one week)
- have a recorded dam
- have a recorded weaning weight

Conclusion

Reports indicate that global warming could become a reality as soon as 2009, and the predictions are that the temperature of half of the years between 2009 and 2014 will be warmer than that of 1998 which was the warmest year on record. It is also predicted that climate change will have a more extreme effect on Africa than on any other continent. Temperatures will rise by a minimum of 2.5° C by 2030, deserts will expand and vegetation will undergo drastic changes. Soaring temperatures and erratic rainfall will also result in crop failures (Ashdown, 2007). With the likelihood of global warming, adapted genotypes from the African continent may play a very important role in the future, even on a global scale, due to their adaptation to hotter climates. It is therefore important that they should be conserved. A Breeder's Society can play an important role in the sustainable use of local livestock genetic resources, since it can act as the modern custodian for the sustainable utilization of such breeds. However, societies should move away from overemphasising uniformity and artificial breed standards, while ensuring that the breeds remain or become competitive (Scholtz, 2005 b and 2006). Proper pedigree and performance recording will be required to identify any undesirable genetic drift and to ensure competitiveness through appropriate breeding programmes designed for local conditions.

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IMPACT OF GLOBALISATION ON PASTORALISTS' MANAGEMENT AND CONSERVATION OF ANIMAL GENETIC RESOURCES

T. M. LOQUANG

Kisup Ateker - Life network
P.O. Box 26459, Kampala - Uganda

E-mail: aatomloquang@yahoo.com

Abstract

Pastoralists are mobile livestock keepers who derive their livelihoods from indigenous uniquely adapted multi-functional livestock that they manage and conserve with their own traditional knowledge. Whereas for the pastoralists, their livestock is life because of not only providing them with food but also economic and social fulfillments; the industrial livestock breeding and production system is slowly, but steadily infiltrating into pastoralists' areas in the name of development. Most developing countries are now adopting the dictum of globalisation; that ensures integration of inputs and outputs into global markets, sharing of information and knowledge, and promulgation of rules governing such integration. The World Trade Organization, International Monetary Fund, and World Bank play an important role in the process of economic globalisation. Globalisation appears attractive as information on international markets for livestock production inputs and products of certain attributes are rapidly transmitted the world over and deals timely hatched. Oftentimes, not only is production subsidised in the industrial system, but also inputs are affordable and readily available, besides adequate infrastructure and distribution networks that support the system. However for pastoralists' communities, globalisation is generally too expensive for them to embrace, given the high costs of inputs, lack of supporting infrastructure and markets and the incompatibility of pastoralism with the industrial model. The pastoralists' livestock are multi-functional, such that meat, milk and egg production and other industrial livestock products are not necessarily the main targets for production. As such globalisation would weaken the pastoralists as they would not only be out-competed in the global market for livestock products, suffer dumping, become poorer and lose the motivation to manage and conserve their well-adapted animal genetic resources but also suffer the destruction of their animal genetic resources and livelihoods.

Keywords: Globalisation, Pastoralism, Conservation, Animal Genetic Resources.

Introduction

There are about 200 million pastoral households worldwide (Nori, et al. 2008); they are mobile livestock keepers who derive their livelihoods from rearing more than two dozen indigenous uniquely adapted multi-functional animal genetic resources [AnGR] on some 30.0 million km² of the world land area (Steinfeld et al., 1999; Köhler-Rollefson, 2000).

Pastoralists often live under precarious environments that demand [for] careful and well-considered mobility in search for pasture and water for their livestock and other needs. As such, their livelihood intricately revolves around their livestock that they have survived on and sustainably managed and conserved over the years with own indigenous knowledge and continually select their choice animals for economically and culturally desirable traits including large body size, high milk yield, appetizing taste of the meat and milk and its products, disease resistance, skin and fur quality, traction, calving ability and even temperament - in a compatible socio-economic-ecological interaction. Pastoralists believe that their livestock is life because they have a wide production base that includes not only food and tangible economic products but also other cultural fulfillments (Loquang, 2006; FAO, 2007a); these aspects are in contrast to industrial livestock breeding and production systems that only target large quantities of meat, milk, eggs and other livestock products for global markets.

The global money economy and the expanded family wants have necessitated pastoralists to regularly engage in livestock trade; which is one of the highest income earners in pastoralists' areas (Loquang, 2005). Pastoralists make substantial contributions to the economy of developing countries, however the pastoral economic system is under increasing threat from the globalisation of the trade in livestock products and unpredictable import policies in many countries. The trend in this century has been for the terms of trade to increasingly turn against pastoralists (Blench, 2001). Pastoralists are also vulnerable to animal epidemics, unreliable rainfall and frequent droughts leading to low animal

and crop productivity, inadequate service provision, poor markets for livestock and livestock products, lack of opportunity for adding value to livestock and specialty livestock products, and absence of supportive policies for them (Loquang and Köehler-Rollefson, 2005).

Global industrial livestock production systems are slowly, but steadily infiltrating into pastoralists' areas in the guise of "development". Most developing countries are adopting globalisation in the effort to penetrate into global markets. Whereas globalisation provides attractive opportunities for [new] markets for pastoralists, access to them can be difficult, as these require not only specialised commercial expertise but also other quality issues (Norton, 2004), which most pastoralists cannot attain! Moreover marketing and other compatible infrastructure are in most cases lacking in pastoralists areas.

Pastoralists instead require, improved service provision opportunities for adding value to livestock and specialty livestock products, niche markets and supportive policies to enhance their livelihoods and improve their production base to motivate them in the management and conservation of their animal genetic resources. This can be achieved and consolidated through the Livestock Keepers Rights (Köehler-Rollefson and Wanyama, 2003; Köehler-Rollefson, 2004).

Globalisation

Globalisation is broadly defined, as the growing integration of economies and societies around the world as a result of flows of goods and services, capital, labor and information [and promulgation of rules governing such integration] (Dixon, J. et al, 2003). The [International Monetary Fund](#) defines globalisation as the growing economic interdependence of countries worldwide through increasing volume and variety of cross-border transactions in goods and services, free international capital flows, and more rapid and widespread diffusion of technology. Meanwhile, the International Forum on Globalisation defines it as the present worldwide drive toward a globalised economic system dominated by supranational corporate trade and banking institutions that are not accountable to democratic processes or national governments (Chatterjee,?). Globalisation is generally considered to have intensified during the decade upto mid-90s that resulted in part from trade liberalisation and the various related agreements and institutions.

The World Trade Organization, International Monetary Fund, and World Bank play an important role in the process of economic globalisation. The goals of World Trade Organization (WTO) include fair and free international trade, free market access of all member states to all markets, fair competition, and the promotion of economic reforms, sustainable development and environmental protection. The slow progress towards the achievement of the named goals has allowed countries in the North to continue subsidising the production of many agricultural products, imposing unfair competition on countries that cannot afford to support their farmers and livestock keepers. The WTO regulations have facilitated the global expansion of large firms and multinational corporations. Northern countries may support transfers of their firms to other countries through tax breaks, as for example Germany does for enterprises wanting to expand to countries in Eastern Europe. Southern countries, on the other hand, may attract investment by multinational corporations by offering subsidised credits (Mathias and Mundy, 2005).

Globalisation appears attractive to pastoralists as information is rapidly transmitted the world over not only on international markets for livestock products of distinct attributes, but also of production processes, inputs, and manufactured products, thus allowing timely hatching of business deals. Globalisation trends may be expected to result in a wider use of a limited number of breeds, standardisation of consumer products and a move towards large-scale production. Meanwhile population growth in developing countries is fueling a massive global increase in demand for food of animal origin.

The term "Livestock Revolution" appropriately describes the course of these events in world agriculture over the next 20 years that would comprise large-scale production and consumption of food of animal origin (Delgado et al., 1999).

In the spirit of globalisation, breeding objectives over past decades focused almost exclusively on performance, as a result, high-yielding livestock populations have become genetically very uniform (Gura, 2007).

Pastoralists would appreciate globalisation as this would expose them to improved production processes, high yielding animal genetic resources, other production inputs, production subsidies and additional financial incentives and consequently more profits as they meet the rigours of 'livestock revolution'. Whereas this scenario appears to be attractive to pastoralists, the system may not be sustainable as infrastructure, distribution systems, information flows that ensure rapid sales and profits are often lacking in pastoral areas. Pastoralists would shun high productive animal genetic resources

that are not adapted to their environment, and for which they do not have any knowledge, practice and experience for their management and conservation; let alone not providing for their cultural and other livelihood needs.

Impact of Globalisation on Pastoralists' Management and Conservation of Animal Genetic Resources

Positive impacts include:

Economic returns from pastoralists' livestock production efforts: Pastoralists would earn more income from exposure and integration to global markets; however a lot would be done to build capacity of the pastoralists and, *inter alia*, to provide the needed infrastructure and develop effective market institutions (Dixon et al, 2003).

Investments in pastoralists' production system: There would be possibilities for investments in pastoralists' areas, for example on organic products from indigenous livestock – which would promote sustainable use and conservation of the concerned animal genetic resource/s.

Management and conservation of animal genetic resources: Better knowledge on pastoralism by the international community [including scientists] not only as a viable source of livelihood, but also a means for sustainable use, management and conservation of indigenous animal genetic resources.

Better global knowledge on pastoralism may also, not only raise awareness at political and policy levels, but also enhance coordination and collaboration arrangements on conservation of indigenous animal genetic resources at regional and / or global levels (Hiemstra et al., 2006).

Adverse consequences / impacts:

Whereas possibilities exist for investments in pastoralists' areas, for example on organic products from indigenous livestock, cheaper options from industrial global livestock production would strangle such initiatives by citing flimsy reasons and skewed equations that would discourage financiers / investors and consumers alike; thus in effect leaving indigenous livestock poorer than ever!

Globalisation trends may be expected to result in a wider use of a limited number of breeds, standardisation / uniformity of consumer products and a move towards large-scale production. This may adversely affect smallholder [like pastoralists] competitiveness and threaten their sustainable use and conservation of indigenous animal genetic resources. (Hiemstra et al., 2006). Furthermore, the narrowing of genetic base would also result in the erosion of pastoralists' traditional knowledge, practices and experience in the management and conservation of animal genetic resources.

The few global livestock breeding companies determine the choice of animal products for the market, thus acting as if consumers all over the world want uniform types and larger quantities of cheaper meat, milk, butter and eggs without caring for human health problems, environmental, social and cultural impact as they expand their market (Gura, 2007). This results not only in lack of market for indigenous livestock products, but eventual loss of indigenous breeds. It is important to note that more than 100 breeds were reported extinct during the past century, while 60 breeds were reported extinct during the past five years alone! A rate of one per month. FAO considers the spread of industrial production (from North to South) as one of the main reasons for the worldwide loss of breeds (FAO, 2000; Gura, 2007).

There would be increased demand for only breeds appropriate for intensive farming systems and consequently a reduced [or no] demand for breeds with adaptive extensive farming systems, thereby minimising sustainable use and conservation measures by indigenous livestock keepers.

Cheap imports of livestock and livestock products adversely affect local markets (Dixon et al, 2003). This demotivates pastoralists and other indigenous livestock keepers, consequently translating to genetic erosion due to reluctance to conserve indigenous animal genetic resources at community level.

Widespread poverty and limited capacity among pastoralists to recognise, explore and compete favorably for available global opportunities would hinder their full participation in global markets.

Small scale farmers, pastoralists and local breeds will have problems to meet the requirements for food safety and product uniformity and to favourably compete in global markets with corporate / large scale operations.

Globalisation would also aggravate the worldwide spread of communicable livestock diseases, for example. the two most recent are: Bovine Spongiform Encephalopathy (BSE), commonly known as Mad-Cow Disease (MCD), is a fatal, neurodegenerative disease in cattle, that causes a spongy degeneration in the brain and spinal cord and also causes red eyes (The Wikimedia Foundation, Inc.; 2008), and Influenza A (H5N1) virus – also called “H5N1 virus” – is an influenza A virus sub-type that occurs mainly in birds, is highly contagious among birds, and can be deadly to them (Centres for Disease Control and Prevention, 2007).

Discussion / Recommendations/ Conclusion

Globalisation would weaken pastoralists, making them not only vulnerable to competition in the global markets for livestock products, dumping and poverty, but also make them lose their livelihoods and the motivation to manage and conserve their well-adapted animal genetic resources.

The global livestock revolution will stretch the capacity of existing production and distribution systems and exacerbate environmental and public health problems. Governments and industry must prepare for this transformation with appropriate policies and investments that will satisfy consumer demand, improve nutrition, direct income growth opportunities and alleviate environmental and public health stress.

The expanding market for livestock products can indeed create income opportunities for the rural poor, including pastoralists. However, many of the approaches so far proposed for directing benefits to the poor follow in the tracks of western livestock development. (Köhler-Rollefson, 2007). This means that there is [still] a great potential for pastoralists to participate and benefit from many aspects of globalisation as they manage and conserve their well-adapted indigenous breeds. There are many marketable products that pastoralists can offer globally. However it is first and foremost important not only to recognise and understand the social and economic background of pastoralists but also their values and value system, livelihoods and their ecosystem. Why have they chosen to live they way they do? Can they be supported to endogenously improve their current livelihoods for more sustainable income generation and security? Pastoralists could produce many [livestock based] items for the world markets, but only if man induced barriers are removed – most of which stem from marginalisation by the very globalisation proponents, inappropriate non-pastoralist led interventions, etc..... We need but only a few experts from outside, pastoralists are the experts themselves, but avail them adequate resources and support the Livestock Keepers Rights, which indeed summarise our demands . . .

Livestock Keepers' Rights on their indigenous knowledge, well-adapted multi-functional livestock breeds and pastures should be legally conferred upon pastoralists and other indigenous livestock keepers (Köhler-Rollefson, 2004; FAO, 2007b). These rights would not only prohibit the private control of pastoralists' indigenous livestock breeds, knowledge and pastures by industrial livestock producers, but also enhance in-situ conservation and management of indigenous livestock breeds, grasslands and rangelands (FAO, 2007a).

Pastoralists require policies that enhance adequate service delivery not only for productivity improvement, sustainable utilisation of their indigenous livestock breeds and rangeland resources, but also for conserving them (Steinfeld et al., 1997; FAO, 2007a).

International agreements regulating agricultural trade are likely to enhance the intensification of livestock production and increase gene flows to the South. Breeding decisions are increasingly taken out of the hands of pastoralists. While relatively few Southern breeds have so far disappeared, these trends are likely to push more to the brink of extinction. Southern breeds are a valuable pool of genetic diversity. Pastoralists and small-scale livestock keepers are crucial for the maintenance of these breeds (Mathias, and Mundy, 2005).

To avoid a negative impact of globalisation on sustainable management and conservation of animal genetic resources by pastoralists, it is essential to understand – fully and accurately – globalisation factors that lead to the loss of breeds, these include: intensification and industrialization of agriculture and animal production; large-scale promotion of uniform high-yielding breeds and cross-breeding and policies and developments that disadvantage ethnic minority (Köhler-Rollefson and the Life Network 2007).

Livestock Keepers' Rights should be conferred upon indigenous livestock keepers: The rights are the hallmark of the LIFE-Network has been to link the conservation of local breeds with both empowerment of local communities and recognition of the customary rights of livestock keepers. LIFE has created and developed the concept of "Livestock Keepers' Rights" (LKR), a bundle of rights and entitlements that would enable livestock keepers to sustainably use conserve and develop their breeds. Since the term LKR was first used at the World Food Summit in 2002, it has been elaborated in numerous international workshops since then. Livestock keepers' rights aims to permit the undisturbed continuation of livestock keepers' traditional ways of life and to recognize the important role of livestock keepers in management, conservation and sustainable use of AnGR. Legal and political aspects of livestock keepers' rights would need to be further explored (Köhler-Rollefson and Wanyama 2003; Köhler-Rollefson, 2004, Köhler-Rollefson, 2005, Hiemstra et al.; 2006).

Cornerstones of Livestock Keepers' Rights: Recognition of livestock keepers as creators of breeds and custodians of animal genetic resources for food and agriculture [AnGRFA].

- Recognition of the dependency of the sustainable use of traditional breeds on the conservation of their respective eco-systems

- Recognition of traditional breeds as collective property, products of indigenous knowledge and cultural expression.
- Right of livestock keepers to breed and make breeding decisions
- Right of livestock keepers to participate in policy making processes on AnGRFA issues
- Support for training and capacity building of livestock keepers and provision of services along the food chain.
- Right of livestock keepers to participate in the identification of research needs and research design with respect to their genetic resources, so as to ensure compliance with the principle of Prior Informed Consent - PIC)

Whereas a few aspects of globalisation would be useful to pastoralists, it is generally not only too expensive and impracticable for them to embrace it, given the generally inadequate [if not] lack of affable attitudes, supporting infrastructure, relevant institutions and policies in pastoralists' areas; but also the incompatibility of pastoralism with the industrial livestock production model; [thus the playing field is not level]. Besides striving for more holistic approaches to livestock development, we must not allow globalisation to strangle indigenous management and conservation of animal genetic resources for the sake of large quantities of meat, milk, butter, eggs, etc; but should take into consideration the survival of pastoralists that combines with the sustainable multipurpose-use and conservation of their well-adapted animal genetic resources and the environment the live in.

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IMPACT OF GLOBALIZATION ON INDIGENOUS CATTLE BREED (NUBLANG) OF BHUTAN

N B Tamang² and Tshering Gyeltshen³

Renewable natural Resource Research Centre, Jakar, Bhutan

Abstract

Many farmers believe that Bhutan is the real home of *Nublang* cattle(*Bos indicus*). This breed of cattle is important reservoir of cattle genetic material unique to Bhutan. Latest molecular marker technology was used to confirm the genetic uniqueness of the breed. This breed is slowly degrading due to cross breeding and is being replaced by exotic crosses. Thus, steps are necessary to conserve them.

² Deputy Chief Research Officer and corresponding author, e mail: nbtamang@yahoo.com

³ Sr. Research Officer, e mail: tgyaltshenffs@yahoo.com

However, conservation activity is long-term process that requires sustained effort to have an effect. In order that the conservation program is implemented successfully, the Ministry of Agriculture need to prepare a long term plan, train people, and necessary resources made available year after year. Thus, trust fund for *Nublang* conservation is required to help preserve Bhutan's only cattle breed for the benefit of people of Bhutan.

Key word: *Indigenous cattle (Nublang), conservation, trust fund*

Introduction

Eastern Himalayas where Bhutan lies, has diverse habitation of wild flora and fauna and is recognised as one of the 10 global hotspots for bio-diversity conservation in the world (UNDP, 1992). Besides, there is diversity of domestic animal genetic resources including yak, cattle, sheep, horses which are equally important to Bhutanese agrarian society where 69 percent of the population depend on agricultural activities (NHPC, 2005).

Due to rugged topography, market inaccessibility and climate, the available domestic livestock species are being gainfully utilized by farmer in their mixed farming systems to improve livelihood and welfare. Conservation of indigenous livestock species is slowly gaining recognition days because of the vital role they play in the life of rural farming communities.

Among domestic livestock species, cattle have long been a central component of Bhutanese farming systems. They are used for the production of milk, draught power, income and a store of wealth. Most of the country's cattle are Siri locally termed as *Thrabam/Nublang (Bos indicus)*. The pure *Nublang* breed makes up 67% of the national cattle population (DoL, 2005) of Bhutan thereby forming the most important livestock resources of Bhutan.

The word *Nublang* means bull of the west, having originated from the western part of the kingdom. In other parts of the country, *Nublang* is also called as *Chulang* and *Thralang* in the migratory herds. Existence of *Nublang*, the native local breed of Bhutan traces back as far as 1000 years of its existence (Dorji, 2005). The breed standard set by farmers for good quality *Nublang* is presented in table 1.

Table 1. Farmers' breed standards of *Nublang*

Body parts	Desirable	Not desirable
Head	Long face, long hair on poll, base of horn and ear, horn directed outward, upward and forward (<i>Rob cha aey go go</i>)	Short face, sparse hair, Horn directed sideward, backward (<i>Rob cha tok kay</i>)
Neck	Short neck, well developed and pendulous dewlap (<i>oeay cheay tsa lay ptsha</i>)	Long neck, short dewlap
Hump	Well developed with growth of thick long hair from its top (<i>Bjala tseau pup pup zum</i>)	Small hump, less hair
General body confirmation	Proportionate (<i>Gu-ju-dem dem</i>)	Big head, thinner posterior part
Limbs	Strong, tall (<i>Kang lub tum rim rim</i>); rounded hooves (<i>Meak chu tey re re</i>)	Weak, short, pointed hooves
Tail	Long, Hairy, Thick switch (<i>jum tsalay ptshak</i>)	Short, thin with sparse hair on switch
Sheath	Tight and big with abundant prepuce hair (<i>Pho cho boam, jaou ray chu ngey ngey</i>)	Small sheath, sparse hair

Source: Dorji (2005)

Bhutanese farmers believe that *Nublang* cattle originate in Bhutan. Bhutanese legend links the origin of *Nublang* with the legendary Lake *Nob Tshonapata*, located on the mountain ranges above Nakha village, Sangbe block, Haa district of Bhutan. This breed of cattle is important cattle genetic material unique to Bhutan. The genetic uniqueness of the breed was substantiated using latest molecular marker technology(Arbenz and Tshering, 2000). However, this breed is slowly degrading due to cross breeding with Jersey and Brown Swiss breed (*Bos taurus*) and traditionally with Mithun (*Bos frontalis*) (Roder *et al*, 2000) and is being replaced by their crosses. Thus, there is a fear that unless steps are taken to conserve them the breed might vanish one day and can never be placed once it is gone.

Nublang although they are poor milk producer, they played an important role in Bhutanese farming systems as a supplier of milk products, draught power and manure. The animal is most adapted to a wide range of agro-climatic conditions; relatively resistant to diseases, it has to survive under adverse nutritional conditions. Therefore its multifaceted role has made the breed the most suitable breed in the extensive to semi-intensive cattle production system in Bhutan.

In Bhutan, Sangbe block of Haa district have been identified as the original breeding tract and efforts were made to conserve them there. But with the globalization and changing socio-economic

needs, farmers no longer are eager to conserve the breed and some area farmers are already resorting to crossbreeding. In order to understand the trend in existing *Nublang* cattle population and impact of globalization on this indigenous breed, this study was carried out with the objective to:

- Assess the impact of globalization of indigenous cattle breed(*Nublang*) in Bhutan
- Understand the population status of *Nublang* its breeding tract
- Discuss with farmers on the *Nublang* herd improvement program

Material and Methods

Team of livestock professionals made herd to herd visit in all *Nublang* rearing villages of its breeding tract in Sangbe, Haa district of Bhutan. The villages visited were Saba, Sebji, Sambeyama, Tima, Tashigang, Mochu, Nakka, Nakekha, Gerekha and Chonglina. The population status of each herd was noted and 162 best animals qualifying the breed standard were ear tagged to initiate milk recording in future.

Results and discussion

Present status (population trend, quality of habitat)

The Local cattle (*Nublang*) population in the country was estimated at 250,000 (MoA, 2000). However, this census does not reflect the true *Nublang* population because Mithun hybrids and back crosses are also considered as local cattle (Phanchung *et al*, 2001). Livestock experts are of the view that true *Nublang* resources may be less than 20% of the total compared to that reported in the census.

Trend analysis showed that the population of *Nublang* was decreasing as compared to past years. The commonly described and the most preferred *Nublang* the so called “*Nubge Langchu Pendo*” is no more to be found in its breeding tract indicating a gradual disappearance of the true type of *Nublang* even in its home tract.

Nublang cattle in the study area recorded were 697 (Table 1). The three villages Trashigang, Shaba and Sebji of Sangbe block have maximum *Nublang* population. The villages also had 120 Mithun-*Nublang* hybrids.

Table1. *Nublang* Population in breeding tract

Village	<1 yr Male	<1 yr Female	Heifer	Uncastrate	Bull	Bullock	Milk	Dry	Total
Sebji	14	20	32	14	7	7	15	15	124
Shaba	16	24	28	31	3	11	28	14	155
Cholingna	0	2	5	8	0	9	5	5	34
Gareykha	3	4	12	8	1	1	9	5	43
Somboeyama	11	9	11	12	3	8	17	10	81
Nakaykha	16	8	16	7	1	11	16	2	77
Nakha	5	4	8	5	2	5	13	5	47
Trashigang	12	13	27	17	3	7	29	28	136
Total	77	84	139	102	20	59	132	84	697

Quality of existing Nublang population in its breeding tract

The qualities of *Nublang* population in every herd were assessed using its breed standard as the base guideline. About 47% of the observed cattle were judged as good quality (Table 2). In particular, the qualities of cows and heifers were noted to be of good quality compared to the existing males.

Table 2. Quality of *Nublang* in Sebji, Shaba, SomboeyAma and Trashigang

Category	Good	Medium	Poor	Total
Cow	77	34	7	118
Heifer	51	16	1	68
Bull	1	2	0	3
Un-castrated Male	8	15	10	33
Castrated Male	2	1	3	6
Calf	5	7	3	15
Total	114	75	24	243

The elderly herders in the study report of gradual deterioration in the quality of animals in their herds. According 72 years old Sangay Wangdi of Nakha and 65 years old Chenchu Pem, of Shaba, following factors are responsible for the decreasing animal quality in their area.

i) Decreasing bull quality

- Lack of systematic bull breeding and exchange plan leading to inbreeding
- Castration of quality young bulls for bullock purpose leading to negative selection
- Sale of quality young bulls to other areas which are castrated for bullock and later sold for beef purpose

ii) Decreasing grazing resources

- Expansion of cardamom plantation (cash crop) in the traditionally grazing area
- Ban is prescribed burning of grasslands
- Proliferation of weed such as *Euophatorium adenophorum* (black weed) on the grazing ground

iii) Other factors

- Decreasing household labour
- Gave more importance to cardamom plantation

Encroaching of limited grazing land due to other economic opportunities such as cardamom plantation, majority of cattle owners have already sold their cattle and maintained a few heads which are allowed to graze near the homestead throughout the season.

Impact of globalization of indigenous cattle breed

The *Nublang* cattle breed has survived because of its utility in the traditional extensive cattle production system. However, production system is changing driven by economic needs. This could pose a threat to survival of the breed. The transition from an extensive or semi-intensive system to which this breed is suited, to an intensive market oriented dairy farming is taking place. This entails crossbreeding with high yielding cattle Jersey, Brown Swiss breeds and Mithun which is contributing to the genetic erosion of this breed. Crossbreeding *Nublang* with these breeds is to take advantage of the heterosis is increasingly advocated and to increase productivity and therefore the income and livelihood of the rural farmers.

As *Nublang* is the only indigenous cattle breed of Bhutan has been the base population for crossbreeding with Mithun (traditional crossbreeding) from time immemorial and with exotics breeds: Jersey and Brown Swiss from 1980s. With so much of emphasis on crossbreeding there has been gradual deterioration in the quality of *Nublang* with passage of time. It has also been observed that with the decline in the quality of *Nublang* there has been decline in the quality of crossbred animals produced.

In addition, a sizeable number of *Nublang* cattle in peri-urban or areas with easy access to fluid milk markets are being substituted by improved breeds. If this trend continues, it would not be long before the breed is endangered. In view of this, sustainable conservation efforts must be explored and pursued to secure the breed for present and future use.

Scope of conservation and utilization

As *Nublang* cattle breed is very unique to Bhutan, it offers an opportunity/scope to recognize as a valuable genetic resource for Bhutan. The underlying reasons are:

- It is the only traditional cattle breed indigenous to Bhutan. It's legendary origin in Bhutan is well established and agreed by the scientific community
- It is genetically distinct to any other cattle in the neighboring countries
- It has traditionally played significant role in the socio-economic, cultural and -religious life of the Bhutanese society;
- It is well adapted to survive and produce in harsh environment especially high rainfall areas, infested with blood sucking leeches and flies;
- It is indispensable to maintain sustainable farming systems in many parts of remote Bhutan

The breed has come under threat of dilution from hybridisation with Mithun and other introduced cattle breeds such as Jersey and Brown Swiss

Steps taken to mitigate depletion of this breed

As an immediate measure towards conserving this breed, a National *Nublang* Breeding Farm was established in 1995 at Tashiyangphu, Tashigang district, under the Royal Command with the main objective to conserve this breed. The farm has 114 heads of animals comprising milking cows, dry cows, heifers, young bulls, adult bulls, male and female calves. Apart from the farm, semen cryo-

preservation (ex-situ conservation) have been established in the country and frozen semen from Jersey, Brown Swiss, Mithun and *Nublang* have been cry preserved and used in the field.

In the process of its conservation, it has also become very useful for undertaking genetic studies on the breed and defining its characteristics. Study confirmed that this breed of cattle is very unique to Bhutan as this type of breed is not existing/available in neighboring India and Nepal.

Future action plan

Short term

- Hold periodic expo to create awareness and reinforce the farmers on the importance of *Nublang*.
- Provide incentives to the *Nublang* owners to maintain and improve the quality of their animals
- Facilitate provision of quality *Nublang* bulls to the area farmers.

Medium and long-term

- Develop mechanism to conserve the animal by both in-situ and ex-situ with more focus given to in-situ conservation in its breeding tract and other selected potential pockets
- Strengthen existing *Nublang* Farm and initiate additional rearing stations
- Introduce animal identification and recording system for *Nublang* cattle in the selected pockets
- Explore sustainable utilization and market opportunities as draft and meat animal
- Make provision for trust fund for *Nublang* conservation.

Conclusions

Nublang with multiple uses is an important cattle genetic resource. Further, *Nublang* has been and will continue to be a base population for crossbreeding with Mithun as well as exotic crosses. Thus, availability of good quality *Nublang* gives opportunities for farmers to select stock or crossbreed in response to changing socio-economic environment. Thus the breed needs to be conserved for sustainable utilization in the near future. However, conservation efforts requires many years of sustained effort to have an effect and for successful conservation program, Bhutan's Ministry of Agriculture, need to prepare effective plans and make resources readily available for it.

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NEW APPROACHES TO CONSERVING TRADITIONAL POULTRY BREEDS OF THE CARPATHIAN BASIN

I.T. Szalay^{1,2*} and K.D.T. Dong Xuan^{1,2}

¹Association of Hungarian Small Animal Breeders for Gene Conservation (MGE),
2100 Godollo, Isaszegi ut 208, Hungary

²Research Institute for Animal Breeding and Nutrition, Division of Small Animal Research
(ATK-KATKI), 2100 Godollo, Isaszegi ut 200, Hungary

*Corresponding author: it.szalay@gmail.com

Summary

History of traditional Hungarian poultry genetic resources, including several chicken, turkey, guinea-fowl, goose and duck breeds demonstrate their important role in family farms and households of the Carpathian Basin. As the expansion of poultry industry made traditional breeds gradually disappear from the countryside, Hungarian preservation programs started in the form of governmental subsidies in the beginning of 1970's to maintain original stocks of certain rare poultry breeds and varieties. Since 1997 conservation of traditional Hungarian poultry breeds is organized and controlled by an NGO: the Association of Hungarian Small Animal Breeders for Gene Conservation (MGE), which is the only official breeding organization for all poultry genetic resources in the country.

Conservation of local breeds (both plants and animals) through the development of different ecological types of production systems and products have real importance in maintaining agro-biodiversity and agro-ecosystems. In this process, local poultry breeds should play a significant role, even in the near future. First step in saving a breed should be the proper execution of a conservation program. On the other hand, additional, new approaches to conserving traditional, local breeds are needed for multifunctional use of poultry genetic resources, including: the maintenance of functional in situ gene banks, research including the assessment of production, education at different levels, elaboration of sustainable production methods and marketable products, development of family poultry, making use of the capabilities of fancy breeders, completing field studies and surveys of local breeds in marginal regions and reintroduction of the breeds to villages, seeking for demonstration and popularization potentials, and adaptation of breeds in diverse environments. Some examples for the new approaches taken from the Hungarian conservation experiences and practices are given in the paper.

Keywords: poultry genetic resources, conservation, utilization

Introduction

Historically, the most famous poultry breeds of the Carpathian Basin are the Transylvanian Naked-neck Chicken and the Frizzled Hungarian Goose, often referred to as "Hungarikum" poultry breeds, and believed to be characteristic only for this region. Three domestic bird species, chicken, goose and turkey are listed by Bartosiewicz (2002) as having autochthonous breeds in Hungary, however, according to the archaeozoological records the idea of direct continuity between ancient birds and the modern autochthonous ones would be difficult to accept. Characterizing the Hungarian activities on the conservation of domestic animal genetic resources, Bodo (1985) listed only the Speckled, Yellow, White and two color varieties of Naked-Neck (black and speckled) chicken, and the Frizzled Feather Goose, as old Hungarian poultry breeds threatened by extinction, and which deserve consideration as genetic resources. Within the species of domestic fowl in Hungary, Bodo et al. (1990) considered for preservation the White, Yellow and Speckled Hungarian Chicken mentioning their naked-neck variety, and the Transylvanian Naked-neck, similar to the above variants, but having different origin. By developing conservation activity and setting up in situ gene banks for traditional poultry breeds in Hungary, it was made clear, that there are two more species (duck and guinea-fowl), and several breeds and varieties of other species having long breeding history in the Carpathian Basin (Szalay et al, 1992; Szalay et al., 1995; Szalay, 2002). At present, traditional poultry breeds, registered and protected for their genetic value in Hungary are represented by seven breeds of chicken, distinguished by their plumage color, two breeds of turkey, one landrace type of Guinea-fowl, Hungarian goose breeds, distinguished by color and feather varieties and Hungarian Duck color varieties. Main features of official conservation programs and alternative approaches to conserving traditional Hungarian

poultry breeds are discussed in the following sections. List of breeds by species, number of birds in registered flocks in the years 2005-2008 and effective size of populations (N_e) in 2008 of traditional Hungarian poultry breeds (MGE data, 2008) are presented in *Table 1*. More details about the history, breeding principles and standard characteristics of the breeds are found in a book on old Hungarian poultry (Szalay, 2002) and on the MGE website (MGE, 2008).

Table 1. Number of birds in registered flocks of traditional Hungarian poultry breeds (females and males) in 2005-2008 and effective numbers of populations (N _e) in 2008 (MGE data, 2008)									
Species	Breed	Year of registration	Number of registered flocks	Sex	Total number of birds in registered flocks/Year				N _e ** 2008
					2005	2006	2007	2008	
Chicken	Yellow Hungarian	1973	3	♀	1569	1525	1447	2027	1057.4
				♂	177	168	176	304	
	White Hungarian	1973	2	♀	299	262	172	248	177.4
				♂	47	40	50	54	
	Speckled Hungarian	1973	3	♀	1331	750	654	836	616.6
				♂	233	192	153	189	
	Partridge-colour Hungarian	2004	3	♀	322	161	237	228	204.7
				♂	60	34	70	66	
	White Transylvanian Naked-neck	1973 as color variety*	2	♀	273	222	161	203	170.6
				♂	49	43	49	54	
	Black Transylvanian Naked-neck	1973 as color variety*	2	♀	189	110	148	249	177.5
				♂	54	43	50	54	
Speckled Transylvanian Naked-neck	1973 as color variety*	3	♀	597	430	290	361	277.8	
			♂	97	85	73	86		
Turkey	Copper	1973	3	♀	167	148	268	220	217.0
				♂	45	47	77	72	
	Bronze	1973	3	♀	340	286	298	212	238.6
				♂	78	97	90	83	
Guinea-fowl	Hungarian landrace	2004	2	♀	227	215	401	285	273.6
				♂	93	85	112	90	
Goose	Frizzled Hungarian	1973	3	♀	518	487	152	184	221.1
				♂	139	166	68	79	
	Hungarian color varieties: white, grey and spotted	2004	1	♀	-	121	180	144	148.5
				♂	-	246	81	50	
Duck	White Hungarian	2004 as color variety*	2	♀	148	106	115	79	106.2
				♂	79	43	47	40	
	Wild-colour Hungarian	2004 as color variety*	3	♀	393	317	335	333	305.3
				♂	131	77	97	99	
*Procedures to register color varieties as individual breeds are in progress.									
**N _e was calculated according to the equation (after Wright, 1931): $N_e = \frac{4N_f N_m}{N_f + N_m},$									
where N _e is the effective population size; N _f is the number of dams; N _m is the number of sires.									

Official conservation program for the traditional Hungarian poultry breeds

Poultry conservation programs are implemented for several indigenous, native or adapted poultry breeds in Hungary, including local chicken breeds and varieties, color varieties of landrace turkey and guinea-fowl, local varieties of domestic goose and duck. AnGR conservation is supervised and partly financed by the Ministry of Agriculture and Rural Development and the Animal Breeding Directorate of the Central Agricultural Office (MGSzH). Hungarian poultry conservation is coordinated and organized by the Association of Hungarian Small Animal Breeders for Gene Conservation (MGE) as a non-governmental organization (NGO), founded in 1997. Conservation programs of elite stocks are carried out by breeding institutions having several decades of experience, including: Debrecen University (copper and bronze turkey), West-Hungarian University, Mosonmagyaróvár (Yellow Hungarian Chicken), Szeged University of Science, Hodmezővásárhely (Speckled Hungarian and Speckled Transylvanian Naked-neck Chicken), and last but not least the Research Institute for Animal Breeding and Nutrition, Division of Small Animal Research (Godollo Poultry Gene Bank includes all registered traditional poultry breeds: 7 chicken, 2 turkey, 2 goose 1 guinea-fowl and 1 duck breeds with some color varieties). During the 10 year history of MGE, conservation basis has been expanded, as several farmers and breeders joined the group of Hungarian poultry conservation network. The main result of the growing conservation network is the stabilized number of breeders in poultry elite stocks in the recent years, conserved as officially registered breeds. In all breeds effective population size exceeds the critical level ($N_e \geq 100$) proposed for conservation of animal genetic resources (Foose, 1983).

Main regulations of MGE conservation programs of elite stocks of traditional Hungarian poultry breeds are as follows:

- Egg collection is made around peak production from at least 10 half-sib female families with rotation of the males in the next generation. Trap-nests are used if available.
- Changing the set of males (reserve males) in the mid of egg collection.
- Maintaining low sire/dam ratio: 1/7 for chicken, 1/5 for guinea fowl, 1/4 for turkey and 1/3 for goose and duck.
- Pedigree hatching and wing-banding are done by families;
- Rearing and egg production conditions are free range, according to the rules of organic farming.
- One year old birds are kept for the following year as registered reserve flocks.
- Limited phenotypic selection is allowed among males.

New conservation approaches

Breeding approach: sustaining functional in situ gene banks

Expansion of commercial poultry breeding and production was followed by the dramatic decrease in poultry diversity. By the beginning of 1970ies, the role of landrace types of poultry were taken over by commercial breeds even in the rural households, and breeding programs for local breeds ceased in a short term. In Hungary governmentally managed conservation programs for certain poultry breeds and varieties started in 1973, which enabled to preserve certain breeding stocks of chicken. Official list of conserved breeds included Yellow, Speckled and White Hungarian Chicken, color varieties of Transylvanian Naked Neck Chicken, Bronze and Copper Turkey and Frizzled Hungarian Goose. Based on these stocks, the breeds has survived in functional gene banks serving as primary breeding centers, providing hatching eggs and day old chicks mainly for family farms. Lately, functional gene bank stocks of additional local breeds have been developed and registered, for which starting populations were collected in different rural regions of the Carpathian Basin where traditional family farming still exists (Hungarian goose and duck varieties, Partridge-color Hungarian chicken). *Functional in situ gene banks* of old Hungarian poultry breeds allow the primary breeders to offer grandparent and parent stocks for sale, providing the chance to elaborate breeding and production systems analogous to commercial ones.

Research approach: assessment of production traits of the breeds

Serving as primary breeding stocks production and reproduction traits of traditional Hungarian poultry breeds are assessed regularly. Records on body weight at different ages, egg production, hatchability and livability are up to date in every stock, while the possibilities of crossings of local breeds with each other or with different commercial breeds are also used to evaluate their production potential. Moreover, they are excellent subjects for other types of applied research in poultry breeding and genetics including DNA typing, reproduction biology, population genetics, nutrition, and veterinary studies. Most of institutions pay special attention to the evaluation of product quality of old breeds in

low input, organic and/or ecological type mixed production, in the frameworks of recent national R&D projects (GAK-OKO and GAK-GALLUS) (e.g. Bodi et al., 2007; Konrad et al., 2008).

Educational and demonstration approaches

Established mainly by higher educational units and research institutions, gene bank stocks of old Hungarian poultry breeds serve as units of on farm training at different levels of education from schoolchildren to university students in poultry management, conservation and alternative technologies.

Hungarian national parks are responsible to some extent for the conservation of animal genetic resources. As part of that activity, farm animal parks have been set up by national parks to demonstrate the different local breeds, including poultry, to acquaint visitors with traditional animal breeding and local breeds. Primary breeders of local poultry breeds have started a program, by which the supply to farm parks with pedigreed individuals of gene bank origin can be assured.

Four major agricultural shows held every year in Hungary are also used to popularize the old breeds. Moreover, some gene bank stocks are also open to public as farm parks for demonstrational and educational purposes.

Sustainable production approach

Parallel with agricultural policy of EU and related national programs intended to develop agriculture in a multifunctional and sustainable way, poultry conservationists seem to have good chance for using poultry genetic resources in alternative production systems. To prove advantages of old breeds, and to show their role in returning to sustainable agriculture, appropriate research with traditional poultry breeds and alternative production systems are of major importance.

Organic (in Hungarian use: *ecological*) *farming* should offer a considerable background for the use of local domestic animal breeds in certain countries, where functionality of conservation stocks has been sustained, as revealed by a recent survey in the CHANNEL project for Slovenia and Hungary (Radics et al, 2006). For their short return period, poultry breeds can be an important share of organic production both in specialized for poultry production and mixed farms. Functional gene banks are the main sources to supply organic farms with animals needed for low input organic production. The low production level of organic poultry certainly will rise in the Carpathian basin, as many of family farms with good facilities for poultry keeping will extend over their production to the market.

As part of the conservation program, MGE and its institutional partners have been working on the elaboration of the genetic bases, management and quality control of production of the *Hungaricum* type quality poultry products. Special poultry production needs old Hungarian type poultry breeds, natural or ecological production and a comprehensive controlling system, by which typical Hungarian product, called *HU-BA* will be produced. Further important aspects of *HU-BA* production are conservation of old Hungarian poultry breeds and breeding traditions, as well as rural family farming. Making *HU-BA* products more marketable, inclusion of ecological type mixed farming in production is very promising, if incorporation of poultry production into ecological plant cultures or horticultures is solved. This type of production can provide a model for the development of ecological type mixed farming systems including poultry, for other countries too.

Family poultry approach: Reintroduction of traditional poultry breeds to the villages

Family poultry production has got a long history in all over the world; however, urbanization and lifestyle changes together with the "poultry boom" resulted in a significant decline in the number of families keeping poultry for self consumption. Decline started much later in countries in transition, while the most important source of meat and egg in rural regions of developing countries are still the household units. Family poultry production in the Carpathian Basin is still important in rural sites, representing about 20% of all production (Horn et al., 2002), depending on the level of urbanization and industrialization of the region. Village poultry is also the source of genetic resources in many cases, as some traditional landrace goose and duck varieties have been collected in marginal rural areas and maintained in gene banks by MGE breeders. The majority of villages, however, have lost their characteristic local poultry breeds, and mostly intensive hybrids are kept by households. As a new program launched by MGE, voluntary model villages are provided with hatching eggs or day old chicks from the gene banks of old Hungarian poultry free of charge. The only obligation of the households of model villages in the program is to keep and reproduce the birds the following year, and possibly supply families of another village with the offspring under the coordination of the breeding association and primary breeders. Additional goals of the reintroduction program are not only the widened background of gene conservation of old breeds and the use local breeds in suitable

conditions, but also the possible breeding basis for production of village poultry, organic or HU-BA poultry. Providing additional incentives and culinary choices, model villages of local poultry can play a considerable role in rural tourism development as well.

Fancy breeders

A group of more than 30 small-animal breeders set up an MGE section of old Hungarian poultry fancy breeders in 2006 to develop their stocks based on the existing poultry gene banks. Fancy breeders should become an important component of gene conservation – as they are in developed countries for old breeds – in spite of their quite different breeding practices. Several small stocks kept by fancy breeders can ensure the maintenance of genetic diversity as the whole. Moreover, poultry shows, both local and international, organized by them, will introduce the breeds to the wide range of human population not acquainted with the variety of traditional poultry.

Field studies and surveys of local breeds

Field studies and surveys done by MGE breeders revealed that many types of local poultry still exist in different regions of the Carpathian Basin in households, which however may disappear rapidly with the change of lifestyle even in the countryside. According to field studies, gene bank stocks of Transylvanian feather and colored varieties of Hungarian chicken (partridge-color), goose (frizzled and spotted) and duck (white, wild-color and white-black spotted) was set up in the Godollo Gene Bank to start conservation of the breeds. Collection of some other varieties of landrace poultry, characteristic for special regions of the Carpathian Basin – e.g. different color types of turkey, guinea fowl and duck – is still remains the task of the future.

Adaptation studies of Traditional Hungarian poultry in Southeast Asia: Trading approach

Collaboration of the National Institute of Animal Husbandry (NIAH) Poultry Research Centre (POREC) Hanoi, Vietnam and the Institute for Small Animal Research (KATKI, Godollo, Hungary) started in the late 1990. Since then, a series of adaptation experiments have been completed to study the potential use of traditional Hungarian poultry breeds under Vietnamese conditions. Studies of rearing and reproduction of several species (chicken, duck, guinea-fowl and turkey) revealed, that hatchability, body weight gain and livability may be somewhat better in Vietnam than in Hungary. Hungarian poultry breeds start egg production earlier in Vietnam, and produce more but in some cases – due to early start of laying and longer production period – somewhat smaller eggs (Dong Xuan et al., 2007). Adaptation studies demonstrate that traditional Hungarian poultry breeds can be reared and reproduced with real success in Vietnam, providing premium quality products for consumers, and therefore are highly marketable. To develop high quality poultry meat production in the countries of Southeast Asia, organization of breeding centers, and propagation of the breeds in the underprivileged rural areas are needed. This type of development, however, should consider traditional farming systems and conservation approaches of local breeds (Dong Xuan and Szalay, 2003; Dong Xuan et al., 2006) as well as the protection of sustainable ways of production (Szalay and Dong Xuan, 2007). Based on the results of adaptation experiments, further development of breeding old Hungarian poultry in South-East Asia is a reality in the near future (Dong Xuan et al., 2007). This activity may also serve as additional conservation approach for some traditional Hungarian poultry breeds, as discussed in a different paper (Dong Xuan et al., 2008).

Conclusions

Conservation of local breeds (both plants and animals) through the development of different ecological type of production systems and products have real importance in maintaining agro-biodiversity and agro-ecosystems. In this process, local poultry breeds should play a significant role, even in the near future. First step in saving the breeds should be the proper execution of an official conservation program. On the other hand, additional, new approaches to conserving traditional, local breeds are needed for multifunctional use of poultry genetic resources, including: the maintenance of functional in situ gene banks, research including the assessment of production, education at different levels, elaboration of sustainable production methods and marketable products, development of family poultry, making use of the capabilities of fancy breeders, carrying out field studies and surveys of local breeds in marginal regions and reintroduction of the breeds to villages, seeking for demonstration and popularization potentials, and adaptation of breeds in diverse environments.

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PRODUCTION OF NON-TRADITIONAL ANIMAL IN VIETNAM RECENT STATUS, TREND AND SOME PROBLEMS

VO VAN SU

Head of Rare animal and biodiversity- National Institute of Animal Husbandry – Vietnam

Email: vovansu@hn.vnn.vn [Http://www.vcn.vnn.vn](http://www.vcn.vnn.vn); Tel: 04 757 2174, 0989 382 311

1. Introduction

Like in other Asian countries in Vietnam production of non traditional animals (NTA) is interested increasingly by many people. Why so, and what is happening and how we have to do to promote and monitor this process.

This report is attempted to answer this question.

2. Non-traditional animals are reared in Vietnam recently

A report from forestry department of Vietnam shows that, there is about 4000 locations raising 2000 NTA approved by CITES. Out of these 2 million animals there 7 types ...are , 40 are ..., 3 birds, 58 are mammals. 58 species are in "red book".

Recently some animals are "hot", such as domesticated wild hogs, porcupine, pheasants, wild chickens.

2.1 Porcupine

This type animal was domesticated first in 1999 by a farmer in South Vietnam. In 5 next years this man build a small herd with more 100 heads of porcupine. This herd had good reproduction, no much disease, easy feed and good benefit. In 2003, a short film was shown in Vietnam television. From this point a wave of porcupine breeding came. Price was 150 000 VND/kg in 2003 was increased up to 1000 000 – 2 000 000 VND/kg nowadays. Some animal was asked for 18 000 000 VND (> 1000 USD)!

Some features: feed cost 15-30 000 VND/month. BW gain: 1 kg/month/porcupine for breeding. Less disease. House is simple, floor and wall are made of cement to avoid animals to mine hole. Sell price: meat -> 200 000 – 300 000 VND/kg. Porcupine meat is lean, tasty. These are factors to make porcupine be hottest animal.

There are some 5000 families/ farmers rear this animal. Son la City is most famous city where there are some 200 families having porcupine and the first "Association of porcupine" was set up.



There some 10 farmers having porcupine head with more than 100 heads, such as Tuan Hoa porcupine farm (Ho Chi Minh City), Phu Nam porcupine farm (Ha tay), Wild animal farms of Cattle and Forage Research Center (NIAH)...

2.2 Domesticated wild pig (DWP)



Wild pig was domesticated since 2000 by a hunter in Binh phuoc. This hunter then do an upgrading crossbreeding between DWP and local pig breeds. His work was successful with pig benefit. In 2004 some man then imported from Thailand 500 DWP. Now in Vietnam there is some 20 000 DWP. Recently there are 5-6 big DWP farms, they are: Khanh gia Company Ltd (500 sows), NIAH – group (200 sows).

Price: 250 000 – 400 000 VND / kg.

Facan (*Pasianus colchicus*)

Facan is used for meat, pet and “traditional medicine” for sick, diarrhoea. This is available in many places in Vietnam. This gives first egg at 8 MOA, 60 eggs / once. Time between laying is 2 month.



Facan is breed in a family in Hanoi

This bird is first time domesticated by a monk. Recently at least 500 females are kept in 8 families. National Institute of Animal Husbandry started conservation and breeding program since 2004. Now the institute is carrying a small program for multiplication of this birds. This bird is expected to be multiplied well.

2.3 Wild chicken

Cuc phuong National park domesticated this wild bird since 2004. This herd has 400 birds.

2.4 Varan (*iguana*)



Some farmer also tried to rear Varan, one type of reptile, 10 kg of body weight, 2.5-3 m long. It is however incubate is not successful yet.

2.5 Gekko



This animal is used for “traditional medicine” for back-pain. First egg laying is at 12 month of age with body weight of 100-120 grams. One year one gekko can lay 6-7 times / year and give 5-7 egg / once. Its feed is insect. Price is 20 000 VND / gekko.

Gekko breeding was started since 1996. A biggest farm in South Vietnam. It has a gekko herd of 1000 gekkoes.

2.6 Scorpion (*Androctonus crassicauda*)

	
	Scorpion is a strange food
This insect is for “traditional medicine” and “food”. This men also rear lizard, bull-frog, salamander... and export them to America, France, Germany...	 Mr. Quang Huy is master of a Scorpion farm of 20 000 pieces.

3. Why more and more people select non-traditional animal for husbandry

There are three main reasons:

3.1 Loss in traditional farm animal production

At this point animal production is facing against to the following difficulties:

Foot-mouth, H5N1, Blue-ear diseases, which gave big trouble to farmers.

Feed price is increased as near 30% maize, soybean is imported from USA, Brasil..

Electricity shortage cause danger, death to animals housed and ventilated. (in 7/2008, 3000 pigs and 15 000 chicks died in “Co dong” animal production cooperation in Hatay province. The loss was 6 billion VND.

Hard fight against American and Brasil chicken, pork meat which is imported to Vietnam after WTO. These difficulties are really serious and long termed.

3.2 Eating habit of Vietnamese and asian people

Vietnamese as well Asian people like wild meat as it is considered “organic”, “clean”, “non-fat”, “Jungle taste” meat (1).



(Picture : Japanese were enjoining with porcupine meat in a Hanoi restaurant)

In fact requirement for wide meat, indigenous animal meat is increased continuously. We can observe this increase by increased number of restaurants where “Ri chicken – one famous small chicken - , or “Man pig” – one type pig bred by Man people. Price for Ri chicken meat is 70 000 -100 000 VND / kg (while one kg comb of chicken from America is 20 000 – 25 000 VND).

3.3 There many wide and indigenous animals available in Vietnam

Vietnam is known as one of the 6 countries that are richest wide animals and also rich in domestic animals (65 types). This big diversity in animals is thanks to diversity in nature, culture, economic system. For example number of ethnic community is 60 that is equal number of ethnic people in China.

3.4 Law and information

In developed countries accessing to any animal types, food types are strictly controlled by government. In Vietnam rules to monitor this activities are not seriously to followed. In many cases government have to “obey” citizen wish.

In many cases people are arbitrary to try domesticate wide animal – event animals in danger and dangerous like bear, tiger - in their home.

Second problem is that small animal are ignored by authorities. People are nearly free to access to these animals, such as snake, scorpions, Gekko gekko...

Third problem is rumor. People in many cases do business after rumor, non-official information only.

4. Production techniques

In a lost cases these wide / or indigenous animals are produced, bred in different ways, techniques made by farmers. That is why this domestication, production takes very long time. Porcupine domesticated was tried in 5 year by a farmer. Wild pigs were domesticated with small success after 3-4 year and nearly 95% animals in these experiment died.

Some misunderstandings:

Wild animals are too strong to prevent themselves against diseases so that need to keep hygiene.

Animals with different ages, type, generations are kept together in one house. In this condition inbreeding may occur, animals are not allowed to take care individually, so animals can not access enough feed.

Animals are fed with too poor nutrient feed because farmers think that wide animals need only some simple feeds only. But they do not know animals in jungle, forest can have more and wide feeds.

4.1 Industrial feed is abused

But in some cases farmers abuse industrial feed (premix, concentrate feed..) for wild animals. Of course industrial feed often supply enough nutrients for animals, but loss “attractiveness” for customers who believe in that raw feed is better and “more natural” for animal, especially in terms organic farming. It is fact that, animal get industrial feed and less exercised often give meat have more water, less tasty. It should be such feeding: at young age or parturition animal should get “industrial feed” and in adult age or before slaughtering animal should be fed with green fodder, tubes..

4.2 Mating system is not proper way

In many farms, one male are housed with more females for mating, so that we can't do not know mating partners and consequently selection cannot done properly.

4.3 Individual recording is ignored

In many cases farmer do not do recording, or does recording but not properly, consequently selection cannot done, inbreeding may occur.

4.4 Business follows “flea-market”

Business on wild animal production in Vietnam is facing to a lot problems. These are: without association between farmers, increase/ or decrease product price unreasonable, duplication. These led some business from good status to bad one, even fail completely

5. Wild animal production from government view

5.1 Governmental regulation, policy

Vietnam government allow to domesticate all wild animals (not in danger and allowed by CITES) and breed them for wide production. It is however in any cases people hurt this rules.

Scientist can't get money for research. They can and have to study on the animal when widely reared and might bring some trouble to environment, to people. That is why scientist can not give advice to farmers and farmers have to try by themselves and have “to pay” for their activation.



5.2 Wild animal product should be wild-organic product

In order to increase value of product from domesticated wild animal it is necessary to apply both criteria of organic production system and “wild system”. Wild system means that animals should be kept half indoor and half outdoor, and feed should be tubes, leaf, green fodder .

5.3 Set up some association and “seed farm”

Recently Vietnam in process to build association system. Very less association on business operates probably. Only two association on this field were established: Mong chicken association (Hanam) and Sonla porcupine association.

It should be establish a network, where a core is farm which is response for breeding and station farm operate only on commercial products.

6. Some conclusion, suggestion

Wild animal production in Vietnam became hot
This activation is not based on scientific principles and facing to many uncertain challenge.
Government should spend some amount to scientist do research work before allowing farmers do their business.

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RESEARCH ON SOME CHARACTERISTIC OF GROWTH, REPRODUCTIVE AND PRODUCTION ABILITY OF LOCAL HO CHICKEN IN BAC NINH PROVINCE

TRAN THI KIM ANH, LE THI THUY

National Institute of Animal Husbandry, Hanoi, Vietnam

Abstract

The study is carried out to collect informative data on physiology the phenotypic characters of Ho chicken as part of MARD project on Biotechnology “*Determine of genetic diversity of local chicken breeds*”. Applying different methods such as: Survey and distribute the questionnaires for interviewing, collect data, morphology description of the breeds and their productivity performance, where available. The result showed: Ho chicken have biggest stature of Vietnamese local chicken breeds with rose red crest and different colors. Most common color is brown, light yellow, blackish (cock) and brownish, light silver color (hen); Survival rate is average and increases through ages 70-85% at 0-20 weeks; 85-96% at 20-45 week old and 98-99% at laying period. Ho chicken is strong but slow growing. The body weight at 20 weeks age: 2146 g (cock) and 1886,4 g (hen) and at adult: 4200 g; 3600g respectively. Maturity age is the late compare with other local chicken breeds: first laying egg is at: 217 days (31 weeks age). The productivity of Ho chicken is about 52 – 60 eggs/hen/year However, the specific feature of this chicken is high adaptability, good ability of resistance diseases. Ho chicken is also being used in traditional ceremonies such as for ancestral worship by hilltribes.

Keywords: Ho chicken, conservation, characterization

Introduction

Livestock genetic resources in general and poultry in particular are valuable to agricultural development, economics and other social functions. During the last 20 years, thanks to agricultural development and cultural exchange, numerous commercial poultry breeds have been introduced to Vietnam. However, this particular development has brought certain negative results to local animal conservation programs. Therefore, many of the local poultry breeds are facing extinction or endangered. The Ho chicken breed is native to Ho region, which is nowadays Lac Tho village, Ho town, Thuan Thanh - Bac Ninh province. It is here where this Ho chicken breed was created, maintained and promoted through centuries. The creation and development of the Ho chicken breed are involved in

traditional customs and culture of the northern village, where Dong Ho pictures are made. The Ho chicken traditional pictures came into history and have been preserved up to now.

Since the Independence Year, because of policy and economic trends and the market's pressure, the breed hasn't been cared step by step, thus its development was held back. The Ho chicken breed resulted from natural selection through many generations, involved in local history and culture, is now risking extinction. Therefore, Viet Nam subsequently revitalized this chicken breed with of the animal genetic resources preservation programme in 1991. This paper we would like to present a part of Ho chicken conservation work. Re-evaluate the existence and development of the Ho chicken breed. Evaluate biological characteristics, production traits to set the basis for selection, pure breeding and preservation of this local chicken breed. The project result will support in-situ and ex-situ conservation.

Content and Method

Content

Research subject: Ho chicken breed
Location: hometown of Ho chicken breeds: Ho town, Thuan Thanh district, Bac Ninh province
Appearance characteristics of Ho chicken breed
Standards of mature chicken body size, reproductivity and egg shapes in semi-commercial conditions
Growth traits of Ho chicken breed in semi-commercial conditions
Reproductive traits, appearance standards of Ho chicken breed in semi-commercial conditions.

Method

Interview husbandry households in research locations, collect data and record results
Describe appearance traits based on direct observations and phototables
During investigation, randomly select samples from households
Standards researched: Current population of Ho chickens; Appearance characteristics: feather color, skin, leg, peak, etc. based on direct observation.
Growth and productive trait observation method
Growth and productive standards
Productive standards.

Result and Discussion

Appearance traits of Ho chickens

1 day old Ho chicken all have light yellow feather. Matured chickens' feather colors vary between and within breeds.

Typical appearance traits of Ho chicken breeds

Description	Ho chicken breed
Color	Cocks: plum, black Hens: white, brownish, brown with yellow.
Comb	cockscornb: similar flower bud, pear or chestnut
Leg color	The leg colour: light yellow
Shape	The body are big, the shank are very high and strong, round leg about 7-8 cm

	
Ho chicken Cock	Ho chicken Cock
	
Ho chickens hen	Ho chickens hen

Growth traits of Ho chickens

Survival rate of Ho chickens in semi-commercial conditions.

Survival rate of Ho chickens

Age (week)	Ho chicken	
	Number of chickens	Rate (%)
0 (birth)	76	100,00
1	76	100,00
2	74	97,37
3	72	97,30
4	71	98,61
5	70	98,59
6	69	98,57
7	69	100,00
8	69	100,00
9	69	100,00
10	68	98,55
11	68	100,00
12	67	98,53
13	65	97,01
14	62	95,38
15	62	100,00
16	61	98,39
17	58	95,08
18	58	100,00
19	58	100,00
20	58	100,00
Total		98,65

Survival rate of Ho chickens is relatively high, from 95.08-100% (with an average of 98.65%). According to author Nguyen Van Luu (2005), survival rate of Ho chicken of 0-12 weeks old is 92.28-100%. According to research by author Le Thi Nga (1999), survival rate of Dong Tao chickens of 0-6 weeks old is 95.33%. The result of this research is evidently higher than that of previous experiments.

Body weight

Ho chickens' body weights (0-20 weeks old)

Week	Male + Female							
	$\bar{X}$	$\pm$	$m_{\bar{X}}$	Cv%				
0	32.73	$\pm$	0.51	10.95				
1	53.50	$\pm$	0.87	11.54				
2	84.20	$\pm$	0.99	8.34				
3	129.40	$\pm$	1.74	9.52				
4	192.60	$\pm$	2.22	8.16				
5	285.10	$\pm$	4.36	10.80				
6	393.80	$\pm$	4.22	7.57				
7	508.00	$\pm$	6.41	8.92				
8	622.50	$\pm$	8.43	9.58				
9	751.60	$\pm$	7.88	7.42				
	Female				Male			
	$\bar{X}$	$\pm$	$m_{\bar{X}}$	Cv%	$\bar{X}$	$\pm$	$m_{\bar{X}}$	Cv%
10	871.60	$\pm$	9.86	5.66	934.80	$\pm$	7.76	4.15
11	1015.20	$\pm$	11.13	5.48	1079.60	$\pm$	12.76	5.91
12	1149.60	$\pm$	13.60	5.92	1245.60	$\pm$	12.11	4.86
13	1257.60	$\pm$	6.62	2.63	1416.80	$\pm$	8.45	2.98
14	1377.60	$\pm$	9.77	3.55	1552.40	$\pm$	10.49	3.38
15	1485.60	$\pm$	9.49	3.19	1682.00	$\pm$	9.70	2.88
16	1577.80	$\pm$	12.96	4.11	1794.80	$\pm$	13.69	3.81
17	1664.00	$\pm$	8.76	2.63	1899.60	$\pm$	16.73	4.40
18	1747.60	$\pm$	12.85	3.68	1990.00	$\pm$	17.32	4.35
19	1818.00	$\pm$	10.74	2.95	2069.20	$\pm$	21.30	5.15
20	1886.40	$\pm$	14.18	3.76	2146.00	$\pm$	36.88	8.59

According to the table, body weight of Ho chickens at birth is 32.73g, lower than the result of author Nguyen Van Luu's observation (2005) of 35.10g.

At 10 weeks old, body weights of cocks and hens are 934.80g and 871.60g respectively. At 20 weeks old, body weights increase to 2146.00g and 1886.40g respectively. These results are higher than those of our research in 2001 of 1994.6g and 1502.2g respectively. Therefore, the selection and pure breeding process has paid off.

Food consumption from 0 to 20 weeks old of Ho chicken flocks

Food consumption per kg body weight gain

Age (weeks)	Breed	Ho chickens	
		Food consumption (g/head/day)	Food/ kg weight gain
1		2,64	1,26
2		13,36	3,15
3		14,68	3,04
4		24,18	4,20
5		27,45	3,35
6		33,56	3,15
7		35,73	3,01
8		40,7	3,28
9		52,65	3,50
10		62,69	3,47
11		66,18	3,65

12	73,53	3,81
13	80,1	4,46
14	87,56	4,37
15	90,9	4,24
16	92,3	4,61
17	95,4	4,58
18	98,5	4,42
19	98,7	4,65
20	101,6	4,21
TB	59,63	3,72

Table shows the food consumption and per kg weight gain.

Food consumption of Ho chickens does not increase proportionally to age. The reason might be the limited number of samples; diseases such as Coccidiosis, Infections Brusel Disease and their treatment might also have reduced food consumption.

The food consumption of Ho chickens is 3.782kg.

The results we collected are higher than other authors. Author Nguyen Van Luu (2005) concluded that food consumption up till 16 weeks is 3.23kg. In an observation of Dong Tao chickens, author Bui Duc Lung (1998) found out that their food consumption up till 20 weeks is 6.04kg. Author Tran Cong Xuan's observation shows that Tam Hoang 882 chickens consume 3.29kg. Author Le Hong Man's observation shows that food consumption of commercial chickens is under 2kg.

Therefore, food consumptions of local chicken breeds are always higher than commercial ones.

Reproductive traits, egg shape standards and hatching ratio of Ho chickens

Reproductive traits

Ho chickens' laying ratio varies irregularly independently from time periods. It increases and decreases difference.

The first egg laying age is 217 days.

Each year, Ho chickens breed four brood, and about 13-15 eggs/brood. Consequently, the productivity of Ho chicken is about 52 – 60 eggs/hen/year. We do not carry out observing the productivity rate of Ho chicken because Ho chicken has an irregular egg production cycle, so observing the productivity rate.

But according to an earlier research by author Le Thi Thuy, the first egg laying age is 258 days, while Nguyen Van Luu's research shows 248 days. It can be inferred that raising Ho chickens with supplementary food shortens the time till maturing and first egg laying age.

Egg shape standards and hatching ratio of Ho chickens

Egg shape standards

Standards	Ho chickens			
	$\bar{X}$	$\pm$	$m_{\bar{X}}$	Cv%
Weight (g)	52,99	$\pm$	0,66	8,67
Length (cm)	52,67	$\pm$	0,26	3,42
Width (cm)	41,31	$\pm$	0,22	3,66
Shape index	1,28	$\pm$	0,01	4,77

Table shows that Ho chickens' egg weigh 52.99g, approximately the same as Nguyen Dang Luu's (2005) of 53.47g.

The shape index of Ho chickens' egg is 1.28. approximately the same as that of local chickens such as Ac's of 1.3 (Tran Thi Mai Phuong, 2004).

Hatching standards of Ho chickens

Standards	Ho chickens	
	Number (piece)	Percentage of total eggs (%)
Number of eggs attempting hatching	253	100
Number of eggs fertilized	180	71,15
Number of eggs hatched	136	53,75
Number of first-class hatched chickens	129	50,99

Table shows that 71.15% of eggs are fertilized, 53.75% hatch and 50.99% hatch into first-class chickens.

While Le Thi Thuy's research: 80,83% of eggs are fertilized; 74,30% hatch.

The reason: Ho chickens' large body weight, sluggishness in mating, their reproductive ability is generally low.

Conclusion and Suggestion

Conclusion

There are currently about 572 chickens in Ho town, Thuan Thanh district, Bac Ninh province.

Ho cocks have 2 major colors: black and plum large body build: tall and long and adult body weight of 3.5-4kg. Hens have a larger variety of colors white, brownish, brown with yellow, relatively large body build and adult body weight of 3 – 3.5kg.

Survival rate after 20 weeks is 98.56%; Body weight at birth is 32.73g; Body weights at 20 weeks of cocks and hens are 2146.00g and 1886.40g respectively; Food consumption is 3.82kg; Maturing age is 217 days; the productivity of Ho chicken is about 52 – 60 eggs/hen/year

Beside keeping pure flock, should increase the productivity to meet the market demand by crossing schem. The question has to be answered in how far the development of Ho chicken is compatible with the utilisation of Ho genetic resources.

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STUDY ON SELECTION FOR IMPROVEMENT OF THREE GUINEA FOWL LINES AFTER THREE GENERATIONS

**PHUNG DUC TIEN, NGUYEN THI KIM OANH, PHAM THI MINH THU,
HOANG VAN LOC, TRUONG THUY HUONG**

Contact: Phung Duc Tien, POREC-NIAH

Tel: 84-4-8385622; Fax: 84-4-8385804; E-mail: pkhtnecgctp@vnn.vn

Abstract

In April, 2002, the Thuy Phuong Poultry Research Center imported the 03 Guinea fowl lines from KATKI - Hungary. After 02 years of study, all have developed well. The 03 lines are highly disease - resistant by the high survivability of 97-99.1% through the three stages and of 98.3 - 100% at the laying stage. At 59 weeks of age, the Large has the highest egg production of 94.18, the Middle 90.74 and the Small 84.52 eggs/hen. The fertility of the Middle is the highest of 96.03%, that of the Middle 89.17% and the Large 80.14%. The hatchability of the Middle is 79.12%, that of the Small 73.19% and

the Large 71.12%. For commercial birds at 1-12 weeks old, the body weight of the Large gains 1,880; that of the Middle 1,380 and the Small 1,369.3 g/bird. The carcass of the 03 lines is 76.56 - 77.10%, of which the leg and breast make up 51.13 - 51.7%. The survivability of the 03 lines maintains 95 - 96.67% with the feed consumption/kg of weight gain of 2.81 kg for the Small, 2.77 kg for the Middle and 2.34 kg for the Large.

Introduction

The Thuy Phuong Poultry Research Center (POREC) imported the 03 Guinea fowl lines of the Large, Middle and Small in April, 2002. These are specialties in the world with high-quality meat and delicious eggs. The egg production/hen/cycle 1 is 85-98 eggs with the feed consumption/10 breeding eggs of 1.9-2.5 kg. At 12 weeks of age (wks), broilers are 1,300-1,800 g/bird in weight with the feed consumption/kg of weight gain of 2.34-2.53 kg.

To conserve and improve the production of this gene as well as to ensure the supply of chicks, the research is carried out.

Materials and Method

The research was done at POREC from August, 2004 to June, 2006.

The experiment is designed with the protein of 18-22% and ME of 2,750-2,950 kcal/kg of feed at 0-6 wks; 15-27% and 2,700-2,765 kcal/kg of feed at 7-27 wks; and 17.5% and 2,750 kcal/kg of feed at the laying stage, respectively for layers. The protein of 22% and ME of 3,000 kcal/kg of feed at 0-4 wks; 20% and 3,100 kcal/kg of feed at 5-8 wks; and 18% and 3,200 kcal/kg of feed from 8 wks to slaughter are used respectively for broilers. Data was processed by Excel.

Results

Layer stock

Phenotype

Head: Short and wide; *Beak*: Short, strong, strongly curved, horn-coloured and red at the end; *Comb*: Helmet-like, horny, red, triangular; *Face*: Bluish-white, unfeathered; *Ear-lob*: Fit to the face; *Eye*: Large, dark brown; *Wattle*: Short, thick, red, with a white spot in the middle; *Neck*: Almost totally unfeathered under the head, with dark-bluish skin on males (lighter coloured on females). Thin, erected when the bird is disturbed. The lower part of the neck is well-feathered; the upper part is naked, covered with fine hair; *Trunk*: Strong. The breast is large, round-shape and full. The back is wide, strongly dome-like and inclines backward; *Wing*: Long, wide, fit to the body; *Tail*: Short, points downwards. Feathers are longer inside (in the middle) than outside; *Shank and toes*: Short, shank colour is reddish, males have no heel; *Plumage*: Fit to the body.

Survival at the chick, growth, prelaying and laying stages.

Table 1. Survival at the chick, growth, prelaying and laying stages

Gene- ration	0-6 wks		7-27 wks		>27 wks	
	Start of cycle (bird)	% produ- ction	Start of cycle (bird)	% produ- ction	Start of cycle (bird)	% produ- ction
Small						
1	700	97.0	659	98.5	118	98.3
2	345	98.1	321	99.7	152	100
3	387	98.7	819	99.2	291	99.6
Middle						
1	900	98.1	870	99.1	210	95.5
2	548	98.1	525	99.8	164	100
3	857	98.2	821	98.7	431	99.5
Large						
1	400	98.0	384	98.4	95	100
2	237	98.7	214	100	64	100
3	534	98.5	521	98.3	253	99.6

After 03 generations, the survival is 97-98.7% at the chick, 98.3-100% at the growth and 95.5-100% at the laying. This proves their high adaptability in Vietnam's environment.

Bodyweight: At the end of week 06, the Small is 603.2-612.0g, the Middle 629.9-653.0g and the Large 905.8-949 g in weight. At 27 wks, the Small is 1725.2-1870.0g, the Middle 1791.5-1936.7g and the Large 1987.7-2289.7 g in weight.

Feed consumption: The feed consumption during 0-27 wks is 11.2 kg for the Small, 11.06 kg for the Middle and 11.77 kg for the Large.

5% and 50% egg production: The Small takes 215 days to reach 5% production and 243 days to reach 50% production, the Middle 221 and 240 days and the Large 207 and 231 days, respectively. This means that the Large takes less time to reach the different egg production age.

Egg weight at 5%, 50% production and 38 wks (g): This parameter is 38.2, 42.6 and 44.1g respectively for the Small; 38.6, 43.3 and 45.0g for the Middle; and 41.1, 44.4 and 48.0g for the Large. This weight meets the requirements of breeding eggs. The setting rate is 98%.

Hen weight at 5%, 50% production and 38 wks (g): The bodyweight increases at different ages. At 38 wks, the Small is 2161.3-2183.7g; the Middle 2204.4-2233.3 g and the Large 2420.4-2584.7g.

Laying rate, egg production and feed consumption/10 eggs

Table 2. Laying rate, egg production and feed consumption/10 eggs of the Small

Wks	Generation I		Generation II		Generation III	
	% prod	Male/ Female	% prod	Male/ Female	% prod	Male/ Female
1 - 4	4.05	1.13	29.57	8.28	50.19	16.16
5 – 8	13.75	3.85	85.96	24.07	76.50	20.9
9 – 12	46.25	12.95	69.32	19.41	59.82	16.75
13–16	54.54	15.27	73.04	20.45		
17- 20	57.50	16.10	68.46	19.17		
21-24	60.11	16.83	25.07	7.02		
Total	66.13		98.4			
Average laying rate %	39.36		58.57			
Feed consum/ 10 eggs	2.59		1.76			

Generation 2 results in an increase of 19.21% over generation 1 in terms of the average laying rate, an increase of 32.27 eggs in terms of the egg production/1 cycle and a decrease of .83 kg in terms of the feed consumption/10 breeding eggs.

Table 3. Laying rate, egg production and feed consumption/10 eggs of the Middle

Wks	Generation I		Generation II		Generation III	
	% prod	Male/ Female	% prod	Male/ Female	% prod	Male/ Female
1 - 4	2.25	0.63	16.04	4.49	46.39	12.99
5 – 8	7.72	2.16	72.4	20.33	69.21	19.38
9 – 12	57.32	16.05	65.32	19.24	57.79	16.18
13–16	63.57	17.80	63.50	18.29		
17- 20	55.54	15.55	47.26	16.88		
21-24	55.36	15.50	23.11	6.47		
Total	68.85		85.7			
Average laying rate %	40.98		51.01			
Feed consum/ 10 eggs	2.36		2.18			

Generation 2 results in an increase of 10.03% over generation 1 in terms of the average laying rate, an increase of 16.85 eggs in terms of the egg production/1 cycle and a decrease of .18 kg in terms of the feed consumption/10 breeding eggs.

Table 4. Laying rate, egg production and feed consumption/10 eggs of the Large

Wks	Generation I		Generation II		Generation III	
	% prod	Male/ Female	% prod	Male/ Female	% prod	Male/ Female
1 - 4	12.75	3.57	29.57	8.28	68.68	19.23
5 – 8	28.71	8.04	81.82	22.91	67.71	18.96
9 – 12	52.18	14.61	70.29	19.68	68.64	19.22
13–16	54.64	15.30	68.82	19.27		
17- 20	49.11	13.75	61.71	17.28		
21-24	59.11	16.55	9.75	2.73		
Total	76.46		90.15			
Average laying rate %	45.51		53.60			

Feed consum/10 eggs	2.26	1.99	
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Generation 2 results in an increase of 8.09% over generation 1 in terms of the average laying rate, an increase of 13.69 eggs in terms of the egg production/1 cycle and a decrease of .27 kg in terms of the feed consumption/10 breeding eggs.

Egg quality examination

Table 4. Egg quality examination (30 wks)

Parameter	Small (n=30)		Middle (n=30)		Large (n=30)	
	$\bar{X} \pm m_x$	CV%	$\bar{X} \pm m_x$	CV%	$\bar{X} \pm m_x$	CV%
Egg weight (g)	44.58± 0.417	5.12	45.43± 0.483	5.82	46.79± 0.519	6.07
Length/Width	1.28± 0.0087	3.72	1.28± 0.0083	3.47	1.30± 0.0075	3.15
Shell thickness (mm)	0.521± 0.0088	9.21	0.518± 0.0077	8.15	0.512± 0.0087	9.36
Force resistance (kg/cm ²)	>5		>5		>5	
Shell ratio (%)	17.99± 0.280	9.14	17.96± 0.296	9.03	16.93± 0.252	8.15
Yolk ratio (%)	31.47± 0.403	7.25	31.90± 0.488	8.38	31.86± 0.346	6.14
White ratio (%)	50.54± 0.408	4.25	50.15± 0.718	7.84	51.21± 0.309	3.24
Haugh	82.15± 0.959	6.24	82.40± 0.071	4.41	82.55± 0.899	5.76
Yolk color	8.54		8.86		8.78	

Guinea fowl eggs are small in weight with a round large end and a sharp small end. The shell is very thick (0.512-0.521 mm). The force resistance is >5 kg/cm². The Haugh is 82.15-82.55, proving themselves to be of high quality.

Hatchability

The Small has the fertility of 89.17-94.8% and the Middle 92.6-96.03%. The Large used to be inseminated but the fertility now is 80.14% in generation 1, 91% in generation 2 and 93% in generation 3. The hatchability/total eggs increases 6.35-15.03%. This is a great advance in Guinea fowl breeding.

Table 6. Hatchability

Gene- ration	Small			Middle			Large		
	Totaleg gs (egg)	Fertilit y (%)	Hatcha bility/tot al eggs (%)	Totale ggs (egg)	Fertility (%)	Hatcha bility/tot al eggs (%)	Totale ggs (egg)	Fertility (%)	Hatcha bility/tot al eggs (%)
I	1117	89.17	73.14	1887	96.03	79.12	841	80.14	71.12
II	1779	94.8	83.0	2057	92.6	81.3	1875	91.0	79.8
III	1752	94.2	87.04	866	93.3	85.45	650	93.0	86.15

Broiler stock

Meat yield, feed consumption and cost/kg of weight gain, survival of the three lines (1-12 wks)

Table 7. Meat yield, feed consumption and cost/kg of weight gain, survival of the three lines (1-12 wks)

Parameter	Small	Middle	Large
Live weight (g)	1415.10	1420.24	1891.17
Bodyweight (g)	1104.4	1087.4	1455.3
Carcass (%)	76.16	76.57	76.95
Thigh (%)	24.47	25.09	25.49
Breast (%)	26.03	26.86	27.35
Thigh+Breast (%)	50.50	51.95	52.85
Abdomen fat (%)	0.57	0.78	1.06
Feed consumption/kg wg (kg)	2.53	2.52	2.34
Feed cost/kg wg (VND)	12,093.4	12,045.6	11,185.2
Survival (%)	96.6	98.3	98.3

The bodyweight at 12 wks is 1415.10 g for the Small, 1420.24g for the Middle and 1891.17g for the Large. The feed consumption/kg of weight gain is 2.34-2.54 kg. The carcass is 76.16% for the Small, 76.57% for the Middle and 76.95% for the Large. The thigh and breast of the three lines averages 50.50-52.85%. The abdomen fat is low (the Small: 0.57%, the Middle: 0.78%, the Large: 1.06%).

Chemical composition

Table 8. Chemical composition

N ^o	Parameters	Unit	Thigh	Breast
1	Dry matters	%	24.62	27.06
2	Crude protein	%	21.16	24.32
3	Crude fat	%	1.02	0.43
4	Crude minerals	%	1.28	1.32
5	Amino acids			
	Aspartic	%		1.867
	Glutamic	%		3.438
	Methionine	%		0.457
	Lysine	%		2.062

The protein level in thigh is very high, making 21.16% in thigh and 24.32% in breast averaging 22.74%. The crude fat in thigh is 1.02%, 0.43% in breast averaging 0.73%. The mineral is 1.28% in thigh, 1.32% in breast averaging 1.30%. All amino acids are very high, especially Aspartic (1.867%) and Glutamic (3.438%) which are used to evaluate the juiciness of the meat. This proves their high quality and thus Guinea fowls are considered a speciality in Vietnam with the price 1.5-2 times of others.

Household production

With their beautiful phenotype, high adaptability, high disease resistance, more than 30,000 day-old chicks have been sold out every year Hanoi, Yenbai, Namdinh, Socson, Vinhphuc, Thanhhoa, Yenbai provinces. The results are as follows:

Table 9. Household production

Parameters	Namdinh	Thainguyen	Thanhhoa
Start of cycle (bird)	750	1000	500
Survival (%)	100	96.7	98.6
Breed cost (VND)	9,000,000	12,000,000	6,000,000
Other costs (VND)	2,686,000	3,568,000	1,684,000
Feed cost (VND)	11,402,500	19,533,400	10,178,700
Total cost (VND)	23,088,500	33,101,400	16,962,700
Feed consumption/kg P (kg)	2.52	2.53	2.58
12 wks bodyweight (g)	1608.8	1598.6	1600.5
Total weight at end of cycle (kg)	1206.6	1545.8	789.0
Total returns (VND)	42,231,000	54,103,000	27,615,000
Difference (VND)	19,142,500	20,999,600	10,652,300
Average profit/bird (VND)	25,523	21,001	22,627

At the end of 12 wks, the average bodyweight is 1598.6-1608.8 g with the feed consumption/kg of weight gain of 2.52-2.58 kg. The profit averages 20,001-25,522 VND. This result is similar to the result of broilers raised at POREC. This means that the three lines adapt with eco-zones, grow and develop well.

Table 10. Layers at households

Parameters	Namdinh	Thainguyen	Thanhhoa
Start of cycle (bird)	1500	1000	1500
Chick (0-6 wks)			
Survival (%)	98.0	96.7	97.2
Feed consumption/kg P (kg)	1.04	1.09	1.10
Bodyweight (g)	652.3	681.7	675.8
Growth (7-27 wks)			
Survival (%)	96.3	95.7	97.0
Feed consumption/kg P (kg)	9.78	9.82	9.93
Bodyweight (g)	1798.7	1802.5	1821.4
Layer (>27 wks)			
Start of cycle (bird)	650+162	430+107	642+160
Survival (%)	95.6	95.3	96.2
Egg production/hen/cycle (egg)	95.3	90.2	89.2
Feed consumption/kg P (kg)	2.24	2.12	2.18
Fertility (%)	92.4	93.1	91.2
Hatchability/total eggs (egg)	82.6	84.2	80.8

Guinea fowl layers in such localities representing the delta and Northern mountainous areas as Thanhhoa, Socson and Thainguuyen show that they have high disease resistance; survival of 96.7-98% at the chick, of 95.7-97% at the growth and pre-laying, and of 95.3-96.2% at the laying. The egg production is 89.2-95.3 eggs/hen with the fertility of 91.2-93.1% and hatchability of 80.8-84.2% (similar to those of POREC). From these flocks, some households can themselves produce broilers to sell to neighboring areas.

Table 11. Layer profitability

<i>Parameters</i>	Namdinh	Thainguuyen	Thanhhoa
Cost (VND)			
Breed cost	18,000,000	12,000,000	18,000,000
Feed cost	133,080,000	82,375,730	131,628,970
Veterinary cost	1,050,000	700,000	1,650,000
Power cost	1,500,000	1,000,000	1,500,000
Total	153,630,000	102,375,730	152,178,970
Returns (VND)			
Discarded males	41,008,500	27,054,000	42,579,000
Table eggs	4,022,200	3,684,700	3,721,900
Day-old chick	237,930	155,125,000	219,790,000
Discarded layers	69,513,690	46,048,820	69,509,340
Total	352,474,600	231,912,520	335,600,240
Difference	198,844,600	129,536,790	183,421,270
Profit/100 day-old chicks (VND)	13,256,307	12,953,679	12,228,085
Average profit/month (VND)	697,700	681,773	643,583

With the above parameters, we have calculated and stated that 100 day-old chicks result in the profit of 643,583-697,700 VND.

Conclusions

* *Layer stock*

The three lines are stable in phenotype and feather color. The survival is high, 97-98.7% at the chick, 98.3-100% at the growth and 95.5-100% at the laying.

The egg production of the later generations is always higher than the earlier ones. In generation 2, the Small has 32.27 eggs more than generation 1 in terms of the egg production/hen, the Middle 16.85 and the Large 13.69.

The hatchability increases through generations. The Large has the most remarkable increase of fertility and hatchability. The fertility of generation 3 is 12.86% higher than generation 1 and 2% higher than generation 2. The hatchability/total eggs increases 15.03% in comparison with generation 1 and 6.35% in comparison with generation 2. The egg quality is high.

* *Broiler stock*

At the end of 12 wks, the Small has the bodyweight of 1415.1g, the Middle 1420.24 g and the Large 1891.17 g. The feed consumption/kg of weight gain is 2.53 kg for the Small, 2.52 kg for the Middle and 2.34 kg for the Large. The survival is 96.6-98.3%.

The protein level is 21.16% in thigh, 24.32% in breast. The crude fat is 0.43-1.02%. Thigh and breast make 50.50-52.85% of carcass.

* *Guinea fowl stock at household production*

Broilers at 12 wks have the bodyweight of 1598.6 -1608.8 g. The feed consumption/kg of weight gain is 2.52-2.58 kg. The profit/day-old chick is 21,001-25,523 VND.

The profit/100 day-old layer chicks is 643,583-697,700 VND.

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CONSERVATION AND DEVELOPMENT GENE SOURCE OF H'MONG CHICKEN

PHAM CONG THIEU¹, HOANG VAN TIEU², VO VAN SU², HO LAM SON¹,
VU NGOC SON¹, TRAN KIM NHAN¹

¹Animal Experiment and Conservation Center

²National Institute of Animal Husbandry (NIAH)

Abstract

Conservation and development gene source of h'mong chicken

H'mong chickens are a local special of H'mong ethnic minority people. H'mong chickens have black skin, meat, bones. They are selected, conserved and developed gene source raised in National Institute of Animal Husbandry in order to conserved their genetic resource as well as bio-character and to production ability and adaption to new environment.

The result showed that: H'mong chickens have average stature, various colored quickly grown feather. Survival rate in period was high 91 -99,4%. Eggs reproduction was low 84,3-92,5 eggs/laying/60weeks. Embryo rate 97,8%. Hatched rate/Incubated egg total 87,9%. Broiler's body weight was 1052,9g at 12 weeks old, matter intake/body weight again kg was 3,76kg.

Introduction

Viet Nam have special chickens: Ri, Mia, Ho, Dong Tao chicken in the Northern part delta. Ac, Tau Vang chicken in the Mekong River Delta and the East South Viet Nam. Te, Tre, Van Phu chicken in the mainland Northern. H'mong, Oke chicken in the mountainous regions of Northern Viet Nam representative. They were valuable gene source animal and each have bio-character and genetic was difference. However as several native poultry breeds, they are reared concentrately with other poultry breeds lead to this breed is hybridized, narrowed their scale and structure of heard. Before pressure of supermarket and many high productive animals, this breed can be degenerated and extinct. Due to the aid of expenses from National gene conservation program this bird breeds was collected from H'mong ethnic minority people, selected, conserved and developed in experimental breeding at National Institute of Animal Husbandry (NIAH) from 2001 to now more 6 year. H'mong chicken was valuable animal, black skin, meat, bones (beside Ac, Oke chicken were in this group). Breeding and development H'mong chicken in NIAH with purposes:

Conservation of gene source as bio-diversified

Research adaption of H'mong chicken to new environment and work out measure raising their productivity and developing into production

Object, content and research method

2.1. Place, time

Research was conducted at Animal Experiment and Conservation Center – NIAH from 2002 - July 2008

2.2. Object

H'mong chicken has been collected from several mountainous village of H'mong ethnic minority people in Son La province in order to raise concentrately in NIAH since 2002.

2.3. Research content

- Conservation, breeding of H'mong chickens by method of transposing and selection, multiplication, widen population
- Research some bio-characters and their adaption (anti-disease, reproductive abilities) breeding to new environment.

2.4. Method of research

- Multiplication, regenerate in order to breeding conservation
- External appearance was performed by method of analysis and synthesize
- Breeding care

Breeding, care regimen			
Target	0-9 weeks	10-20 weeks	> 20 weeks
Care regimen			
Density (bird/m ²)	15-20	6-10	4-5
male/female rate	Concentred	Separate	1/8
Breeding regimen	Liberty	Limit	Accorrding to laying rate
Illumination power (h/day)	23	Nature light	16
Nutrition regimen			
Energy (Kcal/kg)	2850	2750	2700
Crude protein CP (%)	20	15	17

- Research pheotype production: body weight, reproduction by measure, collected data
- Collected data was analized by computer with softwares: Excell and Minitable.

Result and discussion

3.1. External appearance

Adult H'mong chickens (133 days) indicated that feather and skin colors of chicks were very diversified. The percentage of male with striped was 50%, brown-red feather was 34,6%, yellow-red 15,4%. The percentage of female black striped, yellow striped and light black was 17,4-34%, other part from white and black was 8,7%

Table 1: Feather color adult H'mong chicken

Colour feather	Male		Female	
	N ^o .birds	(%)	N ^o .birds	(%)
Black + dark red	45	34,62	-	-
Yollow + purple	20	15,38	-	-
Black, red, yellow striped	65	50,00	-	-
Black-brown striped	-	-	28	17,39
Yellow-brown striped	-	-	50	31,05
Light-black	-	-	55	34,16
White	-	-	14	8,7
Black	-	-	14	8,7

The percentage of chicken with black light dark, back meat was 75-80%, white skin, meat was 20-25%. By selecting through 6 generarions, we builitd H'mong chicken black skin was 90%, with adult male had manily brown-black striped, and adult female had mainly brown-black striped, black-white striped, light black. Chicken had average stature, black or dark purple straight flag, black crest, black skin leg and many feather leg.

3.2. Survived rate

According to the data at table 2, showed that H'mong chicken's survived rate was high in period except 1st generation (88-91%). This reflects the chicken was adjusted to condition of collected breeding on the Northern part delta.

Table 2: H'mong chicken survived rate (%) from period to period

Period	1 st generation	2 nd generation	3 th generation	4 th generation	6 th generation
1-6 th weeks old	88,1	97,0	97,6	96,5	97,1
7-19 th weeks old	91,1	99,6	99,5	98,8	98,9
20-45 th weeks old	92,0	95,6	96,8	96,5	95,5

3.3. Growth ability and feed consumption

Table 3. Body weight and feed consumption 0-20 weeks

Target	1 st generation (2002) n= 220	2 nd generation (2003) n= 690	3 th generation (2004) n= 990	4 th generation (2007) n= 1500
1. Body weight (g)				
6 weeks (male+female)	390,0± 12,6	405,6 ±15,1	410,0 ±12,3	427,7± 8,1
9 weeks male	591,8± 14,7	785,0 ±26,0	870,0 ±20,1	910,6 ±8,8
9 weeks female	468,6 ±10,8	685,1 ±17,6	706,3 ±15,5	710,5 ±16,6
20 weeks male	1232,5± 28,2	1423,2 ±31,4	1392,0 ±24,6	1713,9 ±27,0
20 weeks female	1075,9 ±23,2	1214,3 ±29,3	1191,1± 18,3	1256,2 ±18,3
2. consumption (kg)				
0-9 weeks	8,23	7,68	7,69	8,50
10-20 weeks	2,11	1,92	1,87	2,60
	6,12	5,76	5,72	5,90

H'mong chicken body weight in raised process selected increase male body weight. 1st generation (2002) male 1232,5g to 6th generation (2007) male 1712,9 g, increase 39%. Female body weight stable 1191,1-1256,2g, except 1st generation was low 1075,9g. Feed consumption 0-20 weeks generations fluctuate 7,68-8,5 kg

3.4. H'mong sexual mature old

H'mong chicken sexual mature old was early, first egg laying old was not significantly different from 6th generation from 133-141 days, 5% achieve laying old was 152 days, 30% achieve laying old was 172 days, peak laying old was 200 days.

Table 4: Laying old of H'mong chicken

Target	Laying old (days)
First egg laying old	140
5% achieve laying old	152
30% achieve laying old	172
Peak laying old	200

3.5. Laying rate, egg production and target incubated

Table 5. Result reproduction of H'mong chicken

Target	1 st generation	2 nd generation	3 th generation	4 th generation
1. Number female (birds)	100	300	476	500
2. Average egg rate to 40 weeks (%)	23,6	26,6	27,4	33,0
3. Egg reproduction/female to 40 laying weeks (eggs)	66,21	74,6	76,8	92,5
4. Average feed consumption/10 eggs	4,41	3,99	3,84	3,52
5. Egg weight at 38 weeks (g)	40,0	40,5	42,0	42,5
6. Egg seed rate (%)	84,24	92,5	94,2	94,3
7. Embryo rate (%)	88,11	90,4	95,7	97,8
8. Hatched/incubated eggs (%)	57,0	79,3	78,9	87,9
9. Black chicken rate/ total hatched chicken	50,1	73,6	74,5	81,9

Reproduction ability of H'mong chicken from years to years in raise conservation condition, chicken adapt to new environment, combined with care, selection so target about eggs reproduction/female, hatched rate was improved from generation to generation.

3.6. Growth and feed consumption of H'mong chicken meat reared

3.6.1. Growth ability

Table 6. Result meat reared of H'mong chicken to 12 weeks

Target	2002 (n=120)	2003 (n=300)	2004 (n=150)	2007 (n=300)
Survived rate (%)	88,3	93,4	97,3	97,5
Average body weight (male+female) (g/birds)	933,0 ±16,5	1175,0 ±22,6	1138,0 ±18,1	1225,6 ±25,5
Matter intake/body weight gain (kg)	3,26	2,95	2,90	3,01

H'mong chicken meat reared to 12 weeks, 2002 average body weight 933,0g, 2003: 1175,0g, 2004: 1138,0g, 2007: 1225,6g with feed consumption/kg gain weight 2,9-3,26kg. Survived rate was high from 88,3% (2002) to 97,8% (2007)

3.6.2. Meat ability

Table 7. Meat ability of H'mong chicken to 10 weeks

Target	Male (n=20)	female (n=20)
Live body weight (g)	1280 ±25,1	1100 ±19,2
Dressing carcass(g)	1000 ±20,2	830 ±17,1
% rate in comparison with live body weight	78	76
Leg carcass (g)	350± 8,8	270 ±7,2
% rate in comparison with dressing carcass	35	33
Breast carcass (g)	250 ±6,1	195± 7,6
% rate in comparison with dressing carcass	25	23
Influential carcass (g)	400 ±10,1	365± 9,3
% rate in comparison with dressing carcass	40	43,9

H'mong chicken had dressing rate equivalent chicken others 76,0-78,0%, leg rate 34-36%, breast rate was low 23-25%

3.7. The special feature of H'mong chicken

3.7.1. Meat quality

H'mong chicken had black bone, meat, viscera. Viet Nam have Ac chicken, China have Tay Hoa black bone, meat, too. But Ac small chicken, body weight 0,6-0,8 kg/bird, Tay Hoa chicken 3,1-3,6kg/bird. These have white feather, fishy meat by a lot of iron and often stewed with Chinese traditional medicine to help recover one's health, H'mong processed many food. Ethnic minority people used viscera as bile, bone to cure asthma, swell.

3.7.2. Target chemical of H'mong

Meat H'mong chicken had high Glutamic 3,49 so sweet meat, not greasy by meat was little fat 0,38%, meanwhile meat others had high fat 0,97-1,5%

Table 8. Target chemical and axit amin chicken (n=2)

Order	Composition	Ac chicken	H'mong chicken	Moutain chicken, white meat	Ri chicken	Industry chicken
Target chemical (%)						
1	Water	74,68	74,23	75,83	73,20	76,20
2	Fat	1,35	0,38	0,55	1,50	0,97
3	Total mineral	1,09	1,27	1,27	1,37	1,14
4	Protein	22,4	22,04	21,81	21,45	21,22
Axit amin (%)						
1	Glutamic	3,175	3,487	2,943	2,784	
2	Histidin	0,628	0,970	0,419	0,853	
3	Glycine	0,901	0,875	0,759	0,819	
4	Threomine	1,116	1,038	0,862	1,006	
5	Tyrosine	0,727	1,514	1,546	0,664	
6	Valine	1,145	0,555	0,455	1,007	
7	Metionine	0,521	1,504	1,145	0,452	
8	Phenylalanine	0,914	0,683	0,400	0,842	
9	Isoleusine	1,039	0,769	0,665	0,949	
10	Leusine	1,732	0,769	0,665	1,557	
11	Lysine	2,072	1,369	1,154	1,903	
12	Prolin	1,129	1,315	1,070	0,984	
13	Agrinine	1,445	2,685	2,187	1,261	
14	Iron	7,9	-	-	3,9	

3.7.3. The food processed from meat H'mong chicken

Meat H'mong chicken processed good many food as stew herbal remedy, baked surround honey, steam, boil, roast salt...

4. H'mong chicken development production

4.1. Meat reared H'mong modality different

Table 9. Result meat reared H'mong chicken modality different

Target	Confine 7-8 bird/m ² (n=100)	Let wander garden 1 bird/m ² (n=100)	Let wander hill (freedom) (n=100)
Rear period (days)	84	105	150
Survived rate (%)	97,6	94,5	77,8
Average body weight (g)	1210,0 ± 16,8	1150,0 ± 25,2	1005,2 ± 60,6
Matter intake/body weight gain (kg)	2,95	3,20	4,30

H'mong chicken reared commercial suitable for three mode confine, let wander garden, let wander hill, so apply reared many farmer raise condition different. However result H'mong chicken reared commercial in mode confine and let wander garden higher than let wander hill traditional mode of ethnic minority people. In mode confine and let wander garden, body weight 1150-1210g/bird, Matter intake 2,95-3,2kg, survived rate 94,5-97,6% higher than let wander hill 17% body weight, 23,4% survived rate, reduce 28,5% food spend and 53,5 reared days.

4.2. Result hand over H'mong chicken commercial market

Table 10. Number chicken 01 days supply years (bird)

Order	Import	2002	2003	2004	2007
1	Ha noi	1000	20150	30000	75650
2	Ha tay	-	4200	15600	45000
3	Nha trang	-	-	-	14400
4	Ho Chi Minh City	-	-	8000	30000
	Σ	1000	24350	53600	165050

Demand raise commercial H'mong chicken accelerate annual, not only market Ha noi, 2007, H'mong chicken but also was raised in Nha trang and Ho Chi Minh city meat reared, satisfy need consume people.

Conclusion

Through 6 generations of conservation and developing H'mong chicken gene source, we had some conclusions:

- External appearance: H'mong chickens have average stature, various colored feather, black or dark purple straight flag, black crest, black skin leg, black light skin.
- Survived rate was high in periods 95,5-97,1%
- Body weight at 20 weeks, male: 1713,9g, female 1256,2g with feed consumption 1-20 weeks, male 7681g, female 8550g
- Eggs reproduction/female/60 weeks 92,6 eggs, feed consumption/10 eggs 3,26 kg
- H'mong raised commercial good grow in confine condition and confine combine let wander garden, survived rate 94,5-97,6%, body weight 1150-1210g/bird, matter intake/ gain weight 2,95-3,2 kg.
- Meat H'mong chicken was little fat 0,38 %, Glutamic 3,487%

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GENETIC CONSERVATION OF CO DUCK BREED, THE PILLAR OF TRADITIONAL MIXED FARMING SYSTEMS IN THE CONTEXT OF AVIAN INFLUENZA IN VIETNAM

THI MINH NGUYEN* ET.AL.

Duck Breeding and Research Centre (DBRC)

* Corresponding author: minhthach55@vnn.vn or minhthach55gmail.com

Abstract

Co ducks are traditionally related to rain-fed rice farming and can forage nearly half of their feed requirements while maintaining high reproduction levels. No other breed could take on the Co ducks' role in rain-fed rice areas. They are hardy and resistant to local diseases. A survey in Ha Tay and the Mekong River delta shows that Co ducks are still the main source of livelihood for a large number of poor farmers. To maintain Co duck numbers, a breeding system has been developed in DBRC based on selection, breeding and stabilizing of egg production; improvement of egg production and; supplying selected ducks to integrative system in rural areas with the aim of conserving agricultural biodiversity and enhancing sustainable agriculture.

Keywords: Duck; Genetic resources; Biodiversity; sustainable agriculture.

1. Introduction

Vietnam is the second largest duck rearing country in the World with a diversification of local breeds. Co is one of the duck breed with a huge reproduction potential among that diversified population and, for ages, concerned closely and symbiotically to rain-fed rice. Therefore, Co ducks are called "Ducks of rain-fed rice agriculture".

In the context of globalization, exotic ducks are imported into Vietnam more and more, so diseases have opportunity to spread and contaminate, especially Avian Influenza which shows a danger to break out for animal and human being. Added that, since the introduction of more productive exotic breeds and muscovy ducks the existence of the Co ducks is severely threatened.

Now a question is: How to rescue Co ducks out of danger? How to maintain their position in rain-fed rice agriculture?

The assignment has been carried out in Duck Breeding and Research Centre (DBRC). A breeding system has been developed based on selection, breeding and stabilizing of egg production; improvement of egg production and; supplying selected ducks to integrative system in rural areas with the aim of conserving agricultural biodiversity and enhancing sustainable agriculture.

1. Contents and methods

1.1. Genetic conservation principle

Survey; Collection-Study; Conservation-Assessment; Documentation; Development and Utilization.

1.2. Methods

Small population inbreeding; Family; Through generations.

3. Measurements and data analysis

Measurement was calculated for Co ducks on survey from provinces, hematological study, genetic constitution and eco-technology items in DBRC. Data were documented as a Curriculum Vitae of Co duck breed.

Data analysis: By MINITAB Ver. 13.31.

4. Results and discussion

4.1. A comparison

Firstly, a comparison of egg production and egg weight was made on several duck breeds with similar mature body weight including Co as a reference that may help to direct the experiments correctly. It shows in table 1.

Table 1- Comparison of egg production and egg weight on several breeds to similar mature body weight

Duck breeds	Mature body weight (kg)		Egg production (egg / female/52 weeks laying)	Egg weight (g)
	Male	Female		
Bali (Indonesia)	2.25	2.03	231	68.0
Khaki Campbell (Thailand)	2.03	2.03	250 - 325	65-70
Indian Runner (India)	2.03	2.03	225 - 325	68.0
Sported (game duck)	1.26	1.08	33 - 130	61.0
Mallard (game duck)	1.49	1.13	33 - 163	63.8
Brown Tsaiya (Taiwan)	-	1.38	218	67.8
Tergal	-	1.32	146	-
Alabio (Indonesia)	-	1.68	180	-
Common Co (VN)	1.52	1.42	160 - 220	64.4
Co Sparrow-feather (VN)	1.58	1.52	225.30	64.4

Source: Khajarems, J. and S., 1990; Thummabood, S., 1990; N.T.Minh, 1997.

There is a reason to believe that Co ducks have a good potential of laying, it is second only to Khaki Campbell and Indian Runner as a good laying breed. Khaki Campbell and Indian Runner are considered the two best colour laying breeds with small body size which was recorded that they could lay more than 300 eggs annually. Khaki Campbell is a result of breeding and breed improvement of England, while local breed of Indian Runner has three strains which are identified by their feather colour such as white, grey and molted (Thummabood, S. 1990).

Presumably, the Co is a breed of unknown origin then it is a local breed in Vietnam for ages, so it is possible to improve their egg production in genetic conservation.

4.2. Hematological study:

Secondly, the hematological study was carried out. 70 blood samples of Co ducks were taken in early morning before feeding, at the ages of 1; 21; 70; 140 and 210 day-old and analyzed at NIAH. The flock was in healthy status. The results are showed on table 2.

It is very summary to explain about haemic morphology here. It is suggested that the haemic morphology regards to breed, characters, diseased status, productivity and others..., especially egg production of the Co. For example: numbers of leucocyte were increased in growing period at 140 days old ($30 \times 10^3 / \text{mm}^3$ of blood) when Co ducks were fed on a restricted level and may be easy to contaminate diseases from the environment; or albumen could be reduced at the time of high reproductive level (1.97 g % at 210 days old was lower than it was in 1; 21; 70 and 140 days old), so enriching albumen is necessary in laying period.

Table 2 - Haematological study of Co ducks

Traits	Unit	Days old				
		1	21	70	140	210
Erythrocyte	$10^6 / \text{mm}^3$	3.12 ± 0.06	2.47 ± 0.09	2.77 ± 0.07	2.62 ± 0.08	3.55 ± 0.08
Haemoglobin	g%	9.52 ± 0.28	10.20 ± 0.25	11.29 ± 0.23	11.95 ± 0.29	11.60 ± 0.27
Leucocyte	$10^3 / \text{mm}^3$	20.00 ± 0.47	21.27 ± 0.39	21.97 ± 0.54	<u>30.00 ± 0.50</u>	20.95 ± 0.38
Total protein in serum	g%	3.80 ± 0.15	3.91 ± 0.10	4.25 ± 0.09	4.34 ± 0.08	4.61 ± 0.08
Albumin	g%	2.09 ± 0.06	2.51 ± 0.08	2.42 ± 0.06	2.66 ± 0.06	<u>1.97 ± 0.06</u>
α -globulin	g%	0.44 ± 0.02	0.61 ± 0.03	0.58 ± 0.03	0.74 ± 0.05	0.93 ± 0.05
β -globulin	g%	0.51 ± 0.03	0.55 ± 0.03	0.65 ± 0.04	0.81 ± 0.04	0.92 ± 0.04
γ -globulin	g%	0.75 ± 0.02	0.54 ± 0.03	0.60 ± 0.05	0.75 ± 0.03	0.80 ± 0.02
A/G	g%	1.23 ± 0.06	1.48 ± 0.90	1.32 ± 0.08	1.16 ± 0.05	0.75 ± 0.03

4.3. Study on genetic constitutions of Co ducks

The genetic distance between duck populations was identified in a co-operated studying with Japanese colleagues (Hiroshima Univ., Japan. 1998). The blood samples were taken from our Co ducks. It shows that the estimate (0.105) of average heterozygosities (H) of the Co in North Vietnam

was lower than that (0.152) of the Co in South Vietnam. They suggest that genetic constitutions of the Co are differed from those of the North-East Asian duck populations consisting of the Pekin, the Naki Ahiru, the Aokubi Ahiru, the Kairyo Osaka and the White Tsaiya, and is distinct from those of the Indonesian native ducks and the Khaki Campbell, and also phylogenetic relationships are different between the Co in North and South Vietnam (Okabayashi, H.; Tanabe, Y.; Yamamoto, Y.; Minh, N.T. and Binh, D.V. 1999).

The phylogenetic studies of native ducks in South Vietnam based on blood protein polymorphisms (Okabayashi, H. et. al. 1998) show that the Co is genetically different from Northeast Asian duck breeds and Indonesian native ducks. It is suggested that the Co descended from different origins of mallards from Northeast Asian and Indonesian native ducks (*see the picture of dendrogram of genetic distance between duck populations*).

4.4. Case study

* *The study area*: Survey has been carried out in the provinces of Ha Tay, Tien Giang and Dong Nai, involving 5 districts and 10 communities.

* *Co ducks and the scavenging feeding system*: In a country like Vietnam, arable land is scarce; integration of crops and livestock needs to be enhanced. Ducks grazing harvested rice fields, receiving a supplement of only 1 kg of paddy, produce a gain of 1 kg of body weight. In South Vietnam rice is harvested the whole year round so this system can be applied continuously. Many poor farmers depend on ducks for income. With fish and rice, Co ducks are an integral component of traditional farming. They provide households with meat and eggs, their main source of protein. Surplus products are sold for extra income for buying food, clothes and cover other expenses like school fees, medicine, festivals, wedding and funerals...The traditional of duck rearing has been handed down for generations in all three provinces.

- Flock size:

Table 3. Co duck flock size in North and South Vietnam

Traits	Dong Nai Province	Tien Giang Province	Ha Tay Province
N ⁰ of surveyed communities	3	5	2
Total N ⁰ of surveyed Co ducks	14,300	47,850	1,150
Flock size	1,300 - 2,000	550 - 15,200	400 - 750
Average (bird / flock)	1,788	2,080	575
Male / female	1 / 20	1 / 28	1 / 10

Source: Minh, N.T. et. Al. Survey 2005.

In North Vietnam, most Co ducks are kept for eggs. Flocks vary from a few birds in back-yard to several hundred. In South Vietnam flocks are never less than 500 head. The male / female ratio in the North is 1/10 while in the South it varies between 1/20 - 1/30. In both areas fertility rates are about 95%; even where the ratio between males and female is low (table 3).

- Feather color: The coat color of Co ducks can vary from black to white; over 80% of them have a sparrow colored which is often categorized as a pure breed type.

Table 4. Coat color of Co ducks

Coat color	Dong Nai Province	Tien Giang Province	Ha Tay Province
Sparrow (in %)	82.4	85.0	89.0
Pink brown (in %)	9.3	7.0	5.5
Grey brown (in %)	5.3	6.5	4.5
White (in %)	2.1	1.0	0
Black and others (in %)	0.9	0.5	1.0

Source: Minh, N.T. et. Al. Survey 2005.

* *Appearance and habits*: Co ducks derive from wild duck (*anas platyrhynchos platyrhynchos*) (Dong, L.X.-1994; Minh, N.T.-1994-2001; Ly, L.V.-2001) and resemble their ancestors. There is a photograph of wild duck taken in Mekong River delta 2005. They have a small body, a delicate head, witty eyes, a flattened beak and long neck. Their body size and their short legs allow them to walk briskly and to thread their way through rice fields without difficulty. They forage well, have high egg yields, can survive hardship and are resistant to a number of local diseases such as Duck plague and Duck cholera... Females not in their reproductive period can survive on a very poor diet. Once the reproductive season starts they recover rapidly and fully. Co ducks are gregarious; males are very

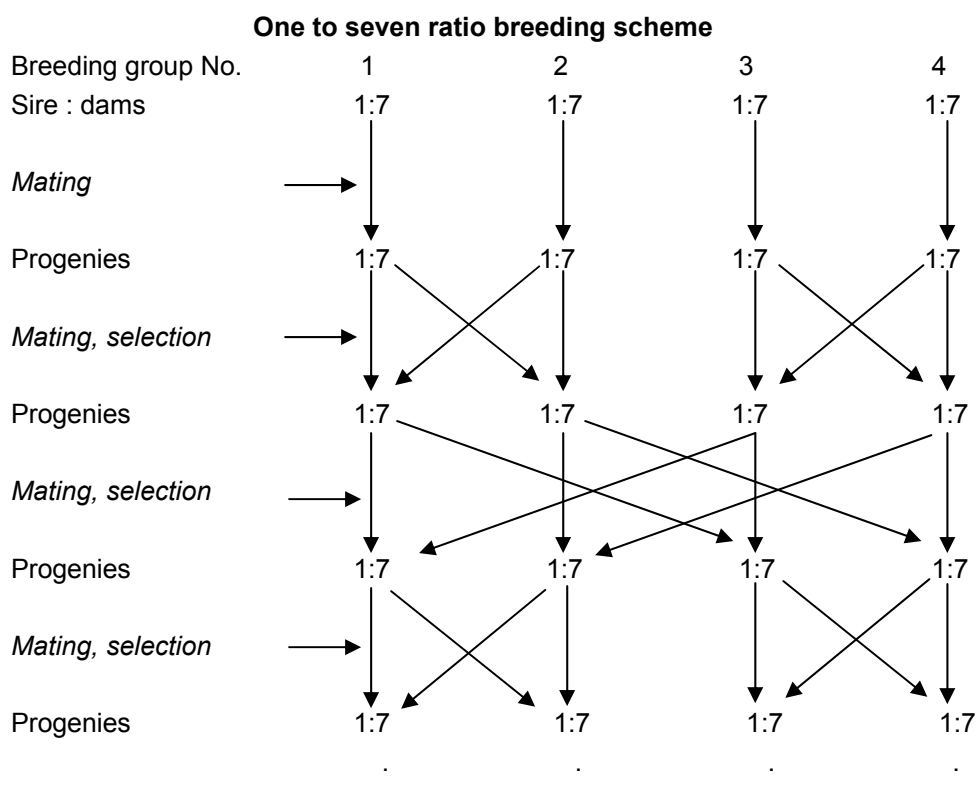
Table 6. Economic benefits from Co duck production

Traits	Unit	Dong Nai Province	Tien Giang Province	Ha Tay Province
Input:				
Feed consumption	g/b/d	157.5	155.4	154.0
By currency	VND/b/d	378.0	373.0	426.6
Out put:				
Egg production	Egg/female/day	0.74	0.68	0.63
Egg Unit price	VND/egg	1200.0	800.0	1050.0
By currency	VND/b/d	888.0	544.0	661.5
Benefit	VND/female/day	510.0	171.0	234.9

Source: Minh, N.T.; survey 2005.

Profits were calculated with egg prices at the time of the survey. The smallest flock owner in Dong Nai (with 1300 birds) can earn 663,000 VND per day while flock owners in Tien Giang and Ha Tay would only earn 222,000 and 306,000 VND respectively, should they rear the same number of birds.

* *Co duck genetic conservation in DBRC*: Methods of family selection and small population inbreeding from IOWA University, The USA (Thummabood, S. 1990) were applied as followed scheme:



Go back to sire and dams and shift mating to other line/group in each generation

And then independent culling selection was applied with 5 standards:

- Average sexual mature age: around 21 weeks.
- Small mature body: 1.2 – 1.5 kg.
- Average egg weight: 60 – 65 g.
- High egg production.
- Pure individuals (sparrow-feather).

The body size and several productive characteristics are shown at tables 7 and 8 below:

Table 7. Mature body size

Traits	Unit	Male	Female
Body length	cm	22.9	22.3
Chest circumference	cm	27.3	25.5
Breast length	cm	7.5	7.3
Leg height	cm	5.1	4.9
Fourth wing feather length	cm	8.0	8.6

Table 8- Several productive characteristics of Co ducks in DBRC

Traits		Unit	Before selection	After selection	Comparison
1	N ^o . of duck	bird	2740	3427	
2	Survival rate at 3 weeks	%	98.5	97.1	Similar
3	Survival rate at 8 weeks	%	97.5	97.1	„
4	Day-old live weight: M	g	41.0	38.5	„
	F	g	40.5	37.3	„
5	3 week-old live weight: M	g	222.1	231.0	„
	F	g	192.5	216.5	„
6	8 week-old live weight: M	g	1020.0	1102.0	„
	F	g	955.1	998.9	„
7	21 week-old live weight: M	g	1579.5	1524.9	„
	F	g	1516.8	1247.8	17.7 % smaller
8	Mature age	day	170	146	3 weeks earlier
9	N ^o of egg in 52 weeks laying	egg	225.3	258.0	14.5 % higher
10	Egg weight	g	64.4	64.2	Similar
11	Fertility	%	94.1	92.2	2.1 % lower
12	Hatchability / fertilized eggs	%	91.2	80.6	11.2 % lower
13	Feed conversion / egg	g	224.1	233.0	Similar
14	N ^o . of duck	bird	2740	3427	
15	Egg shape L / W	-	1.41	1.40	Similar
16	White index	-	0.110	0.087	„
17	Yolk index	-	0.41	0.45	„
18	Haugh Unit (HU)	unit	87.3	87.2	„
19	Pure individuals(sparrow feather)	%	96.0	98.6	2.6% higher

Source: Minh, N.T. 2001-2007.

Survival rate is depended considerably upon the environment. The Co is usually a breed with high survival rate of over 95 %.

Live weight mainly depends on genetics, but how to maintain 8 week-old weight under 1000g is the role of management. This is very important for Co ducks, because egg production will significantly be reduced even very low if the duck was too big at 8 weeks old. Mating weight at 21 weeks old was reduced 17.7% by inbreeding efficiency, it may be usefull significantly for selection to save supplementation.

Mature age of the selected ducks was 3 weeks earlier, that means the feed was saved for 3 weeks before reproduction. There was no significantly different on mature age between selected generations ($P < 0.001$). The calculation showed that feed conversion was 20% saved from smaller live weight and ealier mature age and gave a significantly benefit for farmers.

However, dropping egg earlier may be a new direction for selection and breeding e. g. the breeders in China was very successfull in creating Triet Giang duck breed with mature age around 100 days old.

Through selection and breeding, egg production was improved 32.7 eggs per female equivalent to 14.5%. Fertility and hatchability was reduced 2.1% and 11.2% resp. Egg weight and also feed conversion per egg were similar before and after selection.

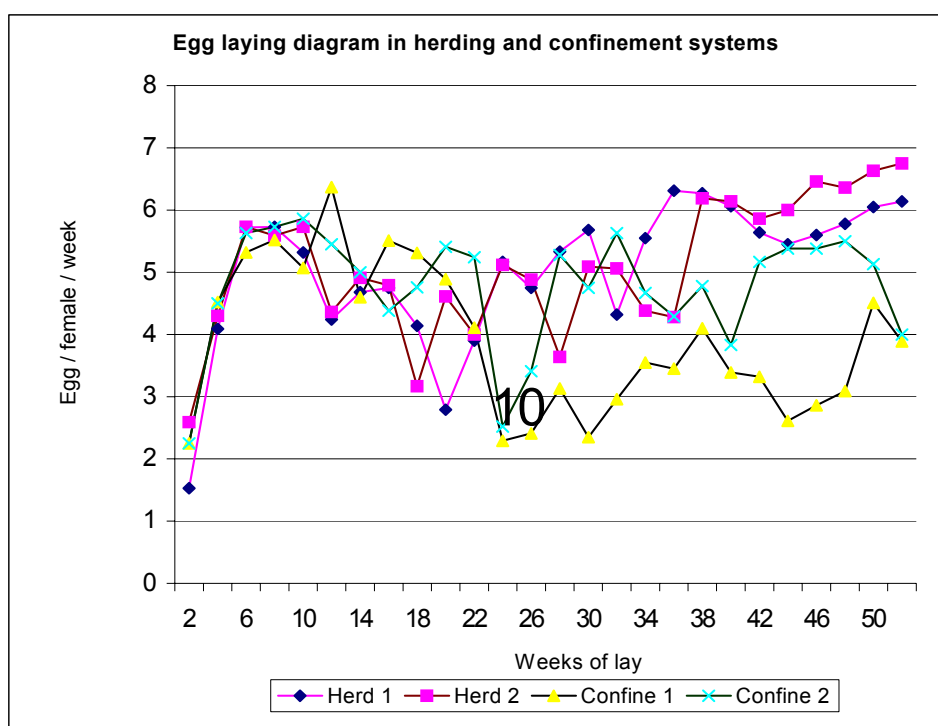
There is an agreement by breeders that to improve egg production for ducks by genetics is very difficult but it is very strong. There is several information about heritability coefficient (h^2) for egg production: $h^2 = 0.17$ (Mozanovski, 1988); 0.23 (Cerveny et. al., 1986); 0.42 (Pingel, H., 1976) or 0.32 (Stasko, 1968). It is considered that h^2 of egg production is rather low and genetic factor is minor among series of factor which impacts to egg production. Leroy, P. et. al. (2003) said that inbreeding will reduce 4.6% hatchability and fertility, and also increase diseased contamination because of more homozygotes, then it might be a similar observation in our experiments.

Although offspring were a little sterile and the fertility in the inbreeding was a little reduced, the improved egg production compared with it before selection was considerable. Correlation coefficient between egg production and fertility of Co ducks $r_p = 0.842$ is conformable to Hattenhauer's (1981; $r_p = 0.72$) or Husky's (1986; $r_p = 0.89$; $r_g = 0.70$) studies.

Egg quality is evaluated by the items as in table 6. The standards of white index $\geq 0.07 - 0.12$; HU ≥ 80 (Vang, N.D., 1989); L/W = 1.35 – 1.44 (Brandchs, H. and Biichel, H., 1978), then Co duck eggs were included inside the standards. There was no different significantly between before and after selection ($P < 0.05$).

Feather color is a quality characteristic controlled by genetic rules which is unknown thoroughly. It is thought that the combination for sparrow feather of Co ducks is very complicated and have not identified yet. However, pure individuals were increased 2.6% through selection and breeding, that figure not means "increasing" but means "rather pure" only.

Chart 1. Egg laying diagram



** Breeding system of Co ducks at village level in Vietnam:*

Collecting eggs: Co ducks are kept in flocks or confined. Eggs are collected daily and the malformed ones are immediately rejected. Every 5 days, the eggs are sold to hatcheries or exchanged for ducklings to restock the laying flocks.

+ Incubation:

There are two main hatching methods; one uses artificial means and the other uses an apparatus. The artificial method is relatively rare: in the South, eggs are heated by other eggs, while in the North, one uses warm rice or oil lamps are used to brood the eggs. This technology is neither efficient nor hygienic and often results in broken eggs and low hatchability. To overcome these weaknesses, home-made incubators with capacities from 8000 to 14000 eggs are popularly used for hatching in all three provinces. These are easy to manage and improves the hatching efficiency.

Day-old ducklings are either sold directly from the owner to the farmers or, often in more remote areas, via intermediaries. Sufficient day-old ducklings are sexed for breeding while the rest are sold or raised for meat. Farmers often select ducklings from high egg-yield flocks. Eggs not needed for incubation are sold or used for “balut” eggs (incubated 18 to 19 days for human consumption).

+ Social and cultural activities:

Co ducks figure in social and cultural activities; usually simply games, which are easy to organize, are enjoyed by farmers and are an important part of the daily lives of communities in rain fed rice areas. “Catching ducks” is often played during festivals: a pond, a healthy Co duck and a group of people are needed. The duck is released on the pond and the people have to catch it. The game is difficult, the duck dives extremely well and easy escapes; whoever catches the duck is winner. During the event the noise of drums and cheering people is overwhelming. Farmers in Dong Nai play “duck neck with ring”: players are given limited numbers of ring which they throw one by one into a dense flock of Co ducks. If a ring slides over a duck’s neck the player wins the duck. The final winner is the person who has “ringed” the largest number of ducks.

+ How to maintain the traditional flocking system?

To maintain and further develop the traditional duck flocking systems, policy-makers should provide support to farmers in the following fields:

Promote the conservation of Co ducks to to preserve agro-biodiversity and more importantly, to alleviate poverty. Farmers need to be informed about the competitive advantage of Co ducks over exotic breeds. In the market system, exotic breeds often raise expectations of higher profits among farmers who do not realize that the link between Co ducks and paddy results in high egg yield with low inputs. Farmers underestimated the importance of Co ducks in achieving sustainable development. Exotic ducks are being imported and even smuggled into Vietnam which is causing a severe reduction in the number of pure Co ducks.

Facilitate the confinement of Co ducks and limit egg and duckling distribution to reduce the danger of Avian Influenza; continuous veterinary health control is imperative. If duck raising is prohibited, the fate of 1.5 million ducks in the Mekong River delta is at stake (VTV news, 4 April 2005). For farmers’ livelihoods it can only be hoped that the existence of Co ducks and their traditional flocking system will not be drastically affected by the virus.

Increase veterinary health coverage. A veterinary network from central level to the rural communities is necessary. Ducks should be vaccinated periodically against Duck plague, duck cholera and others. At present, vigilance to avian influenza is especially necessary.

Review government policies. The Government should look into the needs and expectations of farmers, then review and further develop its policies. Most farmers expressed a need for:

- Credit with low interest rates for recovering duck production;
- Improvement of health care for ducks throughout the year;
- Urgent measures to prevent Avian Influenza and to help further development of the duck sector.

+ Breeding system development:

To maintain the number of Co ducks the Duck Breeding and Research Center (DBRC) has developed a breeding system which is applied following three steps:

Step 1: Selection, breeding and stabilizing egg production.

Step 2: Improvement of egg production.

Step 3: Supplying selected ducks to different integrative systems (duck-fish, duck-rice, duck-rice-fish, duck-rice-fish-fruit tree) in rural areas with the aim to conserve agricultural biodiversity, to enhance sustainable agricultural development.

Conclusion

Local Co ducks (*anas platyrhynchos*) are traditionally and symbiotically related to the rain-fed rice agricultural farming systems. One of their most valuable assets is their capability to forage nearly 50% of their feed requirement. They feed on detritus, insects and aquatic and agricultural byproducts and maintain high reproduction levels. They are closely linked to paddy rice and no other duck breed could bare the same role as the Co ducks in rain fed rice areas in Vietnam. They can endure hardship and are resistant to a number of local diseases. In the rural areas of Ha Tay and the Mekong River Delta Co ducks are still the main source of livelihood for a large part of poor farmers. Via DBRC, the Government of Vietnam develops and implements policies to improve and conserve the Co duck breed.

It is necessary to promote the conservation of local Co ducks to maintain the agro-bio-diversity without insecticides and; contribute to the poverty alleviation in Vietnam.

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STUDY ON ADAPTING ABILITY OF THAILAND “PURE” WILD PIG IN KEEPING CONDITIONS IN THE NORTH VIETNAM

**VO VAN SU^(1*), TANG XUAN LUU⁽²⁾, TRINH PHU NGOC⁽³⁾, NGUYEN THANH HOAI⁽¹⁾,
PHAM HAI NINH⁽¹⁾ AND TRAN THI LOAN⁽²⁾**

¹National Institute of Animal Husbandry,

²BaVi Cattle and Forage Research Centre,

³National Institute of Veterinary Research

* Corresponding author: vovansu@hn.vnn.vn

Abstract

The current study was aimed at evaluating adaptive ability of Thai wild pig in the North Vietnam. Data collected from 50 sows Thai wild pigs in different experiments at Xuonglam farm and Bavi farm from 2007 to now. Thai wild pig had the black coat color, piglets have black-yellow stripes along body in the first 3 months, and disappeared later, medium to big sizes and a good adaptation to climate conditions of the North of Vietnam. Thai wild pig had age of the first breeding is 6.38

months, the ratio of death of wild pig is very low, average 5,25%, percentage of breeding and pregnant of the first two litters was 94,47%, 81,83%, respectively. These datas were similar to that of other local pigs. Therefore, development Thailand wild pig keeping in the North would be necessary to get success in the husbandry industry of Vietnam.

Keywords: Thailand wild pig, adaptive ability, breeding, pregnant

1. Introduction

Domesticating and keeping wild pig was started from a farmer family Mr. Bay Dung – he was a hunter and he has lived in Dong Phu district, Binh Phuoc province (the Southwest Vietnam) from 2000. Thailand pure wild pigs were imported into Binh Phuoc province and Ho Chi Minh City at Khanh Gia Co., Ltd and Huong Tram. Keeping Thailand and Vietnam wild pig and the crossbreed between them and highland breeds have been spreaded out (expended) many places. Up to now, there are at least 20 different farms which are keeping the breeds. Thailand pure wild pig are considered to be the first choice by their “pure character”, easily keeping and nearly similar with pure wild pig of Vietnam which were hunted by farmers.

Thailand is original place and next is the South Vietnam, all are hot regions where are different from the North – It has cold reason. Therefore, our important problem is whether we can keep Thailand pure wild pig in the South or not and this will be answered in scope of this subject.

Aims

- Evaluating adaptable ability of Thailand wild pig in climate condition of the North.
- Constructing wild pig keeping model by intensive farming system.

2. Contents and method

2.1. Object

Thailand wild pig are kept adaptly in the North Vietnam.

2.2. Time and location of research

- Location: There are two farms in the North Vietnam.
- Time: started on 31/5/2007 to now.

2.3 Contents

- Defining biological traits and reproductive ability: age of first breeding, distance between two litters, number of birth, the ratio of alive wild pig at different ages.
- Defining the growth ability of wild pig.

2.4 Methods

*** Keeping**

Wild pigs are kept in two main locations: Xuonglam farm (locate on Xuonglam commune, Langgiang district, Bacgiang province): at first there were 20 pigs. Myhanh farm (locate on Bavi district, Hanoi city): there were 30 pigs at first. In addition, there are two small farms at Codo (Bavi district) and CT 3F (Hoalac district) with 10 pigs/farm.

*** Household keeping**

Pigpen are divided into many special pens: pen for reserve pig, pen for breeding pig, pen for boar, pen for weaned piglings. All the pigpens must have playgrounds.

Quotas are followed as: age of first breeding, distance of two litters, number of birth.... These datas are collected and classified by Vietpig 4 and Vietpig Analysis 1.0 software. Data obtained are analysed statistically using Minitab 14 programme at Rare Animal and Biodiversity Department – NIAH.

3. Results and Discussion

*** Appearance traits of Thailand wild pig**

In general, wild pigs are covered crude hairs all over the body, hair colour is changed from dark-grey to brown. The length of their bodys are from 0.9m to 1.8m with mature weight about 50kg to 350kg, even 450kg and the sows have 6 pair of mammas. While Thailand wild pigs have small

appearance, with height is about 65-70cm, strong body. Thailand wild pig consist of two main breeds/lines:

- Wild pig breed with long face: they are similar relatively with wild pig of Vietnam, long and straight mouth, slim body, high leg, their forelegs are higher than hindleg. However, the growth of this breed is not as fast as short face breed, but they are stronger than short face one and they have epidemic resistance highly.

- Wild pig with short face: salient feature of the type is big body, black hairs cover all over the body, their bodies are bulky and low, large ears, wide forehead.

* *The traits of newborn piglet*

During the first 3 months, piglets have black-yellow stripes along body, contain 7 black stripes and 6 yellow ones, thier backbones have black stripe. With pure wild pigs, people can see stripes clearly, not interruption, regularly. From the fourth month and later, their yellow stripes are disappeared, the coulor of hairs over the body are changed to brown – silvery – gray and white-grey in the cheeks. Mature pigs have mane feather, and boars have tusks which will be developed fairly as they will 2-3 years-old.

* *The number of wild pig*

Table 1: The change in number of wild pig in the farms

	Bavi			Xuonglam			Total			
	Buy	Birth	Total	Buy	Birth	Total	Buy	Birth	Total	Ratio %
Total	30	159	189	26	107	133	56	266	322	100
Remain	20	79	99	22	45	67	42	124	166	51.55
Sale	10	68	78	0	55	55	10	123	133	41.30
Removed	0	1	1	1	4	5	1	5	6	1.86
Died	0	11	11	3	3	6	3	14	17	5.28

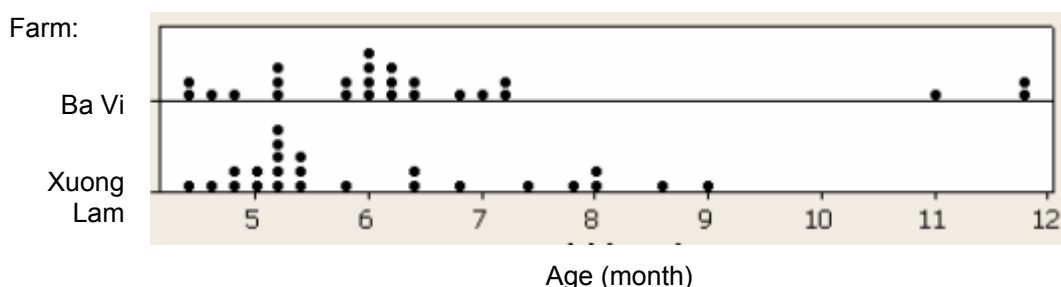
As can be seen from Table 1, in the total of 30 individuals at Bavi farm were bought, the percentage of number alive is absolute -100%, while at Bacgiang farm the percentage is 22/26 pig. The different can be caused climate condition, adaptable ability and different keeping technology between the farms. At Bavi, they used food as agricultural by-product mainly. And at Xuonglam, it is use to feed by combined food and by-product. The percentage of death of wild pig is very low, average 5,25%. It is to prove why wild pigs are adaptable ability and growth well in the climate condition of the North Vietnam.

* Reproductive ability

- Age of the first breeding

In the North, Thailand wild pig had age of the first breeding is 6.38 months (SD= 1,75) when collected datas of 49 sows. Age of the first breeding of wild pig was lower than that of some local pig breeds as I pig, Vanpa pig which are regularly 7-8 months

Distribution of wild pig following age of the first breeding



Effecting of age of the first breeding are evaluated through percentage of pregnant and birth-ratio. Results are presented in table 2.

Table 2: Results of fertilization and pregnant ratio of Thailand wild pig

	Bavi	Xuonglam	Total
Total	52	44	96
Unpregnant	13	7	20
Pregnant	39	37	76
Pregnant-rate	75.00	84.09	79.17

In the total of 96 sows, there were 76 pregnant sows (79,17%) and 20 unpregnant sows (20,63%). Climate condition and different terrain did not affected so much to pregnant –ratio of wild pig, as can see from results keeping at Bavi and Xuonglam farm.

Table 3: Results of fertilization and pregnant ratio to follow litter

Litter	1	2	3	Total
Total	49	38	9	96
Unpregnant	9	2	9	20
Pregnant	40	36	0	76
Pregnant-ratio	81.63	94.74	0.00	79.17

Through the first 3 litters, as can see ratio of breeding and pregnant of the second litter is highest, next is the first one and the third one is 94,47%, 81,83%, 0%, respectively.

Table 4: Distance between two litters (day)

	No	Average	SD	Min	Max
Bavi	18	197,44	23,2	147	215
Xuonglam	15	197,6	25,6	121	216
Total	33	197,52	24,4	134	215,5

Average of distance between 2 litters is 197,52 days when we collected datas from 33 litter, highest is 216 days and lowest is 121 days. The main reason is due to died piglet immediately after was born and fertilized again within 5 - 7 dates later. Meanwhile, the time for weaning is about two months, so distance between two litters is usually very long.

* The growth

Table 5. Result of following weight at birth of wild pig (kg)

Litter / farm		Bavi	Xuonglam	Total
Total	No	37	30	67
	Weight at birth/ piglet	0,51	0,49	0,50
	SD	0,08	0,10	0,09
1	N	19	16	35
	Weight at birth / piglet	0,53	0,54	0,53
	SD	0,09	0,08	0,09
2	N	18	14	32
	Weight at birth / piglet	0,5	0,43	0,47
	SD	0,07	0,07	0,07

In the total of 67 litters, average of weight at birth is 0,5kg. This result is more higher than that of some local pig breeds in Vietnam as Van Pa pig, Meo pig ... However, research on the growth and development of wild pig would be necessary.

4. Conclusion and suggestion

* Conclusions:

After researching on Thailand wild pig in the North climate condition, we have some results as follow:

- Age of first breeding is 6,92 months of age with breeding and pregnant rate is 79,18%.
- Distance between two litters is 197,5 days.
- Number of newborn piglet is about 2 to 11 individuals, average of first litter is 5,17 pigs and second is 6,67 pigs
- Average of newborn weight is 0,5kg / piglet.

* *Suggestion*

- Researching on some biological traits of Thailand wild pig.
- Improving process of Thailand wild pig keeping.
- Developing Thailand wild pig keeping quickly in the North of Viet Nam.

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REARING OF SIKAR DEER FOR VELVET PRODUCTION IN VIETNAM

DO KIM TUYEN¹ AND VO VAN SU²

¹ Department of Livestock Production
² National Institute of Animal Husbandry

Abstract

Rearing of Sikar Deer for Velvet Production in Vietnam

Sika deer is grass eating semi-wild animal, which is highly value animal compaired with the others ruminants. Sika deer rearing for velvet production in Vietnam had been started from the decade 20 of the XX century in Huong Son, Ha Tinh. Deer velvet had been known as good medical gradients for improving the human health in Nghe An and Ha Tinh.

The main feeds for sikar deer are tree leaves, fruits, grasses, which are easy to find and available in the garden and forest. In 2007, Vietnam had 31500 sika deers, which was mainly reared in the smallholder famers. Sikar deer was easy for rearing and which was create the new jobs, ustilize the available labor sources in rural area with high economic efficiency than other domestic animals.

The sika deer velvet is high economic merit value, biological value and supply good activated material for the human. Sikar deer rearing for velvet production not only for local demands but also for exporting opportunity to the international markets.

Nowadays, in Vietnam sika deer production for velvet products is well developed for improving the economic income and living standard for the farmers.

Key words: Sikar deer rearing, deer velvet, velvet production

1. Introduction

The Sika deer is one kind of wild animal, which is available in many parts of the world with the well-known utilized biological value for human health. Sika deer production for velvet in Vietnam had been known from the decade 20 of the XX century. The deer velvet had been processed and used by the animal producer as good medical gradients for improving of human health.

Long-ago, the Ha Tinh people know how to hunt and trap the wild sika deer and step by step for rearing sika deer at their home. Recognize the economic and biological value of rare animal; the State established the State owner deer farm. For the long time development with many difficulties up and down the household sika deer production become the economic farming practical in Vietnam.

According to the State statict datas in 2007, Vietnam had 31500 sika deers, which was mainly reared in the smallholder famers. Only in Quynh Luu of Nghe An district there were 39 per 42 commons, which is sika deer rearing. The avarage 2-3 sika deer/ household, some hoseholds with 10-

12 deer/farm. From the Huong Son, Ha Tinh and Quynh Luu, Nghe An, the sika deer rearing was step by step spread out to the other provinces as Cat Ba-Hai Phong; Cuc Phuong-Ninh Binh; Ba Vi-Ha Tay.

From 1986, for the trials of sika deer production in the Central High Land provinces, the Vietnam



Sicence Institute (VSI) had cooperated with Sicence Boad of Dak Lak and the Tourist Company of Ba Vi established the sika deer farms with sermi natural rearing for utilizing of the available botanic in the biological in the region. From the initial with limited deer number, after few years of trials, the sika deer had well developed with their products.

The sika deer production is developing with the economic result for the farmers. The velvet products not only for demanding of the local people in the country but also for exporting opportunity to the international markets.

2. The belnifite of Sikar deer rearing

Sika deer is grass eating semi-wild animal, which is highly value evaluated animal compaire with the others ruminants. The sika deer velvet is hight economic merit value, biological value and supply the good activated material for the human health. Sikar deer can be confine rearing inside the farm ban and easy manage than other wild animals. The main feed for sikar deer are tree leaves, fruits, grasses, which are easy to find and available in the garden, forest...so the input for sikar deer rearing is low and hight economic value and income.

Sikar deer is highly of the disease ressitance, the precious velvet with hight economic value, easy for manage and transportation. Sikar deer is easy for addapting to the environmental condition, is the ruminant, which is no bad affected to the surrounding environmental.

The deer velvet is the newly horn, the horn is dropping every year and grow the new one. The deer horn is regrowing every year so it is consider as good for improving of the health and longevity for human. When the new horn is growing the outside of horn with the fine hair like velvet so it it called as "velvet", the sikar deer velvet for the long time had been known and used as the health stimulating and improving for human.



In the ancient time of the China, Japan, Vietnam the sikar deer velvet and other parts of sikar deer had been used by the Eastern Physician to the disease treatment for kidney and nervers systems.

3. The Sikar deer population and distribution

The sikar deer number and development rate

From 2001-2007, the sikar deer population had been developed with high rate in Vietnam. Sikar deer population increased from 14876 heads in 2001 to 31539 heads in 2007, Table 1. According to the State statistic during 2005 and 2006 the sikar deer population had been decrease 0.2-0.7% but rapid increase 56% in 2007. The reasons for the up and down of deer population due to the price of the deer velvet, the main product of sikar deer rearing. When the price of deer velvet decrease the farmers had to reduce the farm size by culling of the old deers and low velvet production to keep the balancing of the farm input and output. The sikar deer population fast increase again when the velvet price grow up.

During last six years the average population grow rate of sikar deer of Vietnam was 13,34%, this is higher than the grow rate of livestock production. Nowadays, development of sikar deer in the country is good, the price of velvet and deer breeding stock are high due to the demand of the deer velvet market. The farmer invest for sikar deer production due to high economic efficiency.

Table 1. The sikar deer population of Vietnam (head)

Year	2001	2002	2003	2004	2005	2006	2007	01-07
Sikar deer population	14876	10918	15598	20597	20239	20196	31539	
Growth rate (%)		-26.61	42.86	32.05	-1.74	-0.21	56.16	13.34

Distributed of sikar deer population

According to the Northern and Southern part

The distribution of sikar deer population to the Northern and Southern part of Vietnam had been indicated in table 2. This table shows that the sikar deer population of the country located in the Northern part. In 2007, total sikar deer population of Vietnam was 31592 heads, of which 28695 heads in the Northern, occupied 90.2% of the population and only 2880 heads in the Southern with 9.8% of deer population.

From this figures it indicated that the sikar deer rearing of Vietnam was mainly in the Northern part, where sikar deer production is traditional use of deer velvet for many generations. Distribution of sikar deer population of Vietnam also reflect of the specific culture for each Northern and Southern part.

The sikar deer population of Northern part was increased two times during 2001-2007 from 14035 heads to 28659 heads and the average annual growth rate was 12,64%. While the sikar deer population in the Southern during 2001-2007 increase three times from 841 heads to 2880 heads and the average annual growth rate was 22,7%. This difference between the Northern and Southern part also indicated the difference custom of deer velvet utilization

Table 2. Distribution of sikar deer population

Year	2001	2002	2003	2004	2005	2006	2007	01-07
Population	14876	10918	15598	20597	20239	20196	31539	100%
Growth rate (%)		-26.61	42.86	32.05	-1.74	-0.21	56.16	13.34
Northern	14035	9817	14397	17655	18501	18837	28659	90,2%
Growth rate (%)		-30.05	46.65	22.63	4.79	1.82	52.14	12.64
Southern	841	1101	1201	2942	1738	1359	2880	9,8%
Growth rate (%)		30.92	9.08	144.96	-40.92	-21.81	111.92	22.77

According to regions

Distribution of sikar deer according to the regions is shown in table 3. In 2007, more than 90% of sikar deer population distributed in the Northern part, of which 68% sikar deer population located in the North Central Coast and 20% sikar deer population in the Red River Delta.

In the North Central Coast provinces, where the sikar deer rearing experiences was for a long time ago and with the biggest sikar deer population in the country. About two third of sikar deer population of

Vietnam is located in Nghe An and Ha Tinh provinces. Huong Son district of Ha Tinh province was well known for sikar deer rearing and biggest deer population with velvet production about 3-4 tones per year. The second biggest on sikar deer production was Quynh Luu-Nghe An with about 3 tones of velvet produce and supply to the market per year. Sikar deer rearing for velvet production really got the beniffite and economic income for the farmers in the North Central Cost provinces.

Table 3. Distribution of sikar deer in the region

Year	2001	2002	2003	2004	2005	2006	2007	01-07
Vietnam	14876	10918	15598	20597	20239	20196	31539	100%
Growth rate (%)		-26.61	42.86	32.05	-1.74	-0.21	56.16	13.34
Northern	14035	9817	14397	17655	18501	18837	28659	90,86%
Growth rate (%)		-30.05	46.65	22.63	4.79	1.82	52.14	12.64
Red River Delta	14035	359	443	1744	689	732	6454	20,4%
Growth rate (%)		-97.44	23.4	293.68	-60.49	6.24	781.69	-12.14
East North	526	473	685	662	703	540	592	1,80%
Growth rate (%)		-10.08	44.82	-3.36	6.19	-23.19	9.63	1.99
West North	54	37	38	36			46	0,19
Growth rate (%)		-31.48	2.7	-5.26				-2.64
North Central cost	13218	9848	13231	15213	17109	17565	21567	68,38%
Growth rate (%)		-25.5	34.35	14.98	12.46	2.67	22.78	8.5
Southern	841	1101	1201	2942	1738	1359	2880	9,14%
Growth rate (%)		30.92	9.08	144.96	-40.92	-21.81	111.92	22.77
South Central cost	46	10	10	10	13	7	14	0,04
Growth rate (%)		-78.26	0	0	30	-46.15	100	-17.98
High Land	310	475	609	1642	709	517	2186	6,93
Growth rate (%)		53.23	28.21	169.62	-56.82	-27.08	322.82	38.48
East South	485	616	582	673	835	835	680	2,10
Growth rate (%)		27.01	-5.52	15.64	24.07	0	-18.56	5.79
Cuu Long Delta		0	0	617	181	0	0	
Growth rate (%)					-70.66			

4. Some study rerults

Sikar deer rearing in Huong Son, Ha Tinh

Nowadays, sikar deer rearing in Huong Son, Ha Tinh is a example for deer keeping in smallhousehold of Vietnam. The Huong Son district had a plan to use 1000 ha of grass production for grass eating animal and deer rearing program.

In 2006, the decision of Huong Son district authority for sikar deer production plan. Sikar deer rearing is one of priority in animal production, deer rearing was stable and well developed. The average farm size was about 2-3 heads/household and maximum about 30 heads. In the end of 2008, total sikar deer population in Huong Son was about 16000 heads, the growth rate of population about 43.3% compaire with 2005. Every year, the velvet product was about 3.5 tones with value about 15 billion VND not included the value of breeding stock supplying. Total money income of sikar deer production estimated 32million dong/year, occupied 31% total income of district livestock production.

At present most of sikar deer production farms are located in Son Trung, Son Lam, Son Quang and Son Chau common, minimum 1000 heads in common and maximum 2000 heads.

In 2007, there was 7500 smallholder rearing deer per total 3100 houshold of Huong Son district. In practical, sikar deer production in this district had been confirmed stable income than other kind of

animal rearing. Sikar deer rearing is priority in animal production in economic development of Huong Son. Deer rearing program not only in Huong Son but also develop and spread to the other provinces like Nghe An, Dong Nai, Phu Yen, Ha Giang and Thua Thien Hue vv...

Table 4. Sikar deer population in Ha Tinh and Nghe An last 10 years

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ha Tinh	7200	7100	7100	7400	7900	4200	8529	9500	11020	13500	16000
Nghe An	2900	2950	3000	2750	2830	2577	2506	4500	5300	6500	8000

The results

- Nowadays, sikar deer rearing in Vietnam is mostly in small-farmer, some State farms available in the past but no efficiency so most of them had been put off.
- Sikar deer was confined in the wood barn, average is about 4-6 head per square meter.
- The average age of deer in Ha Tinh and Nghe An according to survey result is about 5 years old.
- The fodder for deer is all kind of leaves, grass in garden, forest and agri-byproducts with total about 6-7kg/day. Concentrate are rice bran, corn bran, corn, sweet potato, cassava, ground nut...
- There is one big deer farm of Huong Son Deer Stockholder company with total 450 heads in Ha Tinh. There are two other deer farms with more than 50 heads/farm in Quynh Luu, Nghe An.
- The rate of male and female deer in Ha Tinh and Nghe An are different. At Huong Son Ha Tinh, rate of male/female was 46.5%/ 53.5%, while in Quynh Luu, Nghe An rate of male/female was very different: 60-64% per 34%-40%.
- There was 15% of farmer in Huong Son-Ha Tinh keeping deer, this rate in Quynh Luu-Nghe An was 4.5%. Average deer per farm was about 2.2 heads.
- Deer velvet productivity: when harvest of velvet at 45 days old, average weight was about 0.85kg (from 0.3-1.2kg).
- Deer velvet harvests by traditional method using the iron saw for velvet cutting and stop bleeding by using of the leaves for banding.
- The velvet marketing by local using or to be sold to the customers in the Cities by fresh product about 80% and dry form about 20%. It is very common when use fresh velvet for making soup or deeping in local wine made from rice.
- The selling price of fresh velvet in Ha Tinh and Nghe An very different due to the time, but nowadays (2008) from 4-5 millions Vietnam dong/1kg.
- The investigate study results of sikar rearing in Ha Tinh and Nghe An in 2006 had been shown that average each deer make the benefit of 2.5-3.0 millions VN dong/year.

5. Conclusions

Sikar deer rearing is the traditional carrier of some provinces of Vietnam, specially as Huong Son district of Ha Tinh and Quynh Luu district of Nghe An.

Sikar deer population had been well development, more 90% of sikar deer is rearing in the Northern part of the country and more than 60% of deer is in Northern Central Coast. Average annual growth rate of deer population from 2001-2007 was about 13.3%.

Sikar deer was a animal easy for rearing and which was create the jobs, economic utilize the available labor sources in rural area with high economic efficiency than other domestic animals.

Beside selling the breeding stock annually, the sikar deer velvet which is rich in biological and economic value not only for local requirement but also for export opportunities to the international markets.

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BREEDING STRATEGIES TO SUSTAIN GENETIC VARIATION FOR THE CONSERVATION OF DOMESTIC ANIMAL DIVERSITY

J. N. B. SHRESTHA^{1*} AND G. H. CROW²

¹Dairy and Swine Research and Development Centre, Agriculture and Agri-Food Canada, P.O. Box 90 - Lennoxville Station, 2000 College Street, Sherbrooke, Québec J1M 1Z3, Canada, and
²Department of Animal Science, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada

*Corresponding author: shresthaj@agr.gc.ca

Abstract

Genetic drift arising from the sampling of individual animals within breed populations, and genes within those individuals contribute towards substantial loss in genetic variation and production performance of endangered breeds which have a small number of male and female parents. In theory, equalizing the number of male and female parents decreases the variance of progeny numbers per parent and increases effective population size. Doubling the number of male and female parents doubles the effective population size, and halves the rate of inbreeding per generation delaying the number of generations taken to attain homozygosity. Genetic drift produces change in gene frequencies, which in turn results in potential loss in performance. Following 20 generations of accumulated genetic drift in livestock and poultry: decreasing the effective population size from 100 male and 100 female parents to 20 male and 20 female parents will double the potential reduction in mean production performance, whereas increasing to 300 male and 600 female parents will halve this reduction in mean production performance. Breeding strategies based on 'randombred' and 'pedigreed' populations in combination with repeat mating of the sires allows for no rise in rate of inbreeding until all sires mate with each dam or dam group. The present study demonstrates that it is possible to safeguard against the loss of genetic variation and mean performance in small populations of endangered breeds, and sustain their genetic authenticity.

Keywords: *Genetic drift, inbreeding, effective population size, randombred and pedigreed populations*

Introduction

Domestic animal diversity has received considerable international attention in the last two decades because genetic variability offers the best opportunity to meet the current and future market requirements for food, commodities, trade, employment and recreation, but is being depleted at such alarming rates that critical levels could occur in the near future. The replacement of the widely held indigenous breeds, populations and landraces with commercial livestock and poultry of superior genetics has been accelerating in the developing countries. This is because of the need to increase the efficiency of production and meet the demand for animal products from the ever-increasing human population. Often unnoticed is the sizeable loss in genetic variation and production performance which occur as a result of genetic drift, particularly in endangered breed populations characterized by a small number of male and female parents. Further loss of genetic variation can happen from a rise in inbreeding rate, founder effect, and genetic bottle necks. Recognizing the importance of this issue, FAO (1998) published guidelines for managing small populations at risk of endangerment. Conservation breeding strategies to lessen the impact of accumulated genetic drift on the erosion of domestic animal diversity and to sustain genetic authenticity of breeds, populations and landraces are the subject of the present study.

Effective population size and genetic drift

In closed populations with a limited number of parents, gene frequencies drift from their initial values as a result of the sampling of genes from generation to generation, increasing the frequency of homozygosity above that in the initial population. Population size as measured by the number of breeding males (N_m) and females (N_f), and their implication in developing breeding strategies were considered here as factors affecting genetic drift (Table 1).

Random breeding population: Mating is random and it is assumed that each parent has an 'equal chance' of contributing to the next generation, and the number of progeny per parent follows a Poisson distribution. Wright (1931) has shown that the effective number of parents (N_e) in this situation

is $\frac{4N_m N_f}{N_m + N_f}$, which can be rewritten as $\frac{1}{N_e} = \frac{1}{4N_m} + \frac{1}{4N_f}$. The inbreeding rate per generation (ΔF) depends upon effective population size, and is $\frac{1}{2N_e}$. Thus, ΔF for a random breeding population is $\frac{1}{8N_m} + \frac{1}{8N_f}$.

Table 1. Effective number of male and female parents, effective population size (N_e), rate of inbreeding per generation (ΔF), number of generations to attain homozygosity, and average value of effective population size as a result of fluctuation in effective parents from generation to generation, in either randombred or balanced pedigreed (in bold) breeding population

Effective parents			ΔF (%)					Homozygosity
Male	Female	N_e	1	5	10	15	20	
(generations)								
1	1	2	25.00	76.27	94.37	98.66	99.68	31
		4	12.50	48.71	73.69	86.51	93.08	
66								
5	5	10	5.00	22.62	40.13	53.67	64.15	172
		20	2.50	11.89	22.37	31.60	39.73	
348								
5	10	13	3.75	17.40	31.76	43.63	53.44	231
		23	2.18	10.47	19.84	28.23	35.75	
399								
10	10	20	2.50	11.89	22.37	31.60	39.73	348
		40	1.25	6.10	11.82	17.19	22.24	
700								
10	20	27	1.88	9.03	17.24	24.72	31.52	466
		46	1.09	5.35	10.41	15.21	19.74	
801								
20	20	40	1.25	6.10	11.82	17.19	22.24	700
		80	0.62	3.09	6.08	8.98	11.78	
1,405								
20	40	53	0.94	4.60	8.99	13.18	17.17	935
		91	0.55	2.70	5.34	7.90	10.39	
1,606								
100	100	200	0.25	1.24	2.47	3.69	4.88	3,518
		400	0.12	0.62	1.24	1.86	2.47	
7,040								
100	200	267	0.19	0.93	1.86	2.78	3.68	4,692
		457	0.11	0.55	1.09	1.63	2.16	
8,046								
100	300	300	0.17	0.83	1.65	2.47	3.28	5,279
		480	0.10	0.52	1.04	1.55	2.06	
8,449								
300	300	600	0.08	0.42	0.83	1.24	1.65	10,562
		1200	0.04	0.21	0.42	0.62	0.83	
21,128								
300	600	800	0.06	0.31	0.62	0.93	1.24	14,084
		1371	0.04	0.18	0.36	0.55	0.73	24,147

Average value of effective population size as a result of fluctuation in effective parents from generation to generation ($\bar{N}_e$)

Generation 1			Generation 2			Generation 3			Generation 4			Generation 1-4
Effective parents			Effective parents			Effective parents			Effective parents			$\bar{N}_e$
Male	Female	N_e	Male	Female	N_e	Male	Female	N_e	Male	Female	N_e	
5	5	10	5	10	13	10	10	20	10	20	27	15
		20			23			40			46	29
10	20	27	10	10	20	5	10	13	5	5	10	15
		46			40			23			20	29
300	300	600	20	40	53	100	100	200	100	200	267	137
		1200			91			400			457	242
100	200	267	100	100	200	20	40	53	300	300	600	137
		457			400			91			1200	242

Inbreeding rate per generation (ΔF) for randombred = $(1/8N_m) + (1/8N_f)$ and balanced pedigreed populations = $(3/32N_m) + (1/32N_f)$; Inbreeding in generation 't' = $1 - (1 - \Delta F)^t$; Number of generations to attain homozygosity = $\log[1 - \{1 - (1 - \Delta F)^t\}] / \log(1 - \Delta F)$.

Balanced pedigreed breeding population: If the distribution of progeny numbers per parent does not follow a Poisson distribution as is assumed above, there will be an effect on the genetic sampling from generation to generation. Any attempt to balance the number of offspring from each parent will

decrease the variance of progeny number and increase N_e . The exact balancing of differences in progeny numbers per parent reduces the sampling variance to zero, while drift variance is one half of that derived from the usual formula. The balanced pedigreed breeding population described in Gowe *et al.* (1959) is one where each male parent has one male offspring and N_f/N_m female offspring, and each female parent has one female offspring and a probability of N_m/N_f of having one male offspring in the next generation. This breeding practise gives $\Delta F = \frac{3}{32N_m} + \frac{1}{32N_f}$ (Hill, 1972).

Genetic bottle neck: The average value of N_e that may occur as a result of fluctuation in effective numbers of N_m and N_f is $\bar{N}_e = t / (\frac{1}{N_{e1}} + \frac{1}{N_{e2}} + \frac{1}{N_{e3}} + \dots + \frac{1}{N_{et}})$, where t is number of generations (Wright, 1939).

Complete homozygosity: $\Delta F \approx 1$ will be attained in $\frac{\log[1 - \{1 - (1 - \Delta F)^t\}]}{\log(1 - \Delta F)}$ generations.

Potential loss of production performance

In livestock and poultry populations, the potential loss in mean performance of economically important traits from accumulated genetic drift can be predicted from N_e together with the additive genetic variance. This is because, in theory, the change in gene frequency due to drift has a variance of $\frac{q(1-q)}{2N_e}$, where q is the frequency of a given allele and N_e is the effective number of parents. For quantitative traits, there is a corresponding effect of genetic drift on the mean performance of populations under constant environmental conditions. The change in mean performance from one generation to the next due to genetic drift has variance ($\hat{\sigma}_d^2$) of $\frac{\hat{\sigma}_g^2}{N_e}$, where $\hat{\sigma}_g^2$ is additive genetic variance. This may be rewritten as $\hat{\sigma}_d^2 = 2\Delta F \hat{\sigma}_g^2$ (Gowe *et al.*, 1959).

Published estimates of genetic parameters in goats (Schoeman *et al.*, 1997; Taddeo *et al.*, 1998; Kominakis *et al.*, 2000; Bosso *et al.*, 2007) and sheep (Barillet and Boichard, 1987; Naser *et al.*, 2001; Ozcan *et al.*, 2005; Bosso *et al.*, 2007; Demirören *et al.*, 1995; Hansen and Shrestha, 1997) were used in conjunction with the above formulas to estimate the influence of 20 generations of accumulated genetic drift on production performance (Table 2). This is expressed as the maximum expected drift in mean performance, which is calculated as $2\hat{\sigma}_d$, and represents the range within which the mean performance should occur 95% of the time.

Results and Discussion

In the randombred (and balanced pedigreed) populations with $N_m=N_f$ and N_e ranging from 2 to 800 (4 to 1371), estimates of change in ΔF decreased from 25 to 0.06% (12.5 to 0.04%), respectively, in generation 1; corresponding ΔF accumulated from 94 to 0.62% (74 to 0.36%), respectively, in generation 10; and from 99.7 to 1.24% (93 to 0.73%), respectively, in generation 20 (Table 1). The number of generations to attain homozygosity for $N_m=N_f=1$ was 31 (66) generations, which was delayed for $N_m=N_f=100$ to 3,518 (7040) generations, and for $N_m=300$ and $N_f=600$ to 14,084 (24,147) generations. An example of average value of N_e as a result of fluctuation from $N_m=N_f=5$ in generation 1, $N_m=5$ and $N_f=10$ in generation 2, $N_m=N_f=10$ in generation 3, and $N_m=10$ and $N_f=20$ in generation 4, or vice versa for the randombred (and balanced pedigreed) populations was 15 (29); and from $N_m=N_f=300$ in generation 1, $N_m=20$ and $N_f=40$ in generation 2, $N_m=N_f=100$ in generation 3, and $N_m=100$ and $N_f=200$ in generation 4, or vice versa was 137 (242).

In theory, the impact on erosion of domestic animal diversity can be lessened, by increasing N_m and N_f , which in turn decreases ΔF . For example, a twofold increase in both N_m and N_f from 10 to 20 will double N_e from 20 to 40, which in turn halves ΔF from 2.5% to 1.25% in generation 1, and from 22.4% to 11.8% in generation 10 (Table 1). At the same time, doubling or tripling the number of female parents relative to a population with $N_m=N_f=100$ will increase the N_e from 200 to 267 and 300, respectively, which will decrease ΔF by 0.06 and 0.08%, respectively, in generation 1, and 0.61 and 0.82%, respectively, in generation 10. Any effort to equalize the number of male and female parents will decrease the variance of progeny numbers per parent and increase N_e . An advantage of increasing N_e would be extending number of generations to attain complete homozygosity. In breeding populations that fluctuate in N_m and N_f from generation to generation, the low N_e in specific generations result in a tremendous loss of genetic variation which cannot be realized by increasing N_e in later generations, unless new variation occurs from mutation. Conservation breeding strategy based on increasing N_e , equalizing the number of male and female parents, and maintaining a constant

population size over many generations demonstrates opportunity for minimizing loss of genetic variation.

Table 2. Effective number of male and female parents, and maximum expected drift in the mean performance after 20 generations ($\pm$) for randombred and balanced pedigree (in bold) populations of goat and sheep.

Effective parents (n)		Boer (Schoeman et al., 1997)				Angora (Taddeo et al., 1998)		Skopelos (Kominakis et al., 2000)		West African Dwarf (Bosso et al., 2007)		
Male	Female	Body wt. (kg) at				Grease fleece wt. (kg)	Mean fiber diameter (μ g)	Milk yield (kg) at		Body wt. (kg) at		
		Birth	100d	6-mo	12-mo			90d	Total	Birth	120d	360d
20	20	0.47	1.21	4.29	3.97	0.27	1.8	13.8	18.1	0.09	1.93	3.67
		0.34	0.88	3.12	2.89	0.19	1.3	10.0	13.2	0.07	1.41	2.67
100	100	0.22	0.57	2.01	1.86	0.13	0.8	6.5	8.5	0.04	0.91	1.72
		0.16	0.40	1.43	1.32	0.09	0.6	4.6	6.1	0.03	0.64	1.22
300	600	0.11	0.29	1.01	0.94	0.06	0.4	3.3	4.3	0.02	0.46	0.87
		0.08	0.22	0.78	0.72	0.05	0.3	2.5	3.3	0.02	0.35	0.66
Mean		4.4	17.8	22.7	36.9	1.52	24.7	156	224	1.57	5.75	8.04
$\hat{\sigma}_g^2$		0.123	0.827	10.34	8.85	0.04	1.77	107.12	185.08	0.0047	2.1002	7.5601
$\hat{h}^2$		0.36	0.60	0.60	0.36	0.25	0.33	0.14	0.07	0.50	0.43	0.30

Effective No. of parents (n)		Lacuane (Barillet and Boichard, 2001)			Dorper (Nese et al., 2001)			Turkish Merino (Ozcan et al., 2005)				Djallonké (Bosso et al., 2007)		
Male	Female	Yield			Body wt. (kg) at			Body wt. (kg) at		Grease fleece wt. (kg)		Body wt. (kg) at		
		Milk (l)	Fat (kg)	Protein (kg)	Birth	42d	100d	Birth	90d	12-mo		Birth	120d	360d
20	20	5.8	1.45	1.26	0.33	1.66	2.61	0.30	2.39	4.56	0.30	0.11	3.78	4.68
		4.2	1.05	0.92	0.24	1.21	1.90	0.22	1.74	3.32	0.22	0.08	2.75	3.40
100	100	2.7	0.68	0.59	0.15	0.78	1.22	0.14	1.12	2.14	0.14	0.05	1.77	2.19
		1.9	0.48	0.42	0.11	0.55	0.87	0.10	0.80	1.52	0.10	0.04	1.26	1.56
300	600	1.4	0.34	0.30	0.08	0.39	0.62	0.07	0.56	1.08	0.07	0.03	0.89	1.11
		1.1	0.26	0.23	0.06	0.30	0.47	0.05	0.43	0.82	0.05	0.02	0.68	0.85
Mean		140	9.43	7.57	3.98	11.9	25.6	4.30	31.2	53.3	5.26	2.01	8.51	14.8
$\hat{\sigma}_g^2$		19.1	1.18	0.89	0.06	1.55	3.83	0.05	3.21	11.68	0.05	0.0066	8.0458	12.2897
$\hat{h}^2$		0.27	0.23	0.22	0.11	0.28	0.20	0.08	0.12	0.25	0.08	0.39	0.54	0.21

Effective parents (n)		Reproduction				Ewe weight (kg)	Lamb mortality (%)		Total lamb wt. per ewe lambing (kg)		
Male	Female	Fertility (%)	Prolificacy (n)	Multiple birth (n)	Fecundity (%)		Birth	91d	Birth	21d	91d
20	20	0.21	0.48	0.13	0.47	5.3	0.10	0.10	1.08	2.88	8.0
		0.15	0.35	0.09	0.34	3.9	0.07	0.08	0.79	2.10	5.9
100	100	0.10	0.22	0.06	0.22	2.5	0.05	0.05	0.51	1.35	3.8
		0.07	0.16	0.04	0.16	1.8	0.03	0.03	0.36	0.96	2.7
300	600	0.05	0.11	0.03	0.11	1.3	0.02	0.02	0.26	0.68	1.9
		0.04	0.09	0.02	0.09	1.0	0.02	0.02	0.20	0.52	1.5
Mean		77	2.4	0.82	190	74.8	18	20	8.9	21.8	64.3
$\hat{\sigma}_g^2$		0.0244	0.1268	0.0088	0.1232	15.9460	0.0052	0.0060	0.6592	4.6648	36.3100
$\hat{h}^2$		0.14	0.15	0.06	0.08	0.21	0.06	0.07	0.10	0.07	0.06

$\hat{\sigma}_d^2 = \hat{\sigma}_g^2 / N_e = 2\Delta F \hat{\sigma}_g^2$, where $\hat{\sigma}_d^2$ = drift variance, $\hat{\sigma}_g^2$ = additive genetic variance, N_e = effective population size, and ΔF = rate of inbreeding per generation. Maximum expected drift in the mean performance following 20 generations of accumulated genetic drift = $2 \hat{\sigma}_d$. Mean, $\hat{\sigma}_g^2$, $\hat{h}^2$ = are genetic parameters.

In goat and sheep, the maximum influence on mean growth, fleece, milk and reproductive traits expected from 20 generations of genetic drift were estimated. These were based on previously published estimates of genetic parameters and N_e 's for $N_m=N_f=20$, $N_m=N_f=100$, and $N_m=300$ and $N_f=600$ for randombred (and balanced pedigree) populations (Table 2), which represent endangered and commercial breeding populations. In general, the maximum influence expected in the mean performance traits of goats and sheep from 20 generations of genetic drift nearly doubled, when the population of $N_m=N_f=100$ was reduced to $N_m=N_f=20$. At the same time, the maximum influence in the mean performance was about half, when the population was increased to $N_m=300$ and $N_f=600$.

These findings were based on estimates for economically important production traits e.g. bodyweights of the Boer breed, fleece characteristics of the Angora breed, and milk yield Skopelos dairy breed, body weights of the West African Dwarf breed, average yield of milk, fat and protein of the Lacuane breed, average body weights at birth, 42d and 100d of the Dorper breed, and average body weights at birth, 90d and 12-mo, and average grease fleece weight of the Turkish Merino breed, average body weights at birth, 120d and 360d of the Djallonké breed, and average fertility, prolificacy, multiple birth, fecundity, ewe weight, lamb mortality at birth and 91d, and total lamb weight per ewe lambing at birth, 21d and 91d in Rideau Arcott breed. One can expect the maximum influence from genetic drift on mean performance of traits to decrease as N_e increases. The influence of genetic drift is cumulative, therefore expected loss in performance, will continue to rise over the following generations.

In a randombred population, the identity of individual animals, as well as pedigree records are not required. Random mating occurs each generation, while ΔF becomes a function of N_e . In theory, these populations are expected to be genetically stable because of the absence of artificial selection, and allows for an estimate of environmental trends. The balanced pedigree population (Figure 1) has the advantage over a randombred population, and each generation, a female or group of females will be assigned to a specific male for breeding, while avoiding half- or full-sib matings. This will reduce ΔF and the expected change in mean performance from genetic drift in a pedigree population by half relative to randombred population. A number of selection studies have utilized pedigree populations as controls to benefit from a lower ΔF compared to the randombred population. The disadvantage of pedigree population is the necessity to identify individual animals and maintain good pedigree records over generations. Examples of maintaining a genetically stable randombred population to measure genetic response to selection are those described in the development of Arcott sheep (Shrestha *et al.*, 1996), and the Chinese and Synthetic strains of geese (Shrestha *et al.*, 2004).

An alternate breeding strategy based on repeated mating of the sire allows for no rise in inbreeding until all sires within a population mate with each dam or group of dams. When the number of sires

repeated exceed years of breeding, the rise in ΔF can be estimated as $\frac{4}{3} \left(\frac{1}{2^s + 3} \right)$, where s = number of

male parents (Smith, 1977). Further reduction in ΔF can be achieved with a combination of repeated mating of sires with the randombred or pedigree populations.

In conclusion, conservation breeding strategies based on randombred or balanced pedigree populations in combination with repeat mating of sires can sustain genetic variability within populations. This can be achieved by minimizing loss of genes within individuals, genetic sampling of individuals in each generation, rate of inbreeding per generation and the expected loss in production performance from accumulated genetic drift, while maintaining genetic authenticity of breeds, populations and landraces.

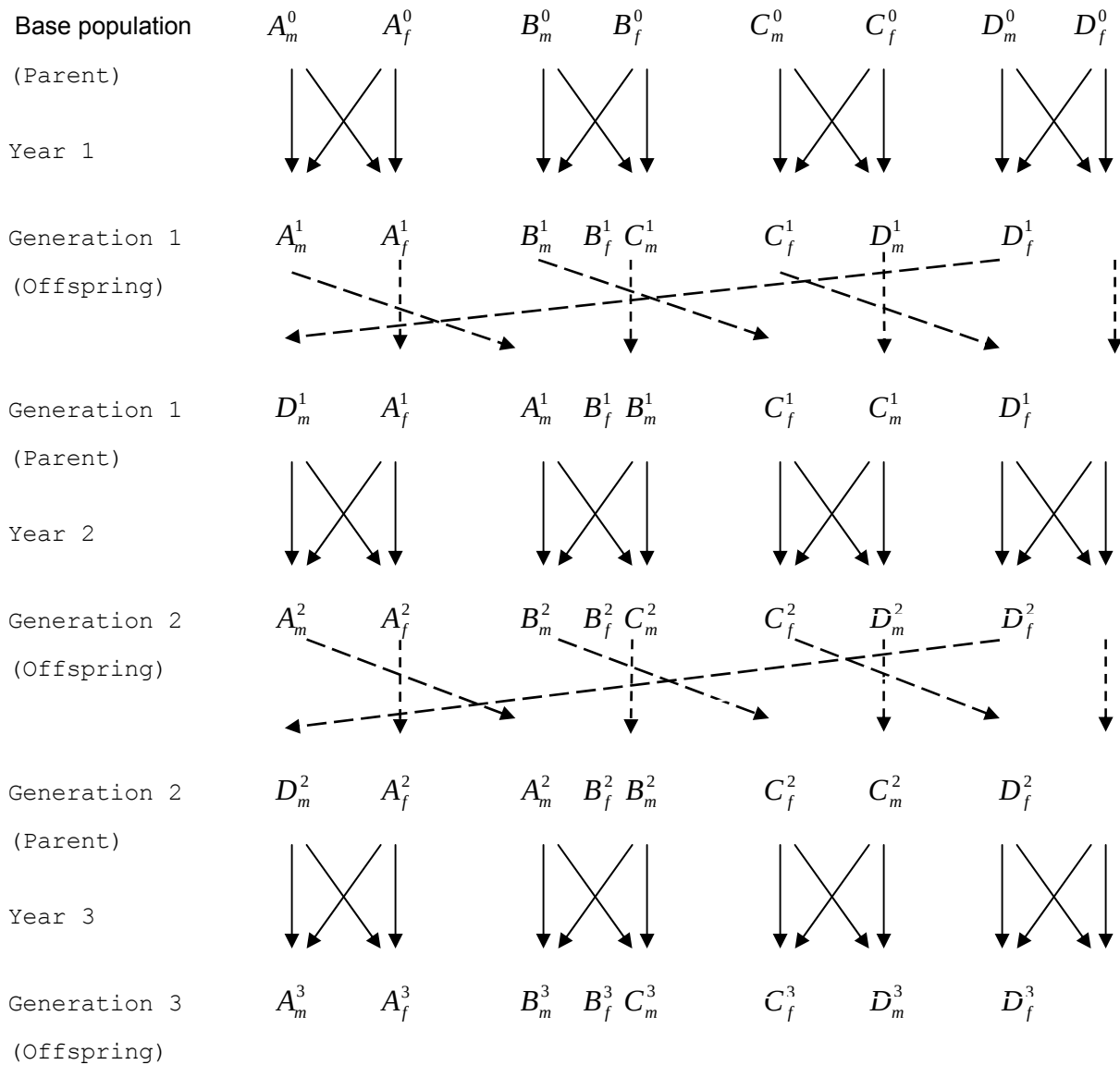


Figure 1. Breeding scheme for balanced pedigree population
 Subscript m = male and f =female, and superscript 1 to 3=1 to 3 generations

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AVIAN GENETIC RESOURCES HELD IN PUBLICLY FUNDED INSTITUTIONS OF AGRICULTURAL RESEARCH IN CANADA

F.G. SILVERSIDES*

Agriculture and Agri-Food Canada, Agassiz Research Centre, Agassiz, British Columbia, Canada,
V0M 1A0

* E-mail: silversidesf@agr.gc.ca

Abstract

Sixty years ago, there were about 300 commercial poultry breeders in Canada and most or all Canadian research institutions that conducted research on poultry maintained their own strains. Since then, industrial breeders have consolidated and discarded genetic variation and institutions have eliminated those lines without immediate research applications. In the early 1980s Canada was home to two major industrial breeders (Hybrid Turkeys and Shaver Poultry Breeding Farms) and 13 commercial breeders that kept a total of 20 stocks of chickens, turkeys, and waterfowl. At about this time, 12 Canadian agricultural research institutions kept 119 lines of nine different poultry species, including 79 lines of chickens. Currently, worldwide industrial poultry breeding is grouped under two companies, neither of which is Canadian, and most Canadian non-industrial commercial lines have

been lost. A survey of the Faculties of Agriculture in the summer of 2005 found that five institutions maintained 33 populations of chickens representing 23 different lines, nine lines of Japanese quail, and one line each of turkeys, ducks, and geese. Four of these populations of chickens and the turkeys, geese, and ducks are no longer being maintained at research institutions. Remaining lines are all kept as living populations because cryopreservation of avian genetic material is poorly developed. The Agassiz Research Centre keeps nine lines of chickens and nine lines of Japanese quail. Using these lines, we are developing methods of gonadal transplantation to allow cryopreservation and recovery of genetic material. We have produced donor-derived offspring from ovaries and testes transplanted between day-old chicks and from ovaries transplanted between week-old Japanese quail. We have also produced offspring from transplanted frozen/thawed testicular tissue in chickens and hope to soon demonstrate similar success with frozen/thawed ovarian tissue. On the basis of these results, we have cryopreserved gonadal tissue from 1,660 day-old chicks or late-term embryos from 18 chicken populations obtained from four Canadian institutions.

Keywords: chicken, Japanese quail, cryopreservation, genetic resources

Introduction

In 1946, there were about 300 Canadian commercial chicken breeders (Shaver, personal communication) and most or all Canadian research institutions conducting poultry research maintained their own lines. In 1980s there were two primary breeders based in Canada (Shaver and Hybrid), 13 middle level breeders of chickens, turkeys, and waterfowl, and 119 populations kept in 11 research institutions (Crawford, 1981; Crawford 1984). Today there are no primary breeders based in Canada and two breeders dominate the international market for layers, broilers (90%), and turkeys. There are few (if any) middle level breeders in Canada, and 38 populations (31 lines) of chickens and Japanese quail are kept by five Canadian institutions conducting agricultural research. This report lists the lines that are maintained as living populations and describes efforts to cryopreserve avian genetic material.

Lines maintained as live populations in Canadian institutions

In 2003, Agriculture and Agri-Food Canada (**AAFC**) implemented a program of avian genetic resource conservation at the Agassiz Research Centre. At that time, the Centre accepted six lines of chickens (Table 1) from Dr. D. Shaver who had collected a total of eight lines since his retirement in 1989. The Agassiz layer lines are maintained yearly with 60 males mated to at least 160 females using artificial insemination with each male mated to three females. Dr. Shaver had practiced mild selection for egg production, but at the Agassiz Research Centre specific pairings are random and pedigree records are not kept. A brief description of these lines is provided by Silversides et al. (2007).

Near the same time, the Centre also entered into an agreement with the University of British Columbia (**UBC**) to accept three additional lines of chickens (Table 1) that had been maintained at UBC for many years under the supervision of Dr. Kim Cheng. The UBC-Minnesota marker and Rhode Island Red lines are kept in floor pens and reproduced with natural matings between 50 males and 100 females. The UBC-rc line is maintained with smaller numbers by back-crossing into the UBC-Rhode Island Red line. In one generation, homozygous blind chickens are mated by artificial insemination to the UBC-Rhode Island Reds, and in the next generation the resulting heterozygotes are mated inter-se to produce 25% blind chickens. Brief descriptions of the UBC-Minnesota Marker and UBC-Rhode Island Red lines are provided by Pisenti et al. (1999). The origin of the UBC-rc line is described by Cheng et al. (1980).

Table 1. Lines of chickens kept at the Agassiz Research Centre		
Line	Year of isolation	
Agassiz Barred Plymouth Rock 60	Early 1950s	From H.R. Richards (Harco), from D. Shaver in 2003
Agassiz Columbia Plymouth Rock	Late 1960s	From several stocks (LS, WL, RIR) with elimination of white skin, from D. Shaver in 2003
Agassiz Rhode Island Red 50	Early 1950s	From the Warren line, from D. Shaver in 2003
Agassiz Black White Leghorn	<1920	Founded on Tancred and Hollywood lines, from D. Shaver in 2003
Agassiz Blue White Leghorn	Late 1960s	Commercial stocks with minimum Mount Hope breeding and the Cornell K line, from D. Shaver

		in 2003
Agassiz Burgundy White Leghorn	Early 1990s	Slow feathering from K Line with very little Mount Hope breeding, from D. Shaver in 2003
UBC-Minnesota marker	Late 1960s	Gene pool carrying 18 dominant genes, from UBC in 2003
UBC-Rhode Island Red	~1960	From Minnesota, 80% inbred in 1981, from UBC in 2003
UBC- <i>rc</i>	1980	Carries mutation for blindness, <i>GUCY1*</i> , from UBC in 2003

Nine lines of Japanese quail (Table 2) also came to the Agassiz Research Centre in 2003 under the agreement with UBC. The Japanese quail are reproduced yearly with natural reproduction of 50 males and 100 females, except that the Inbred and Atherosclerosis lines are pedigree mated. Matings in the Inbred line are planned to increase the inbreeding at a low rate, and the Atherosclerosis lines are selected every two generations to maintain the distinction between them. The Atherosclerosis lines are best described by Shih et al. (1983), the QO line by Caron et al. (1990) and the inbred line by Kim et al. (2007). Information on the other five lines of Japanese quail or the genes they contain is best accessed by consulting Pisenti et al. (1999) and Cheng and Kimura (1990), with the knowledge that budget cuts in 2000 resulted in consolidation of several lines carrying single genes into the UBC-White breasted and UBC-Cinnamon lines (Cheng, personal communication).

Table 2. Lines of Japanese quail kept at the Agassiz Research Centre		
Line	Year of isolation	
UBC-Wild	1985	From 12 feral quail captured in Hawaii
UBC-Randombred	1968	Quail from Korea crossed with a UC Davis strain
UBC-Nagoya	1988	From University of Nagoya with blue egg gene, <i>ce</i> , added
UBC-Atherosclerosis resistant	<1983	Acquired from North Carolina State University
UBC-Atherosclerosis susceptible	<1983	Acquired from North Carolina State University
UBC-Meat line	2000	From Deschambault Research Station, Quebec and two commercial lines
UBC-Inbred	1992	Derived from UBC-Meat line
UBC-White breasted	2002	Pool: <i>wb, erh, wh, Y, Bh, B, pc, AID, al</i>
UBC-Cinnamon	2002	Pool: <i>cin, YF, rt, sp, E, sb, H5 histone</i>

The University of Alberta maintains 10 lines of chickens (Table 3) originating from the AAFC Central Experimental Farm in Ottawa (1957, 1977 male and 1977 female lines), from Dr. Shaver's collection (Lines 55 and 90), and from the extensive collection of middle-level commercial stocks originally kept by Dr. Roy Crawford at the University of Saskatchewan. The Alberta lines are maintained by natural matings in floor pens; reproduction of the Ottawa and Saskatchewan lines uses 10 males and 80 females and that of Shaver's lines uses 50 males and 220 females. The Ottawa lines are described by Gowe and Fairful (1990). To my knowledge there is no published description of the Rhode Island Red Line 55 and Barred Plymouth Rock Line 90 and the Saskatchewan lines are briefly described by Crawford (1981). Silversides et al. (2006) provides more information on the Saskatchewan Brown Leghorn line.

Table 3. Lines of chickens kept at the University of Alberta		
Line	Year of isolation	
U of Alberta 1957 Meat Athens Randombred	1958	From AAFC Ottawa
U of Alberta 1977 Meat male line	1979	From AAFC Ottawa
U of Alberta 1977 Meat female line	1979	From AAFC Ottawa
Rhode Island Red Line 55	?	From D. Shaver in 2003
Barred Plymouth Rock Line 90	?	From D. Shaver in 2003
Saskatchewan White Leghorn	1956	
Saskatchewan Brown Leghorn	1965	From commercial source in Ontario
Saskatchewan Light Sussex	1965	From commercial source in Saskatchewan

Saskatchewan Barred Plymouth Rock	1920s	
Saskatchewan New Hampshire	1950s	From a commercial source in 1980

The University of Saskatchewan was a leader in conservation of avian genetic resources for many years and continues to maintain a line of Barred Plymouth Rocks (Table 4, the same line is kept at University of Alberta) and one carrying a gene for epileptiform seizures (Crawford, 1970). The University of Saskatchewan uses artificial insemination with 20 males and 50 females for the Barred Plymouth Rocks and 40 males and 80 females for the Epileptic line. This year, the Nova Scotia Agricultural College obtained four lines originally from the University of Saskatchewan that are also kept either by the Universities of Saskatchewan or Alberta. With the transfer of lines to Nova Scotia Agricultural College, the University of Saskatchewan stopped maintaining the Brown Leghorn and Light Sussex lines.

Table 4. Lines of chickens kept at the University of Saskatchewan and Nova Scotia Agricultural College		
Line	Year of isolation	
U of Saskatchewan		
Barred Plymouth Rock	1920s	Selected for many years
Epileptiform seizures	<1963	Gene, <i>epi</i> , first identified in 1963
Nova Scotia Agricultural College		
Saskatchewan Brown Leghorn	1965	From U of S in 2008
Saskatchewan Barred Plymouth Rock	1920s	From U of S in 2008
Saskatchewan Light Sussex	1965	From U of S in 2008
Epileptiform seizures	>1963	From U of S in 2008

The University of Guelph maintains six lines of chickens (Table 5), including four of the layer lines also kept at the Agassiz Research Centre. "Smokey Joe" is described by Kirby and Bedecarrats (2006) and I have no additional information on the Leghorn line that they maintain.

Table 5. Lines of chickens kept at the University of Guelph		
Line	Years of isolation	
Barred Plymouth Rock 60	Early 1950s	From H.R. Richards (Harco)
Rhode Island Red 50	55	From the Warren line
Black White Leghorn	90	Founded on Tancred and Hollywood lines
Agassiz Columbia Plymouth Rock	40	From several stocks (LS, WL, RIR) with elimination of white skin
"Smokey Joe"		Obtained from MSU
Leghorn		Susceptible to fatty liver

Cryopreservation of cells and tissue

Blastodermal cells from 43 lines of chickens from AAFC in Ottawa and the University of Guelph were isolated and frozen in liquid nitrogen in 1995 and stored at the University of Guelph before their recent transfer to the Canadian Animal Genetic Resources (**CAGR**) program in Saskatoon. A total of 1,150 vials are stored, with each line represented by 2 to 124 vials. In 2008, the CAGR program collected and stored semen from two lines of chickens (1 to 11 straws for each of 414 males, total 188 straws) and one line of turkeys (up to 20 straws from each of 43 males, total 320 straws) from the University of Saskatchewan. To my knowledge, the only other cryopreserved avian material is the gonads that were stored at the Agassiz Research Centre in 2007.

Gonadal cryopreservation at Agassiz

Until now, the only effective method of conserving poultry germplasm has been in living animals. Fertility obtained from cryopreserved chicken semen is unpredictable (Fulton and Delany 2003) and the structure of the avian egg prevents its cryopreservation. Embryonic cells can be stored and used to generate germline chimeras (Tajima et al. 1998) but with complex procedures and low efficiency. Transplantation of ovaries began long ago for mammals, and freezing ovarian tissue of some mammals is a simple and effective method of conserving the female germline (Paris et al. 2004). Over the past century, chicken ovarian transplantation has been attempted (Grossman and Siegel 1966) with limited success until the reports by Song and Silversides who produced donor-derived offspring from ovarian (2006, 2007a, 2008b) and testicular (2007b) tissue. Mammalian testicles have also been

frozen (Pukazhenthi et al. 2006) and Song and Silversides (2007c) reported the production of offspring from cryogenically preserved chicken testicular tissue. Techniques of ovarian transplantation in the chicken have also been adapted for the Japanese quail (Song and Silversides, 2008a). Based on the development of these procedures, we have frozen gonads from 1,660 day-old chicks or late-term embryos from 18 chicken populations kept at Nova Scotia Agricultural College, the University of Saskatchewan, the University of Alberta, and the Agassiz Research Centre. This is described by Silversides et al., submitted).

Next steps in cryopreservation

At the Agassiz Research Centre, we continue to develop the program for cryopreservation of gonads. Although we have demonstrated the production of offspring from cryopreserved testes, we have yet to demonstrate the production of offspring from cryopreserved ovaries or the regeneration of a complete line. We would also like to optimize the developmental stage for transplantation and the site for testicular transplantation, and would like to simplify the procedure for insemination using testicular sperm. We are currently working (with Drs Song and Cheng and Ms Liu, an MSc student) on transplantation between related avian species, and we continue to develop the collection.

Conclusions

In the past 70 years, there has been a dramatic decline in the number of pure lines of poultry maintained in Canada, including those held in publicly funded institutions conducting Agricultural research. Only five of Canada's eight Faculties of Agriculture maintain pure lines of poultry, and only 31 different lines are represented, although several of these lines are kept at more than one institution. There is a limited amount of material stored cryogenically as blastodermal cells and semen. In addition, the Agassiz Research Centre is actively conducting research on cryopreservation of avian gonads and has begun to collect material from Canadian lines.

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PHAN RANG SHEEP-TYPICAL DEVELOPMENT OF INDIGENOUS BREED IN VIETNAM

DINH VAN BINH¹, LE VIET LY²; NGUYEN THI MAI³

¹Goat and Rabbit Research Center (GRRC)

²National Institute of Animal Husbandry (NIAH)

³NinhThuan Science Technology Department

Summary

Local Phan Rang sheep is a very good animal of Vietnam they have body weight at adult from 30-35kg (female), 45-50kg (male). Reproductivities: Litter size was 1.36-1.45; Lambing per litter 1.4-1.5; Ages first matting at 270-300 days. Carcass rate is 42-44%; Muscle is 29,2- 29,6%. They adapted very well in the North of Vietnam so can razing very good in North, Centre and South of

Vietnam. After more than 15 years studies, conservation, development population of Phan Rang sheep are increased very quick.(2000 to 2007: 24% per years) From 3.230 sheep in 1991 up to now (2007)there are 64,000 heads Phan Rang sheep and the price of sheep meat are also increased from 5,000VND to 45,000VND per kg live weight. In 2008 development Phan rang sheep is a Advanced Technologies in Agriculture of Vietnam.-Phan rang Lamb is a special product liked by many consumers. The range of consumption market is enlarging to all of provinces in Vietnam and the price is increasing and stabilizing. Phanrang sheep production at Ninhthuan having a well development prospects. Consequently, Phanrang sheep is playing an important role not only in the livestock production but also in the changes in the agricultural structure and encouraging the developments of sheep production at Ninhthuan province and other provinces in Vietnam.

Keywords: productivity Performance; adaptation, development

Introduction

Since 1967 there were 500 sheep from Mongolia and 1976 there were 600 sheep from China were imported to the north Vietnam, however they could not adjusted to the harsh conditions (hot and wet) in this area and everyone have thought that the sheep could not raised in the Vietnam.

Whereas, the local Phan Rang sheep (short thin tailed), origin from may be India or France were existed and well developed with the hot dry weather and poor nutritive food in Ninhthuan province for hundred years and used for meat production purpose. (Ly and et al., 1991).

The population of Phan Rang sheep before 1975 were about 14.000-15,000 heads. From 1976 to 1990 The population of Phan Rang sheep were decrees to 6,000 -7,000 heads event in 1976 there were only 3.260 heads..

In 1994 there was a program on indigenous breed genetic Conservation in Vietnam and Phan Rang sheep was one of the animals of this program. Some studies on determine of biological characteristics and productivity performance of Phan Rang sheep were carried out and .the population of Phan Rang sheep were maintained around from 5,000 to 6,000 heads

However, the introduction of this sheep breed to others places of the country has ever been conducted by anyone, therefore the question has appeared that can local Phan Rang sheep adapt and develop in North or the other areas of Vietnam? And how to maintain and development Phan Rang sheep in Vietnam?

In odder to answered this questions From 1998 to 2005 the studies on adaptation and development Phan Rang sheep was conducted at Goat and Rabbit Research Centre and some provinces such as Ninh binh, Hatay, Quang ninh, Hai Duong, Quang Binh, Phu Tho provinces to identify their adaptation, production and reproduction abilities with raising conditions in Northern Vietnam

Results of studies, Conservation and developments of local Phan Rang sheep

Some situations of Ninh Thuan province

Ninhthuan province is located at the southern end of central Vietnam. It occupies the geographically favorable position as central transportation point. Natural area of the province is 3,430 km² with 393km length of plain, 105km of coastal. There are 58,213.6 ha of cultivated land, which accounts for 17% of natural land area. The climate is a combination of the tropical monsoon and dry and windy weather. The annual average temperature is 27 °C, mean humidity and rainfall are 73% and 753mm respectively. The population is 442,300 with the density of 163 people/ km²; in which Kinh group accounts for 78% and minor ethnics such as Cham, Raglay, Hoa, k"Ho...accounts for 22% of the population. Agricultural economy occupies about 30.08% of GDP of the province, of which 59.7% is from crop production, 30.3% is from livestock production and 10% is from service section. Up to now Ninh thuan is one of the poorest province of Vietnam and sheep species plays an especial role in changes in crop and livestock structure and it is paid more attentions by Ladders of the Ninhthuan province. Sheep is an animal species that can contribute to hunger and poverty alleviation for farmers in Vietnam.

Determine productivities performances of Phan Rang sheep

Phan Rang sheep breed have two kind of phenotype of there hair:

Fur hair Phan rang sheep



Twisted Hair Phan rang sheep



+ Reproductive abilities of Phan Rang sheep are reported in table 1. Phan Rang sheep gestation was 146 and 147 days . Litter size was 1.36-1.45 ; Lambing per litter 1.4 -1.5; Ages first matting at 270-300 days.

Table 1: Reproduction Characteristics of Phan Rang sheep

Parameter	Fur hair		Twisted Hair	
	n	Mean and SE	n	Mean and SE
Males				
Copulated reflex (days)	12	153±14.5	16	159±14.1
First mating age (days)	6	295±25.4	4	308±19.8
Females				
First oestrus age (days)	28	171±13.5	23	185±15.7
Age at first mating (days)	25	295±35.15	20	309±37.8
Oestrus intervals(days)	50	19±4.55	22	20±4.25
Length of gestation (days)	48	146±2.87	20	147±2.1
Litter size (heads/litter)	109	1.46	58	1.25
Lambing Intervals (Days)	50	246±24.7	6	252±27.3
No of Lambs/doe/year	40	1.69	7	1.37
Survival rate (0-3month) %	48	95.4	13	92.7

Table 2 : body weight Change of Phan Rang sheep

	Ages (month)	sex	Hair Phenotype Phan Rang sheep			
			n	Fur hair	n	Twisted Hair
1	At Birth	Male	165	2.6	132	2.4
		Female	172	2.4	141	2.3
2	3 Month	Male	155	14.2	123	13.1
		Female	164	12.8	116	11.7
3	6 Month	Male	143	20.4	84	17.5
		Female	151	17.6	86	16.3
4	9 Month	Male	64	23.6	37	20.5
		Female	135	20.8	102	19.2
5	12 Month	Male	29	30.7	31	26.4
		Female	126	27.6	98	25.7

12 lambs were slaughtered at 6 months of age after a 24 hour fast. The results showed that the carcass rates were 44.2% and 40.4% for long hair and roll hair Phan Rang sheeps respectively (table 3). This value is equivalence value reported by Chacon et al. (1970; cited in Combellas, 1980) for the lamb of tropical breeds was 44.9%. However, this value is in the range of value reported by Lopez et al. (1979; cited in Combellas, 1980) for the sheep of mixed tropical breeds up to 5 years of age was from 39.1% to 46.9%.

Table 3. Carcass characteristic of lambs (mean and SE) at 6 month of age

Parameters	Fur hair PR. Sheep (n=6male)	Twisted Hair sheep (n=6 male)
Average body weight (kg)	20.22±1.51	17.76±1.72
Carcass (%)	44.2±2.12	40.40±1.79
Muscle (%)	29.67±1.32	29.28±1.17
Bone (%)	10.33±0.75	10.13±0.89
Head (%)	6.37±0.675	6.3±0.81
Viscera (%)	35.44±2.91	35.02±2.32
Hooves (%)	2.86±0.16	2.87±0.25
Skin and wool (%)	7.17±0.51	10.69±0.46
Blood (%)	4.9±0.24	4.28±0.34

+ Milk production is presented in table 5. The highest milk yield was recorded at the first month of lactation period for both generations and thereafter it was slightly declined. This finding is consistent with finding of Combellas (1980) who reported that the lactation peak in tropical sheep was reached in the first week after parturition and thereafter production decreased rapidly, being very low after 8 weeks of lactation.

Table 4. Milk production in sheep (kg/day)

Month	Fur hair PR. sheep		Twisted Hair PR. sheep	
	n	Mean and SE	n	Mean and SE
1	40	0.57±0.17	15	0.72±0.18
2	38	0.52±0.08	14	0.52±0.07
3	38	0.40±0.04	14	0.42±0.05

+ The results of feed conversion ratio (FCR, table 5) showed that FCR were very similar for both Phan Rang sheep

Table 5: Feed conversion ratio of sheep

Parameter	Fur hair PR. sheep		Twisted Hair PR. sheep	
	n	Mean and SE	n	Mean and SE
Kg Milk/kg weight gain (0-3 months)	34	4.2±0.72	32	4.1±1.2
Kg DM/ kg weight gain				
3-6 months of age	25	5.98	28	5.84
6-9 months of age	20	6.31	22	6.23
9-12 months of age	16	6.84	18	6.7
Kg DM/ kg weight gain				
3-6 months of age	25	0.60	28	0.59
6-9 months of age	20	0.63	22	0.62
9-12 months of age	16	0.65	18	0.64

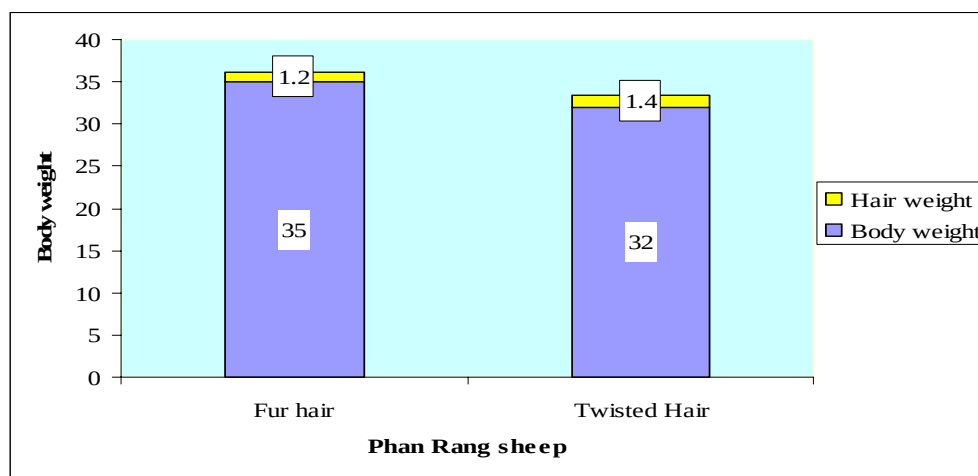
+ Some index of physiologies and Biochemistry of Phan rang sheep

Table 6 Some index of physiologies

arameters	Body temperature (oC)		Heart rate (Time/Minute)		Breathing rate (Time/Minute)		Rumen movement (Time/2minute)	
	Long Hair	Roll Hair	Long Hair	Roll Hair	Long Hair	Roll Hair	Long Hair	Roll Hair
Male	<u>39.28</u>	<u>39.45</u>	59.37	61.05	<u>15.3</u>	<u>15.9</u>	1.97	1.95
Female	39.24	39.24	<u>65.71</u>	<u>66.6</u>	17.6	18.1	<u>2.05</u>	<u>1.97</u>

Table 7 Some index of Biochemistry

Parameters	Unit	Fur hair (Female)	Twisted Hair (Female)	Fur hair (Male)	Twisted Hair (Male)
Red blood cell	Milion/mm ³	9.74	9.84	10,55	10,68
White blood cell	Thousan/mm ³	9.5	9.2	9,1	8,80
Hemoglobin	G%	7.3	7.61	7,9	8,10
Total Protein	G%	6.03	6.3	6,12	6,28
Albumin	%	40.41	41.1	40,52	40,48
A Glubin	%	17.81	16.6	17,88	17,68
B Glubin	%	17.63	17.1	17,61	17,75
γ Glubin	%	23.44	21.2	23,55	23,45

Diagram 1: Bodyweight and hair weight of Phan Rang sheep

Results of studying on Adaptation of Phan Rang sheep at GRRC and some provinces of the North Vietnam

In 1998 there were 55 original Phan Rang sheeps from Ninh thuan province (Centre coast of Vietnam) were transferred to Goat and Rabbit Research Center (GRRC) in Bavi Hatay province (North of Vietnam) by road with thousands km for adaptation studying. There was no serious happened due to changes in living conditions. After 3 years raised at GRRC with harsh climate conditions (hot and wet), the sheep were still well developed without serious diseases.

+ Reproductive abilities of Phan Rang sheep are reported in table 1. Phan Rang sheep raised at GRRC for both parent and first generations had a similar results compared to the sheep raised at Ninh thuan. The duration of gestation (at Bavi) was 146 and 147 days for parent and first generations respectively, while it was 150 days for sheep raised at Ninh thuan. Litter size was 1.36-1.45 at Bavi and 1.45 at Phan Rang.

Table 8: Reproductivities characteristics of Phanrang sheep

Parameter	Parent		First generation		Ninh thuan*
	n	Mean and SE	n	Mean and SE	
Males					
Copulated reflex (days)	12	153±14.5	16	149±14.1	150
First mating (days)	6	295±25.4	4	308±19.8	300
Females					
Age at estrus (days)	28	181±13.5	23	185±15.7	180
Age at first mating (days)	25	295±35.15	20	309±37.8	270-300
Interval between estrus (days)	50	19±4.55	22	18±4.25	16.17
Leng of gestation (days)	48	146±2.87	20	147±2.1	150
Litter size (lams/litter)	109	1.36	58	1.45	1.35
Interval between births (Days)	50	246±24.7	6	252±27.3	250

Body weight changes and daily weight gain of lambs are showed in table 2 and 3. The body weight of male lambs in both generations at every recorded times were higher than that of female lambs (table 2). The highest daily weight gain was obtained in period from 0 to 3 month of age, thereafter gradually decreased (table 3). In general, body weight of sheep born in Ninhthuan (parent) at every recorded times was similar to those obtained in sheep born in GRRC. The growth rate was also similar for both generations.

Table 9. Body weight changes of lambs (kg/head)

Month of age	Parent				First generation			
	Male		Female		Male		Female	
	n	Average	n	Average	n	Average	n	Average
At Birth	22	2.59±0.76	24	2.27±0.06	22	2.58±0.46	28	2.32±0.2
3	17	14.48±3.1	24	13.36±2.36	18	14.73±1.3	27	13.87±1.2
6	16	21.47±5.7	23	20.99±3.77	16	21.39±1.89	26	20.78±2.0
9	14	27.19±3.3	21	24.64±1.28	15	27.43±2.17	24	24.79±1.5
12	12	28.09±4.0	20	26.63±1.76	14	28.1±1.88	23	26.8±1.87
18	5	36.1±1.08	20	28.3±4.51	12	36.5±1.2	22	29.02±3.4
24	5	49.5±1.8	20	33.9±2.8	5	49.9±1.9	21	34.8±1.8

Table 10: Weight gain of lambs (g/day)

Period (months)	Parent		First generation	
	Male	Female	Male	Female
0-3	122.43	109.4	123.51	112.12
0-6	107.9	104.6	108.85	104.78
0-9	92.76	83.22	92.53	84.15
0-12	72.11	68.15	73.09	68.95

After five years raised at GRRC, the Phanrang sheep were demonstrated to adjust and well develop in hash environment in Northern Vietnam, the productive and reproductive parameters of these sheep were similar or higher compared to those obtained in Ninhthuan province.

The number of sheep in Northern has been yearly increasing from 55 heads at the beginning to more than 500 heads in 2003.

The sheep born in Bavi had a better resistant ability to the common diseases compared to their parent. During 2001 to 2003 there was no sheep died, it means that the Phanrang sheep have been well adjusted with the environmental conditions and management systems in Northern Vietnam.

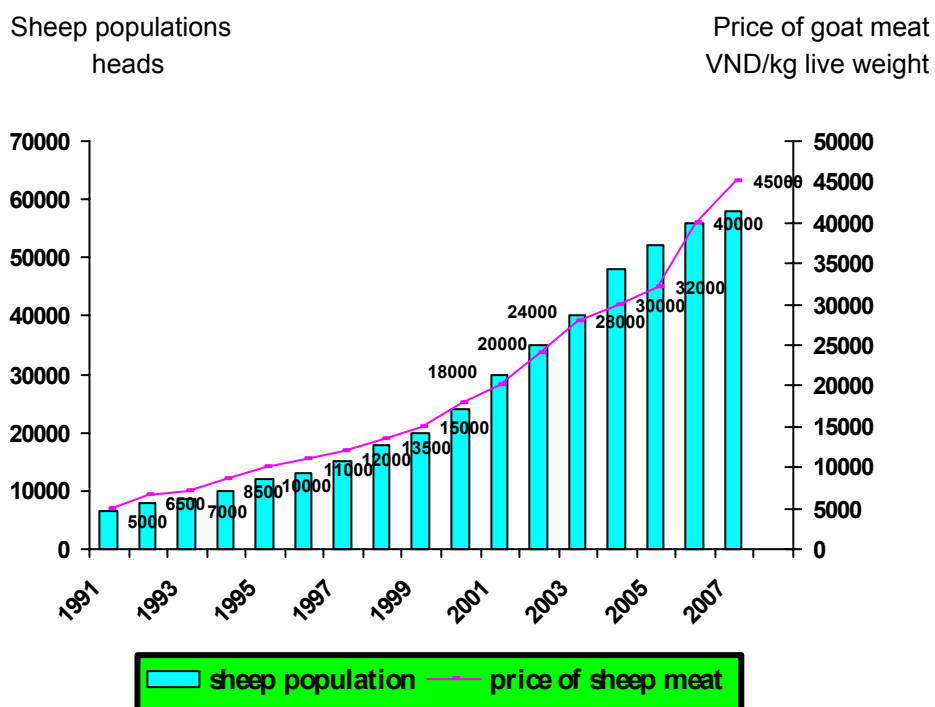
Development Phan rang sheep in Vietnam

From 1999 up to 2008 Phan rang sheep were raised many provinces in Vietnam such as: Hatay, Haiduong, Ninhbinh, QuangNinh, Phutho, Quangbinh, YenBai(North Vietnam) Binhthuan, Phuyen, Daclac, Dongnai. Vungtau (Center Vietnam) Tiengiang, Kiengiang, Cantho(Mekong Delta). Population of Phanrang sheep are increased very quick.(24% per years) From 3.230 sheep in 1991 up to now (2007)there are 64,000 heads Phan Rang sheep and the price of sheep meat are also increased from 5,000VND to 45,000VND per kg live weight. In 2008 development Phan rang sheep is a Advanced Technologies in Agriculture of Vietnam.

Table 11: Livestock population and production trends

	Population (1000 heads) 2000	Population (1000 heads) 2004	Population (1000 heads) 2005	Population (1000 heads) 2006	Population (1000 heads) 2007	Growth rate (%)/ year 2000 - 2007
Pigs	20.194,0	26.144,0	27.435,0	26.855,0	26.644,0	8.5
Cattle	4.127,9	4.908,0	5.540,7	6.511,0	4.908,0	7.2
Poultry	196.100,0	218.200,0	219.900,0	214.600,0	213.800,0	2.1
Buffalos	2.897,0	2.870,0	2.922,0	2.920,0	2.921,0	0.2
Goats	525,0	1.006,0	1.314,0	1.472,0	1.712,0	21.6
Sheep	27,5	31,2	40,2	58,5	64,2	24.2

Sheep population and price of sheep meat



Conclusions and Recommendation

1- local Phan Rang sheep is a very good animal of Vietnam they have body weight at adult from 30-35kg (female), 45-50kg (male). Reproductivities: Litter size was 1.36-1.45 ; Lambing per litter 1.4 - 1.5; Ages first matting at 270-300 days. Carcass rate is 42-44% ; Muscle is 29,2- 29,6%

2- local Phan Rang sheep can adapted very well in the North of Vietnam . They can razing very good in North, Centre and South of Vietnam.

3- After more than 15 years studies, conservation, development population of Phanrang sheep are increased very quick.(24% per years) From 3.230 sheep in 1991 up to now (2007)there are 64,000 heads Phan Rang sheep and the price of sheep meat are also increased from 5,000VND to 45,000VND. In 2008 development Phan rang sheep is a Advanced Technologies in Agriculture of Vietnam

4- Phan rang Lamb is a special product liked by many consumers and it will be consume more and more in coming years. The range of consumption market is enlarging to all of provinces in Vietnam and the price is increasing and stabilizing. With the sustainable climate for sheep production and the high experiences of the raiser that lead the Phanrang sheep production at Ninhthuan having a well development prospects. Consequently, Phanrang sheep is playing an important role not only in the livestock production but also in the changes in the agricultural structure and encouraging the developments of sheep production at Ninhthuan province and other provinces in Vietnam.

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CONSERVATION OF FARM ANIMAL GENETIC RESOURCES OF TURKEY

SOYSAL, M.I.

Department of Animal Science, Namik Kemal University, Tekirdag-Turkiye

Abstract

Türkiye has a great potential for animal production and the topographic and climatic conditions are favorable for animal husbandry in general. Even though Türkiye is among the leading countries in the numbers of some of the livestock, the animal productivity sometimes can be quite low due to the high numbers of low producing, unimproved native animals. Nevertheless, the adaption capacity of these indigenous animals, to the local conditions is higher than cultural breeds.

Animal Genetics Resources is a component of biological diversity and it is important in meeting her food requirement of countries of the world. Simply there is a paradox between economical development and ecology one of the elements of the pollution is the tendency of decreasing number of animal breeds.

Turkey has a great potential for animal genetic resources and also animal production. Development of Turkey's animal production in the last twenty years caused risk of extinction for farm animal genetic diversity. Several examples and the risk potentials existed in Turkey.

Cattle population decreased from 18 million down to 11 million within 30 years through several cattle improvement projects in an attempt to increase the productivity of the native breeds. Also sheep and goat population decreased last 20 years. Several reasons of the risk of extinction of farm animal genetic sources of the Turkey were argued. But today there is a structure of the global strategy for management of farm animal genetics resources in Turkey. The establishments and activities regarding conservation of Animal Genetic Resources in Turkey according to the convention on Biological Diversity (CBD) acted by UN and also FAO and several NGO's were explained in the text.

Introduction

Türkiye has a great potential for animal production and the topographic and climatic conditions are favorable for animal husbandry in general. Even though Türkiye is among the leading countries in the numbers of some of the livestock, the animal productivity sometimes can be quite low due to the high numbers of low producing, unimproved native animals. Nevertheless, the adaption capacity of these indigenous animals, to the local conditions is higher than cultural breeds.

Türkiye is ranking among the top countries in terms of cattle, sheep, goat numbers. However these numbers seemed to have been reduced over the recent years and particularly during the recent decades.

Native farm animal genetic resources constitute an important resource in total number of farm animal population.

Production systems in Türkiye vary from changes in international and national agricultural policies and in the milk and beef markets had greatest effect to the production systems and changing the content of population from native breeds to the exotic breeds. The insufficient productivity of native breeds resounded the declining trend of the native farm animals in total animal population. Breeds of low economic values were investigated in the beginning of the republican period and showed that the selection would be ineffective to obtain the production values same as exotic breeds.

Türkiye has a great potential for animal production and the topographic and climatic conditions are favorable for animal husbandry in general. Even though Türkiye is among the leading countries in the numbers of some of the livestock, the animal productivity sometimes can be quite low due to the high numbers of low producing, unimproved native animals. Nevertheless, the adaption capacity of these indigenous animals, to the local conditions is higher than cultural breeds. Cattle population of Türkiye is approximately 11 million heads and sheep and goat populations of this country are 29 and 8 millions, respectively. Türkiye ranks among among the leading countries in the population of cattle sheep and goat.

Native cattle breeds accounted for 75% of the total cattle population in the country and are consisted of mainly Native Black, Anatolian Red, Native Grey, Southern Red and Yellow native breeds. However native sheep breeds of Türkiye comprise almost 94% of the total sheep population and the native breeds are primarily Kıvrıkcık, Sakız, Dağlıç White Karaman, Karayaka, Awassi, Red Karaman and Tuj. The most peculiar indigenous goat breed of Türkiye is basically Angora goat. The total 11

million cattle are the sum of native cross breeds and the imported modern dairy cattle breeds. Modern dairy cattle accounted for almost 25% of the present cattle population. Typical characteristics of the Turkish dairy Cattle Husbandry is being as a family scale operation rather than a larger scale operations suited to the needs for the dairy industry. Average number of animals per operation is 5 heads and 14 heads for the Holstein – Friesian Breeding Union members. The production potential for dairy cattle is quite high. However we need to spread out the establishment of the breeding organization to the whole countryside and increase the number of members of HFBU in order to increase the average milk production level.

Cattle Production

Cattle population decreased from 18 million down to 11 million within 30 years through several cattle improvement projects in an attempt to increase the productivity of the native breeds. These projects consisted of mainly cross breeding of these low producing native animals with high producing modern breeds such as Black and White or Brown Swiss dairy cattle. Simmental and other beef type cattle were used to improve growth rate and carcass quality of the native cattle located particularly in the Marmara and Blacksea regions

Native Cattle Breeds in Türkiye

Unfortunately there is no data as results of official inventory studies done as a census based on breed. It is also estimated that total (10) Million head cattle existed in Türkiye

Total (3) Million head of native cattle population (30% of total population) remained as estimation of 2005.

The remaining population (70% of total cattle) is consisted of whether purebred of mostly Holstein, Brown Swiss, Jersey and few Simmental or crossbreed of these breed with local breeds.

The distribution of Native cattle breeds is estimated as Native Black cattle (17%), Eastern Anatolian Red (10%), Southern Yellow and Red (3%) and Grey cattle 0.002%; 2000 head only)

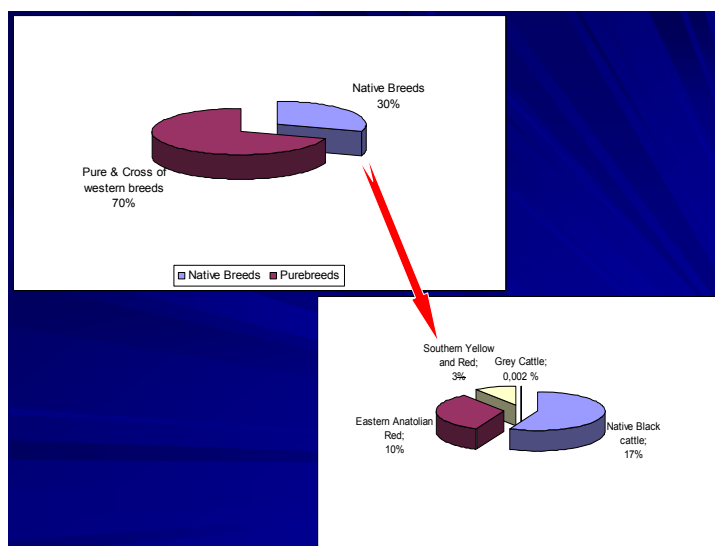


Figure 1 Distribution of Native cattle breeds in Türkiye

There are mainly three genotype sources for dairy cattle as native, imported (pure, exotic) and cross breed among imported and native cattle breeds. Most of local native cattle Native Black cattle in Türkiye (33.82%). Native Black cattle are raised all over Türkiye, except eastern Anatolia and the European part of Türkiye. Characteristics features of Native Black cattle breed are relatively small body size, black color and short horns. There are small white color spots on the underside of the body and around the udder. Under village conditions, live weight and milk production varies between 200-300 kg and 500-600 kg respectively.

The Native Black can be raised easily in central Anatolia where poor conditions exist. The Native Blacks have relatively high adaptability for inadequate conditions, some improvement programs have been carried out for Native Blacks. As a result it can be told that it is possible to get 300-400 kg live weight and 1500-2000 kg milk yield. The breeding purposes of Native Black are milk, meat and source of power (as a working animal).

Gray Cattle (or Grey Steppe) Breed is originated from the Balkan region of Europe, so the other name of this breed is Plevne cattle breed. They are raised in Trakya (European part of Türkiye),

Marmara Region, Western Anotolia and partly in Central Anotolia. The Grey cattle have big horns and usually a grey colour. Their body size is relatively large. They are used especially as power source. The live weight which depends on levels of nutrition, management and housing facilities vary from 300-350 kg and milk production can reach up to 800-1000 kg and sometimes 1500-2000 kg . Since meat fibers are thick and strong the meat quality is not good. In order to improve their performance they were mated with Brown Swiss bulls.

Eastern Red Cattle breed is raised mainly in Eastern Anotolia especially in Kars, Ağrı and Erzurum provinces. The color of this breed is basically red but varies from light yellow to dark brunette. There are white spots in the tail and around the mouth and nose. Up to now Eastern Anotolian breed were mated with the Brown Swiss bulls for improving their productivity. Live weight of Eastern Red native cattle varies from one province to another and is about 250-500 kg. Average live weight in improved flocks is 350 kg and in poor conditions it is 250 kg. The milk yields vary between 1000 and 1200 kg under poor village conditions. This amount of milk yield reaches the 1500 kg or more in improved conditions. They give best meat quality among the native breeds of Türkiye.

Southern Yellow and Red Native Cattle Breed is known as giving more milk yield than those of other Turkish native cattle breed. Southern yellow red breed has a relatively small body size and a live weight of 200-350 kg. The milk yield is 500-600 kg in poor conditions and 600-800 kg in better conditions. For several years, Southern yellow red adapted for poor conditions enduring against to disease.

Another type of southern yellow red is called Kilis has more big body size and more milk yield . Milk yield of Kilis breed is 1500-2000 kg. Kilis breed's live weight is about 300-400 kg. Among the Turkish native cattle breeds, Kilis breed has highest height of cidaço of 129 cm. The adaptability of Kilis breed for bad village conditions is not well. In perfect management and nutrition situations, their milk yield can be around 2500-3000 kg.

To improve the production level of Turkish dairy cattle husbandry, several efforts have been made. It was understood that native breeds of cattle were not suitable for efficient milk production. Native breeds were suitable only for the primitive village conditions.

Later on the pure breed dairy cattle breeding policy was encouraged for the improved conditions.

The crossbreeding of Turkish native breeds with popular European pure breeds were also carried out at the same time. As a result of studies mentioned Holstein Friesian, Brown Swiss and Jersey have gained popularity in central west Anatolia, Eastern Anatolia and Black Sea coastal region respectively.

Native sheep breeds

Türkiye is one of the major sheep-breeding countries in the world. sheep-breeding is carried out in small enterprises. Sheep-milk and lamb-meat production is on the foreground. Unfortunately there is no data as results of official inventory studies done as a census based on breed.

But it is estimated that there are 38 Million head of total Small ruminants consisted of 30 Million head of sheep & 8 Million head of goats existed.

Sheep population can be divided into two major group as Fat tailed (85 % of total) Thin tailed (15% of total). The distribution (% of total sheep population) of fat tailed sheep breeds of Türkiye are as Ak Karaman (45%), Mor Karaman (20%), Daglıç (10%), Avassı (4%), Sakız (0.2%), crossbreeds (5.8%) The distribution of thin tailed breeds are as Kivircik, (7%), Karayaka (3%), Merino (4.9%), Gökçeada (0.1%)

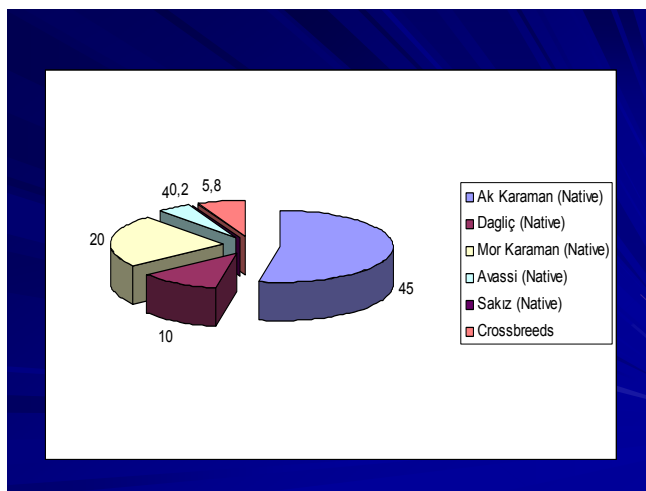


Figure 2. Distribution of Native sheep breeds of Türkiye

Kıvırcık sheep (the dominant sheep breed in Trakya region) being crossed with the milky and prolific East Frisian sheep has provided more prolificable sheep types called Tahirova and Türkgeldi.

During last twenty years the remaining breeds of sheep (Kıvırcık, Karayaka, İmroz, Dağlıç, Akkaraman, Morkaraman, İvesi) and one goat breed (Angora Goat) are subjected to heavy pressure of cross-breeding from economical point of view .

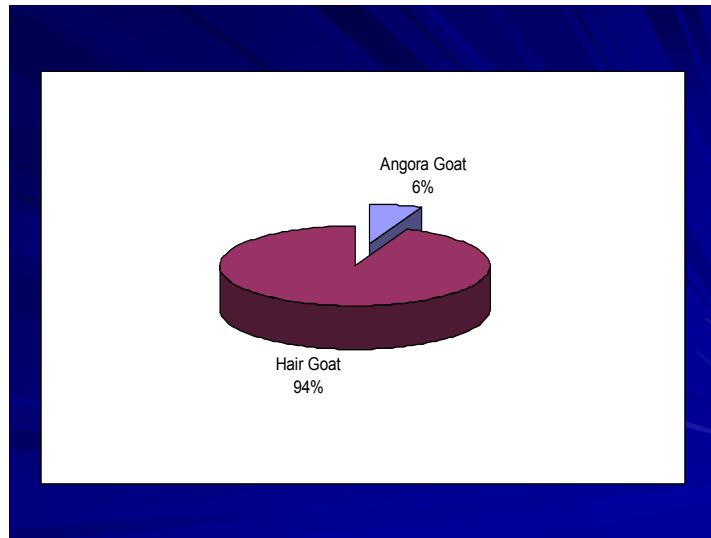
This crossbreeding trends is the major source for extinction. According to the World Watch List for domestic animal diversity (3rd Edition edited by Beate D. Scherf Food and Agricultural organization of the United Nations, Rome, October, 2000) .

The breeds subjected to the program of genetic preservation studies are Sakız, Dağlıç, İvesi, Kıvırcık, Karayaka, İmroz, Red Karaman

Goat population of Türkiye is approximately eight million heads

Unfortunately there is no data as results of official inventory studies done as a census based on breed. But it is estimated that there are 8 Million head of goat population. Total goat population is consisted of (0.5) Million head of Angora goat and (7.5) Million head hair

The most peculiar indigenous goat breed of Türkiye is basically Angora goat. Three sheep breeds are extincted. The most important reason for extinction is cross breeding with exotic breeds (economic reasons). Türkiye ranks after CIS, Australia, China, New Zealand with respect to the number of sheep raised in the country. The primary products are milk and meat. Wool is of also prima importance regarding bedding and carpet making . Most of the breeds belong to the fat tailed carpet-wool breeds. White Karaman in Central Anatolia, Red Karaman to the East and short fat tailed Dağlıç to the West. Along the border to Syria the Awassi is spread out. Due to the climatic conditions in the main parts of the country, sheep production is the major income for the poor farmers. The majority of the sheep population consist of. Native cattle breeds in Türkiye. In Türkiye the cattle population is about 11 million head according to 2000 statistics. The native cattle are predominantly of the East Anotolian red type in Eastern Anotolia, South Anotolian type in South East Anotolian and Relatively small numbers in Mediterranean area, Grey cattle breed in Western Anotolia and European part of Türkiye A small number of Zagot breed (another unimportant local native breed) are kept in some villages of Eastern Anotolia



Sheep and Goat Production

Türkiye ranks the fifth place in the world as far as its sheep population is concerned, after CIS, Australia, China and New Zealand. Of the world sheep populations 4.4% is kept in Türkiye the number of sheep Per inhabitant is 0.89 which is rank seven. According to the data obtained from FAO (2001) Türkiye is ranking as the number one in sheep and goat populations in Europe. The primary products are milk and meat and wool is of some importance as well. Most of the breeds belong to the fat tailed carpet wool breeds : White Karaman in Central Anatolia, Red Karaman to the East and short fat tailed Dağlıç to the West. Along the border with Syria the Awassi or İvesi found.

As stated before the mountainous area particularly in west, south and high steps of eastern region provide a suitable environment for sheep and goat production. Over 95% of goat and sheep populations are consisted of native breeds. Although their milk and meat productions are rather low,

they are adapted very well to the local conditions. Their carcass weight is approximately 23-25 kg milk production Per animal is 37 kg and wool production is about 1,75 kg.

There is a sheep population of about 30 million animals about 80% of which are fat - tails, and 80% of the meat eaten in Turkey is mutton the thin-tail is preferred. Over 20% of the country's milk comes from sheep. Turkey also has 8 million goats, among which the Angora, producing mohair, is important.

The native sheep of Turkey are found in distinct areas and can be divided into four main types the Karaman (66%), Dağlıç (15.5%), which are fat-tails, the Kivırcık (7.5%) and Karayaka (3%) which have long thin - tails. There are also small numbers of other sheep including the Awassi and the Sakız, which is originally came from the Aegean islands.

The Karaman type has two varieties. There is the black-faced and often horned Kızıl or Mor Karaman of the high mountains in the east. This has heterogenous, often coloured, carpet wool of 28-32 S quality. The other type the Akkaraman is widespread through the country and has better wool 32-36 S quality that is used in the famous Turkish carpets. The Dağlıç breed is kept farther west. It has some resemblance to the Karaman but grows more lustrous wool of 36-44 S quality, which is however still used in carpet manufacture. The males are usually horned and the females polled.

The white-faced Kivırcık is found in the extreme west around the Sea of Marmara the wool is of 44-56 S quality and is used for clothing and knitting yarns.

It has been suggested that the Kivırcık may be a degenerate descendant of the ancient fine - wool found in the same area and thought to be the early ancestor of the Merino. The Karayaka can have a back face and be horned or polled and it is kept in northern Turkey along the Black Sea coast. It has long coarse wavy wool that is used for filling mattresses as well as in carpets. The Sakız sheep is confined to a small area of the Aegean coast opposite the islands from which it came. It is a very fertile sheep with a good milk yield.

Total *Buffola* population of Türkiye decreased to the number of 100000 head. The majority of buffaloes were concentrated in middle Anatolia regions of Türkiye. Their number were highly decreased. General directorate of agricultural research (GDAR) of Ministry of Agriculture and rural affairs are responsible to represent the country in FAO's DAD-IS frame work. It is supposed that National Coordination should coordinate the researches, university institutions and NGO studies related with frame work in the country.

GDAR has several insitu and exsitu studies of preservation of farm animal genetic sources.

One of this researches are dealing with genetic conservation of domestic. The breeds are subjected to the program of genetic preservation studies are Eastern Anatolian, Red Cattle in Erzurum, Angora Rabbit (Poultry Research Ins. in Ankara), native silk worm lines of Bursa region (Silk Worm Research Institute in Bursa), native poultry breed of Turkey, Sakız, Dağlıç, İvesi, Karacabey Merino, Kivırcık, Karayaka, İmroz sheep breeds (Bandırma Research Ins.), Red Karaman sheep breeds are preserved in Eastern Anatolian Research Inst. in Erzurum.

According to the World Watch List for domestic animal diversity (3rd edition Edited by Beate D. Scherf Food and Agricultural organization of the united nations, Rome, October, 2000). Ten cattle breeds, two horse breeds and three sheep breeds are extincted. The most important reason for extinction is cross breeding with exotic breeds (economic reasons).

According to the same source Malakan horse breed and Cinecapari sheep breeds are in endangered state (as breeds at risk). During last three years the remaining eight breeds of sheep (Kivırcık, Karayaka, İmroz, Dağlıç, Akkaraman, Morkaraman, İvesi), one goat breed (Angora Goat) and four cattle breeds (Gray Cattle, Native Black Cattle, eastern Anatolian Red Cattle, Southern eastern Anatolian Cattle, Red Cattle) are subjected heavy pressure of crossbreeding from economic point of view. To pull attention to this problem two university based database were constructed. One is called native farm animals genetics sources (<http://genkaynaklari.sitemynet.com>) established department of animal science of Tekirdağ Agriculture Faculty of Trakya University by Prof. Dr. M. İhsan Soysal for all farm animal species. One data based from Middle East Technical University by Prof. Dr. İnci Togan for only sheep breeds (<http://togan3.bio.metu.edu.tr/turkey.html>) as the form of database of sheep breed of Turkey.

The General Directorate of Agricultural Research has also recently constructed the national data base of farm animals (<http://www.tagem.gov.tr>.)

reasons in Türkiye as a results of decreased demand for the output of *Buffaloes*

Chronological events of Turkish conservation program for native animal genetic resources

Animal improvement law numbered 4631 were accepted by parliament 28. 02. 2001

This law has rules for conservation of native animal genetic resources (article 14 and 15)

Animal rights and welfare law were accepted by parliament at 24. 06. 2004 (numbered 5199) has also same regulations for the concept of conservation animal genetic resources.

Law with number of 5262 for organic agriculture including animal husbandry were accepted on 3. 12. 2004 has some aspects regarding the concept of conservation of animal genetic resources

Regulations numbered 24812 accepted 14.07.2002 by ministry of agriculture were aimed to arrange organic agriculture

Regulations aimed to arrange breed registration has been come into force on 17. 06. 2003 numbered 25141

These regulations had suggested to construct "national comity for animal registration and native breed identification "from the breed point of view. Regulation accepted on 21.06.2003 by ministry of agriculture numbered 25145 were also foreseen the construction "national commity for preservation of native animal genetic resources."

The agriculture law numbered 5488 was accepted by parliament on 18. 04. 2006

Article number of 10 agriculture law especially aimed to conserve the native animal genetic diversity as much as possible

Türkiye was the active member of the program of animal genetic resources (AnGR) directed by FAO. According to the decision taken by Rio Submit (1992) convention of biological diversity declared by agenda 21.Türkiye's unique geographical locations among the continents as centre of domestications gave her great responsibility with respect to take urgent measures for conservation of animal genetic resources

The activities regarding policies and measures are the duty of General Directorate of Agriculture Research (GDAR).

Results

GDAR has several in-situ and ex situ studies of preservation farm animal genetic resources

First applications of conservation program has started as ex situ preservations studies.

This program were applied as construction of small population in the farm of GDAR located in several difference geographic locations in Turkey. This program realized by buying small herds from farmers at 2002.

Native southern red and southern yellow cattle breeds were taken under program in Adana region of southern Turkey.

Grey cattle population were construction in Bandirma Agricultural Research Institution of North-west of Turkey as for ex situ conservation program.

Native sheep breed of Kivircik, İvesi, Dağlıç, Sakiz, Karayaka, Gökçeada were subjected for ex situ program in Bandirma region of South-west of Turkey.

The Red Karaman were taken under program in Erzurum region of east Turkey.

The pulling attraction for awakening the public awareness; the university based data base were constructed.

One is the called native animal genetic resources.

(<http://genkaynaklari.sitemynet.com>) established by the department of Animal Science of Tekirdağ Agricultural Faculty by Prof.Dr.M.İhsan SOYSAL et all for all farm species

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In 2005 in situ conservation studies were started.According to the priciples of Decision taken by council of ministers (numbered 2006/ a) on the regulation for supporting animal husbandry.

There are two sort of support for in situ conservation program. First sort of support were given under the name of conservation aimed support.Second sort of support is classified as the improvement of native animal genetic population.

.Support declared to be aimed to conserve the AnGR was given following breed (and provinces)

Kivircik (Tekirdağ, Edirne, Kırklareli of Trakya port of Türkiye)Sakiz (İzmir province of west Türkiye)

Gökçeada (Gökçeada island ol Aegean sea coast of Türkiye).Herik (Amasya provinces of central east Türkiye).Tuj (Kars, Ardahan provinces al eastern Türkiye). Dağlıç (Afyon provirces of west Türkiye)

Norduz(Van provinces east Türkiye). Kangal Akkaraman (Sivas provinces of central east Türkiye)

Hemşin (Artvin provinces of east black sea region of Türkiye).Cine Caparı (cross breed) (Aydın provinces of west Türkiye).

Goat breeds

Angora goats= Ankara province of central Turkiye. Kilis goats: East Mediterranean and south east regions of Turkiye. Norduz goats: Van provinces of east Turkiye. Honamlı goats: Internal Mediterranean region of Turkiye. For each breed averaged 200 head animals. (minimum 56 female 16 male, maximum 184 female 16 male). Belonged preferably one farmer otherwise four farmer were undertaken the program. The selection comity has selected the appropriate applicants according to the criteria, determined for sustainability point of view

The amount of subsidy given to the farmer was approximately was 26 euro per year/per small headed animal (sheep and goat). Total 3200 head of sheep had take benefit from this conservation program

Name of cattle breeds were subjected to in situ conservation programs which were given below.

Native black cattle: Ankara provinces of central Turkiye. Grey cattle: Edirne provinces of north west of Turkiye. Eastern Anatolian Red: Erzurum provinces of eastern Turkiye. Kilis cattle: South east provinces of southeast Turkiye. Native southern yellow: İçel, Adana provinces of south Turkiye.

.Zavot: Eastern Turkiye's provinces There is only one water buffalo breed called Anatolian water buffalo in Turkiye. The water buffalo in- situ conservation program was conducted in Balıkesir province of western Turkiye

The principles of in situ conservation programs used in cattle breeds was to construct a population consisted of averaged 150 individual (minimum 56 female, 16 male; maximum 134 female, 16 male) for each breed mentioned. Total 1050 head of cattle for all breeds were supported by this program. The amount of money given to the farmer to compensate their lack of income sourced using these low productivity native breed was 160 Euro / head / year

Second important part of this conservation program was called breed development aimed support or only sheep and goat breeds. These program were planned to sustain the population together with improving the productivity by use of result of progeny tests. 6000 female and 300 male total 6300 head for each breed & Grand total 50400 head for all breeds were targeted at the beginning.

The targeted breed included in this program as below.

Akkaraman breed: Konya and Karaman provinces of central South of Turkiye

Morkaraman breed: Erzurum province of eastern Turkiye.

İvesi breed: Urfa, Diyarbakır provinces of South east Turkiye.

Anatolian Merinos breed: Eskişehir province of internal west Turkiye

Karacabey breed : Balıkesir province of internal west Turkiye.

Karayaka breed : Tokat province f internal east Turkiye

Karya breed: Denizli, Aydın provinces of internal east Turkiye.

The Pirlak goat breed of Afyon provinces of internal west Turkiye

and Angora goat of central of Turkiye were subjected to this program for 6000 female and 300 male of total 6300 head of each breed. The only rule expected to be followed by farmer was keeping the records inspected by in charge of conservation program and not to sell without informing before at least for period of (1,5) year. In order to be involved in this program farmer should have the size of herd as 80 head.

The amount of subsidy given under this program to the owner of herd was 13 Euro / head / year.

Another big project accepted by Turkish Scientific and Technical Research Council with total budget of 3 million Euro dealing with every aspects of conservation programs of AnGR including cryo conservation of tissue etc.... named as "in vitro conservation and preliminary molecular identification of some turkish domestic animal genetic resources-I (Turkhaygen-I)

The latest attempt regarding Conservation of animal genetic resources was establishing Water buffalo breeding organization of Turkiye in 2008.

Due to opening door for subsidizing the support to the farmer ;this activity will help very much stopping the tendency for decreasing the number of water buffalo in Turkiye

Table 2 Conservation of animals including in situ and ex situ current state of in vivo

Species	Breed	In original farming	In research institutes	No. of animals	No. of males	No. of females
Cattle	Native Black	√		150	14	136
			√	21	7	14
	East Anatolian Red	√		150	16	134
			√	189	55	134

	South Anatolian Red	√		127	34	93
			√	70	24	46
	Anatolian Grey	√		100	16	84
			√	67	26	41
	Zavot	√		86	14	72
	Native Southern Yellow	√		147	28	119
Buffalo	Anatolian Water Buffalo	√		80	24	56
			√	38	7	31
Sheep	Sakiz	√		113	7	106
			√	102	22	80
	Kivircik	√		200	16	184
			√	308	80	228
	South Karaman		√	25	11	14
	Gokceada	√		200	32	168
			√	82	24	58
sheep	Herik	√		120	16	104
	Karagul	√		200	32	168
	Hemisin	√		200	16	184
	Cine Capari	√		54	7	47
Goat	Ankara Goat	√		200	16	184
			√	139	43	96
	Kilis Goat	√		194	32	162
	Honamlı Goat	√		200	6	194
Chicken	Denizli		√	400		
	Gerze		√	200		

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GENETIC VARIATION OF TURKISH WATER BUFFALO POPULATIONS

M.İ.SOYSAL^{1*}, E.ÖZKAN¹, M. GARGANI², L.PARİSET² AND A. VALENTINI²

¹Department of Animal Science, Namik Kemal University, Tekirdag-Turkiye

²Department of Animal Production University of Tuscia Viterbo Italy

*Corresponding author:misoysal@ttmail.com

Abstract

Indigenous Anatolian water buffalo population of Türkiye were characterised with 11 cattle autosomal microsatellite loci. A set of 4 cattle microsatellite loci was found to be polymorphic in the Anatolian water buffalo genome. Genotyping of these polymorphic microsatellite loci revealed alleles ranging from 3 to 9. The observed heterozygosity ranged from 0.550 to 0.775 and the expected heterozygosity ranged from 0.494 to 0.815. The F_{IS} value changed from -0.101 to 0.205. This result shown that, Anatolian water buffalo population samples seemed to be in Hardy-Weinberg expectation. The genetic variation and relationship among six Turkish water buffalo populations typical of different regions was assessed using a set of twenty-six heterologous (bovine) microsatellite markers. Between 7 and 17 different alleles were identified per microsatellite in a total of 254 alleles. The average number of alleles across all loci in all the analyzed populations was found to be 12.57. The expected mean heterozygosity (H_E) per population was between 0.5 and 0.58. The overall polymorphic information (PIC) value was between 0.33 and 0.86. Significant departures from Hardy-Weinberg equilibrium were observed for 44 locus-population combinations. Population differentiation was analyzed by estimation of the F_{ST} index (values ranging from 0.053 to 0.123) among populations. The PCA analysis identified three clusters: the Merzifon and Danamandra populations represented one cluster each, and the Afyon, Coskun, Pazar and Turhal formed a single cluster.

Keywords: *Microsatellite, Anatolian water buffalo, heterozygosity, population structure*

Introduction

The water buffalo (*Bubalus bubalis*) greatly contributes to agricultural economy through milk, meat, hides and draught power. A larger part of the human population depends on domestic water buffalo than on any other livestock species in the world (FAO & UNEP 2000). The number of water buffaloes in the world has decreased rapidly over the past three decades (Georgoudis *et al.*, 1998). Most of world buffaloes live in Asia, Egypt, Southern and south-eastern Europe. Also buffaloes have played an important role in the rural economy of developing Asian country from ancient times.

According to FAO (2000) data, there are about 166 million domesticated buffaloes raised in the five world continents. However, there are about 158 million buffaloes left in the world (FAO statistics, 2003). Roughly 97 percent of them or 153 million heads are water buffaloes essentially found in the Asian region.

Also, in Turkey the buffaloes population have declined dramatically over the last decades. The total population according to FAO statistics is 164.000 heads (2003 <http://faostat.fao.org/>). Formerly buffaloes have been used as draft animals for centuries. Also they have been used for source of meat and milk products. Than buffalo number was decreased, because of increasing demand for cattle breeding and increasing technology in agriculture.

Anatolian water buffalo is found mostly in the half Northwestern of Turkey including North part of the middle Anatolia. It is more common along the coast of Black sea. It is also found in Eastern Anatolia. From a taxonomical point of view it is classified as 'Mediterranean' type; indeed, in Europe and countries of the Near East, all buffaloes belong to the 'River' type, characterized by similar phenotype but variable size (Borghese and Mazzi, 2005). In the past, buffalo farming has been an important production source for Turkey (1,117,000 heads assessed in 1971), while currently the population size is of only 110,000 heads (Borghese, 2004). Although there were 544.831 head buffaloes in Turkey in 1985 they decreased to 164.000 head buffaloes according to 2003 statistics.

In despite of the popular indifference, farming of this species has survived in order to promote productive systems in agreement with sustainable rural development and trend to revalue autochthonous genetic types. In this context, beginning from 1963 some provincial, regional and national research institutes have established programmes aimed to revalue and improve reproductive and productive potentiality of Anatolian water buffalo. In 1989 improvement plans has been

established by crossing Anatolian buffalo with “Murrah” buffalo imported from Bulgaria. Concerning milk production, research is evidencing that controlled farming and feeding conditions may significantly improve performances. Indeed, in comparison with buffaloes reared in village conditions, buffaloes under experimental conditions show more favourable values for mean lactation period (245 d vs 250 d), maximum and minimum milk yield (1.715 vs 1.603 litres and 442 vs 186 litres, respectively) and mean fat milk percentage (8% vs 7 %). Milk is also employed to make a very popular traditional product, known as ‘lüle kaymağı’ whose preparation and chemical composition were described by Uratz (1970).

Buffalo for draught purpose is limited to tree stump hauling in forest area when mechanical equipments may not be used..

Concerning housing system, most farmers own 1-2 buffaloes as source of animal protein for family consumption and this system, very widespread in villages, is based on pasture resource exploitation; on the contrary, big herds (around 100 heads) are located near to the big cities and buffaloes in this case receive concentrate supplemented feed (maize, wheat, barley, cottonseed and sugar beet by-products) when available.

Artificial insemination is not applied in villages while is widely used in experimental farms, such as Afyon and Bandırma district of Turkey previously and at Department of animal science of Mustafa Kemal University currently by (Şekerden, Ö. 2007). The programme is currently in progress at Zootecnics Institute of Bandırma district in the Turkish province of Balıkesir employing instrumental insemination and breeding programmes. The larger farms with 40-50 females maintain their own males and the villages usually share a common male. Natural mating keeping two sires within the herd continuously is practised. Live weight is about 450-500 and 700-800 kg in the adult female and male respectively.

Anatolian water buffalo is reared for triple aptitude: meat, milk and draught.

Most meat is especially used for making sausage, which is a very popular typical product in Anatolia, prepared with buffalo meat, beef and mutton spiced especially with garlic. Anatolia buffalo have been bred since centuries in Anatolia. That buffalo belong to turkey was a Mediterranean type. Generally they have small massive body weight. As compared others buffalo breeds of the world they are more thick and weak build than others. Though Nipple, finger nail and horns are black colour, it may ranged from brown to black colour. (Şekerden, Ö. 2001).

Table 1. Several Characteristics About Anatolian Water Buffalo Raised in Turkey

	Maximum	Minimum	Sources
Lactation Yield (kg)	1070.5±279.9	709.6±23.0	Şekerden et al (2000b) Uslu, N.T. (1970b)
Lactation Length (day)	269.2±70.0	222.0±44.2	Şekerden et al (2000a) Şekerden et al (2000b)
Fat (%)	8.1±0.205	6.6±0.68	Kök, S., (1996) Şekerden et al (2000a)
Adulty Body Weight	518.6±17.2	411.0±9.07	İlarslan et al (1983) Uslu N.T, (1970a)
Calving Interval	434.3±57.1	365.2±17.5	Şekerden et al (2000a) İlarslan et al (1983)
Age at first Insemination(day)	679.7±210.9		Şekerden et al (2000a)
Age at first calving (day)	1313.2±234.8	964.1±3.94	Şekerden et al (2000b) İlarslan et al (1983)
Birth Weight (Male)	34.3±1.20	26.7±0.52	Alaçam et al. (1992) Uslu N.T; (1970b)
Birth Weight (Female)	31.6±0.90	22.1±0.48	Alaçam et al. (1992) Uslu N.T., (1970b)
Servis Periyodu	112.45	70.8	İlarslan et al (1983) Şekerden et al (2000b)
Gestation Length (day)	326.5±5.8 (artificial insemination)	317.0±51.5 (natural insemination)	İzgi and Asker, (1989) İzgi and Asker, (1989)
Daily Live Weight Gaining (gr) (0-3 Month)	(Male)	(Female)	Şekerden et al. (2000c)
Male	0.483		
Female		0.456	

Daily Live Weight Gaining (gr) (3-6 Month)	(Male)	(Female)	Şekerden et al. (2000c)
Male	0.305		
Female		0.294	
Daily Live Weight Gaining (gr) (6-9 Month)	(Female)	(Male)	Şekerden et al. (2000c)
Male		0.314	
Female	0.357		
Daily Live Weight Gaining (gr) (9-12 Month)	(Male)	(Female)	Şekerden et al. (2000c)
Male	0.504		
Female		0.360	
Fat Content of Milk	8.1	6.1	Kök, S. (1996) (Soysal and Kök, 1997)

Indigenous water buffalo population called Anatolian water Buffalo were characterised with 11 cattle autosomal microsatellite loci. A set of 4 cattle microsatellite loci was found to be polymorphic in the Anatolian buffalo genome. Genotyping of these polymorphic microsatellite loci revealed alleles ranging from 3 to 9. The observed heterozygosity ranged from 0.550 to 0.775 and the expected heterozygosity ranged from 0.494 to 0.815. The FIS value changed from -0.101 to 0.205. This result shown that, Anatolian water buffalo population samples seemed to be in Hardy-Weinberg expectation. Heterologous cattle microsatellite markers have been tested on Anatolian buffalo genome. A set of 11 (TGLA227, ILSTS005, CSSM66, BM1818, ETH10, ETH225, ETH3, HAUT24, HEL5, TGLA122, TGLA126) cattle microsatellite loci was analysed in Anatolian buffalo samples. Four cattle microsatellite loci was found to be polymorphic in the anatolian buffalo genome. Allele frequencies for each of four microsatellite loci in each of the individuals are reported. The number of alleles Per locus varied from 3 (ILSTS005) to 9 (BM1818). The mean number of alleles Per locus is about 6.75. Allele numbers distribution at the four analysed loci is given in Table 3. The observed heterozygosity ranged from 0.550 to 0.775, and the expected heterozygosity ranged from 0.494 to 0.815.

The Anatolian water buffalo population F_{IS} value changed from -0.101 to 0.205. This result shown that, Anatolian water buffalo population samples seemed to be in Hardy Weinberg expectation. As a conclusion, it can be said that the present study revealed the presence of high degree of genetic diversity within the water buffalo populations of Turkey

Table 2. The table shows the name of the microsatellite loci used in the study, their primer sequences, Polymorphism information contents (PIC), annealing temperature, the chromosome number the belong to, and the references articles

Locus Name	Primer Sequence	PIC	Annealing Temp. (°C)	Chromosome Number	Reference
TGLA227	CGAATTCCAAATCTGTTAATTTGCT ACAGACAGAACTCAATGAAAGCA		55	18	Steigleder et al, (2004)
ILSTS005	GGAAGCAATGAAATCTATAGCC TGTTCTGTGAGTTTGTAAGC	0.42	55	10	Arora et al, (2003)
CSSM66	ACACAAATCCTTTCTGCCAGCTGA AATTTAATGCACTGAGGAGCTTGG	0.49	58	14	Arora et al, (2003)
BM1818	AGCTGGGAATATAACCAAAGG AGTGCTTTCAAGGTCCATGC	0.40	58	23	Arora et al, (2003)

Table 3. Characteristics of Bovine Microsatellite Markers Tested on Anatolian Water Buffalo Population

LOCUS	Number of alleles (n_A)	Observed Heterozygosity (H_O)	Expected Heterozygosity (H_e)	H_{n.b.}	F_{IS}
TGLA227	7	0.600	0.743	0.753	0.205
ILSTS005	3	0.550	0.494	0.500	-0.101
CSSM66	8	0.775	0.707	0.716	-0.084
BM1818	9	0.750	0.815	0.825	0.092
Mean	6.75	0.668	0.689	0.698	0.043

The genetic variation and relationship among six Turkish water buffalo populations typical of different regions was assessed using a set of twenty-six heterologous (bovine) microsatellite markers. Between 7 and 17 different alleles were identified per microsatellite in a total of 254 alleles. The average number of alleles across all loci in all the analyzed populations was found to be 12.57. The expected mean heterozygosity (H_E) per population was between 0.5 and 0.58. The overall polymorphic information (PIC) value was between 0.33 and 0.86. Significant departures from Hardy-Weinberg equilibrium were observed for 44 locus-population combinations. Population differentiation was analyzed by estimation of the F_{ST} index (values ranging from 0.053 to 0.123) among populations. The PCA analysis identified three clusters: the Merzifon and Danamandira populations represented one cluster each, and the Afyon, Coskun, Pazar and Turhal formed a single cluster. The assignment of individuals to their source populations performed using the Bayesian clustering approach implemented in STRUCTURE 2.2 software evidentiate a high differentiation of Merzifon and Danamandira populations as well. The results of this study could be useful for the conservation strategies of the Turkish buffalo populations. Several sub populations of Anatolian Water Buffalo were also analysed by microsatellite analyses Gargari et al(2008) Animals were selected from six different Turkish districts belonging to four regions (Fig.1) that represent the most important sites of water buffalo breeding area. Pazar and Turhal are two districts of Tokat province located in central East Anatolia, Danamandira and Coskun belong to Silivri district of Istanbul province, Merzifon is the district of Samsun Province located on Black sea region and Afyon is the province located in central Anatolia. Coskun is a large factory buying breeding stock all over Turkey, while the others are local populations of buffaloes often belonging to very small farms. One hundred and fifty-five animals representing six populations were included in this study. A total of 26 heterologous (bovine) microsatellites primers were used. Markers were selected from BOVMAP database (available at www.marc.usda.gov/) and recommended by FAO (Lenstra 2004) for diversity studies in cattle . A total of 154 animals representing six populations of Turkish buffalo (Fig.1) were analysed using 26 microsatellite markers. Among 26 microsatellites tested, 21 loci amplified successfully in our samples while five (ETH3, ETH185, HEL5, HEL1 and INRA023) did not amplify. A total of 254 alleles were identified, giving a mean number of 12.57 alleles per locus. PIC (polymorphic information content) was calculated for each marker and ranged from 0.242 (ETH10) to 0.861 (BMS1747)(data not shown). Only ETH10 and TGLA126 markers show a PIC value below 0.5. The average PIC in our samples was 0.702. Table 2 summarizes the diversity indices. The average number of alleles per population ranged from 5.14 (Danamandira) to 9.19 (Merzifon). The observed and expected heterozygosity (H_E) over all loci varied from 0.5 to 0.58 and 0.62 to 0.81, respectively. The F_{IS} values ranged from 0.08 (Thural) to 0.29 (Merzifon), indicating that Merzifon population has the highest rate of inbreeding. Significant departures from Hardy-Weinberg equilibrium were observed for 44 locus-population combinations . All 21 loci studied showed lack of equilibrium in one or more populations. BMS1724 locus was mostly in disequilibrium. Among various populations, the Merzifon had the maximum number of loci (13) that deviated from HWE, confirming the inbreeding hypothesis.

Population differentiation was analyzed by estimation of F_{ST} index (values ranging from 0.0053 Coskun-Afyon to 0.123 Merzifon-Danamandira) between populations (Tab.4). Thus, 12% to 0.53% of microsatellite variability is explained by the subdivision of populations while the remaining variability is within populations.

The PCA analysis was performed using the frequencies of the 254 alleles of the 21 markers. The first two components explained 74.29% of the total variation (Axis 1= 57.21, axis 2= 17.08). The PCA plot (Fig.2) identified three clusters: Merzifon and Danamandira populations represented one cluster each, and Afyon, Coskun, Pazar and Turhal formed a single cluster. Merzifon showed the highest differentiation from the other populations.

We further performed Bayesian clustering approach using STRUCTURE software. The assignment of individuals to their source populations show a high differentiation of Merzifon and Danamandira populations (Fig.3), confirming the PCA clustering

The bottleneck test did not show a significant effect of recent population bottlenecks. The PCA analysis revealed at least three distinct clusters: the Merzifon and Danamandira populations represented one cluster each, and the Afyon, Coskun, Pazar and Thural formed a single cluster. The presence of these three clusters is also strongly supported by Bayesian clustering analysis. Coskun is not represented as a unique cluster but distributed with most of the other buffalo populations. This could reflect the heterogeneity of its breeding stock caused by the farmers use of buying animals from other regions.. Danamandira appears as a well separated cluster in the PCA analysis. Indeed, the population is well recognized in Istanbul province where husbandry is very popular and most of the farmers rear few head for family consumption.

Merzifon is a district of Samsun province located in the Black sea region. Our results show most of the Merzifon animals as a distinct cluster, separated from Thural and Pazar animals despite the

geographic proximity. In Merzifon district the buffalo population size is shrinking and the breeding territory is confined to a small area. This could have caused a reduction of breeding animals and led to high levels of inbreeding

In conclusion, we have presented the first study of genetic diversity of Turkish water buffalo using microsatellite markers. We found a fair amount of genetic variation and we distinguished three clusters among the six populations sampled. This preliminary results could be useful for the conservation strategies of the Turkish buffalo, which represents an important resource for small villages far from the big cities. In particular the Merzifon population would deserve special attention, to prevent a further increase of the population inbreeding.

Table 4. Population indices: n, sample size; Ho, observed heterozygosity; He, unbiased expected heterozygosity; A, mean number of alleles; Fis, inbreeding coefficient

Population	n	Ho	He	A	Fis
Pazar	32	0.55	0.62	5.76	0.1
Danamandira	18	0.53	0.62	5.14	0.13
Merzifon	34	0.58	0.81	9.2	0.29
Turhal	20	0.58	0.64	5.42	0.08
Coskun	34	0.55	0.65	6.38	0.16
Afyon	19	0.5	0.7	7	0.18

Fig. 1. Sampling sites of the six Turkish buffalo populations. Numbers correspond to the following sampling sites: 1, Pazar; 2, Danamandira; 3, Merzifon; 4, Turhal; 5, Coskun; 6, Afyon

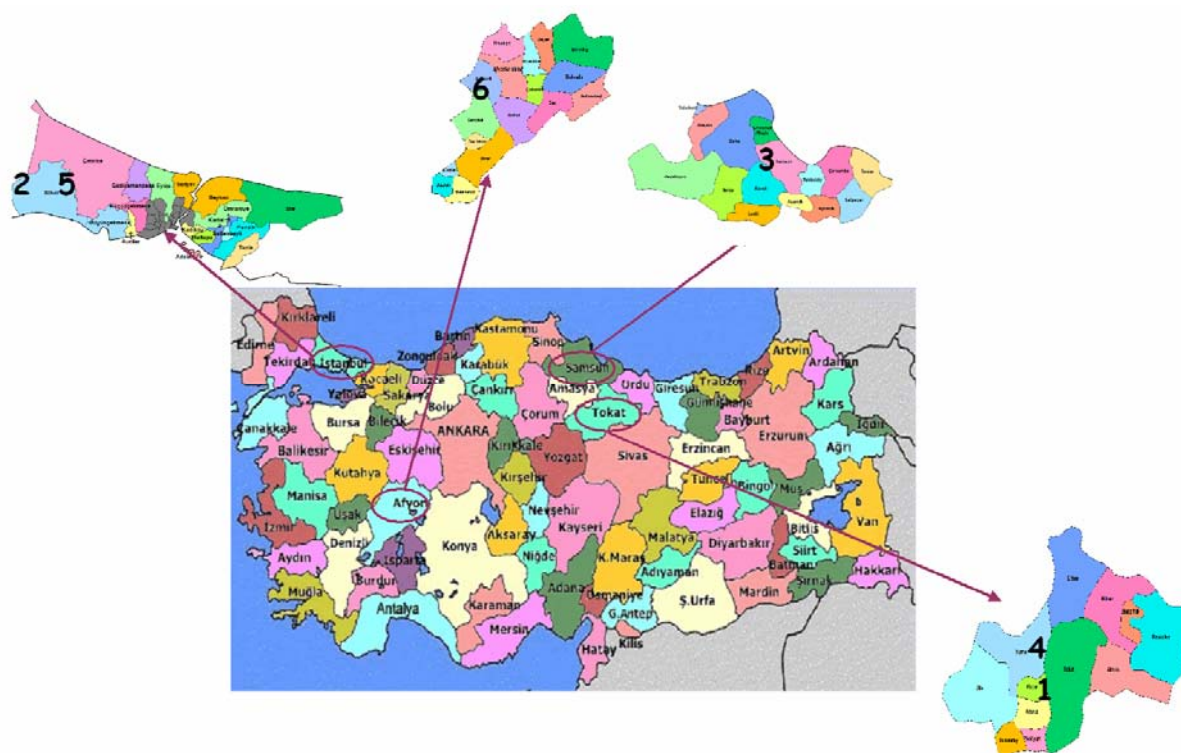


Fig.2. Principal component analysis. Axes 1= 57.21, axse 2= 17.08

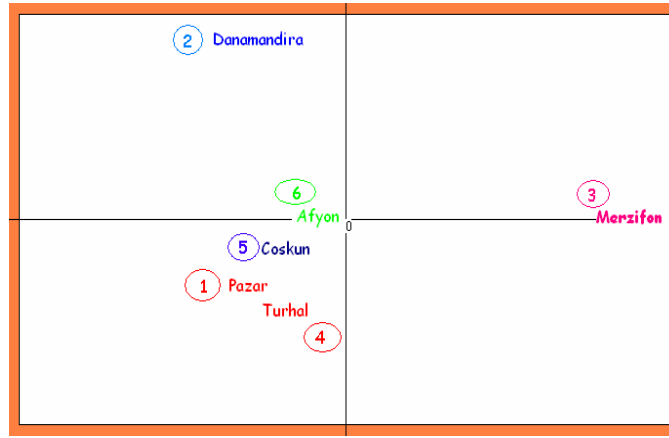


Table 5. Parwise F_{ST} of six Turkish water buffalo populations

	Pazar	Danamandira	Merzifon	Thural	Coskun	Afyon
Pazar	0					
Danamandira	0.0608	0				
Merzifon	0.1127	0.1237	0			
Thural	0.0249	0.0681	0.1	0		
Coskun	0.0206	0.0472	0.0984	0.023	0	
Afyon	0.0384	0.053	0.0736	0.0364	0.005	0

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CRYOPRESERVATION FARM ANIMAL GENETIC MATERIALS IN VIETNAM

LE THI THUY

National Institute of Animal Husbandry, Ministry of Agriculture and Rural Development, Vietnam

Tel: 84 4 8389770; fax: 844 8389775; Email:thuyniah@vnn.vn

Summary

The ex-situ method is a very important components of the animal genetic conservation to prevent mishandling and mistakes. Cryopreserved germ cells can be saved permanently and, notwithstanding any accidents in the storage system, remain available in exactly the same condition as at the time of their collections. This method could contribute not only to increase population size but also to avoid inbreeding depression in a species.

The procedures for preservation of semen, embryo and DNA, the techniques to extract DNA from blood, tissues and were improved. The endangered breeds such as I pig was brought to keep in small holders to collect germlasma cells. A total of 2300 sperm doses, 749 embryo, 6169 somatic cells and 5636 DNA samples from Vietnam FAnGR: Cattle, Mong cai, I, Co pigs, Yellow cattle, Coc cattle, Ri, Ho, Dong Tao, Mia, Ac, Choi chickens and Sika deer were collected, extracted DNA and preserved.

Key words: Cryopreservation, semen, somatic cell, embryo, AND, F.AnGR.

Introduction

Worldwide, a large number of domestic animal breeds is endangered, in a critical status or already extinct. Of the 6379 domestic animal breed populations, 9% is in critical condition and 39% is endangered. There is worldwide consensus about the global decline in domestic animal diversity and the need to conserve genetic diversity.

In farm animals, in order to be able to cope with changing requirements and future demands in breeding and selection. A small effective population size in rare or endangered breeds requires monitoring of within-breed diversity and conservation programs to maintain within breed diversity. There are several options to conserve genetic diversity. In general, *in situ* conservation is preferred as a mechanism to conserve breeds. A breed has to evolve and adapt to changing environments and efforts to create a need for products or functions of the breed should be promoted. Conservation without further development of the breed or without expected future use is not a desirable strategy. However, in addition to *in situ* conservation, methods or techniques to maintain live animals outside their production or natural environment (*ex situ live*) or through cryopreservation of germplasm (*ex situ*) are set up to preserve (germplasm of) rare breeds as well as the more widely used commercial breeds. Moreover, cryopreservation of germplasm is a very good *ex situ* strategy to conserve existing allelic diversity for future use.

In situ conservation though simple and does not require high technologies or initial high cost, has certain disadvantages, such as increase of homozygote and decrease of survival rate due to inbreeding in small scale herds, interaction between genes and environment, high cost of keeping, techniques and management of the herds and risks such as diseases, accidents and disasters that can happen anytime.

Ex situ preservation includes mainly preserving sperms, eggs, embryos, chromosome, somatic cells and DNA in specific environment to stop cell functions for a period of time and resuming them to continue reproduction or development into new individuals. For securing the future of these breeds and preventing negative effects of diseases and accidents, embryo and semen banks need to be established.

Although this method may require highly developed techniques, strict technologies and high initial equipment cost, the later stages are less costly. This method, most importantly, not only overcomes disadvantages of *in situ* preservation such as keeping genetic material at its original state regardless of environment conditions and allowing easy access to preserved material at anytime afterwards but also increases the population size and prevents inbreeding.

Vietnam is considered as one of the world's ancient animal domestication areas. In total, 62 local breeds have been found in Vietnam with a density of: 1.520 species/km², high compared to the global overage of 0.098 species/km².

However, due to undirected natural selection, market demands, importation of exotic breeds and crossbreeding, local breeds are being exposed to danger and extinction. Despite having low productivity, Vietnamese local breeds adapt very well to hot and humid ecosystem and local husbandry habits. These breeds contain potential genes deciding valuable characteristics such as egg and milk quality and resistance against diseases.

In this paper the focus is placed on *ex situ* conservation in Vietnam including: semen, embryo, somatic cell and DNA cryopreservation.

Material and Method

Frozen sperm preservation method

Select males of good breeds from populations intended to be preserved.

Practice collecting sperms.

Evaluate collected semen.

Freeze sperms.

Quality-check frozen sperms. Qualified sperms are preserved in liquid nitrogen at -196⁰C until used.

Quality-check sperms during preservation based on functioning and survival rate.

Check the fertilization/pregnancy ratio of frozen sperms throughout preservation.

Check growth capacity of offspring from frozen sperms.

Plan future uses of frozen sperms.

Embryo preservation method

Select female embryo donors. Donors must bear typical breed traits, have good productivity traits or certain traits intended to be preserved.

Over ovulate female donors.

Mate female donors.

Harvest embryos.

Scan for embryos, evaluate and classify the detected. Qualified embryos are frozen.

Embryo information such as number, parent breeds, collection date, quality, development status, collection location, etc. is recorded in records, notebooks and embryo straws.

After frozen, embryo straws are suspended in liquid nitrogen at -196°C for customized time.

Somatic cell and DNA preservation method

- Sample collecting and DNA extracting techniques

Blood is taken from veins. A sample of 1ml is taken and vacuumed with EDTA. Samples are preserved at 4°C until kept at laboratory at -20°C .

Tissues are severed using specially made taggers and preserved in pure alcohol until kept at laboratory at -20°C . All sample donors are recorded (age, sex, productivity traits, body weights, etc.)

- Sample collecting and somatic preserving techniques: Ear tissue samples are collected and washed with PBS 3 times before taken back to the laboratory. They are then treated with specific chemicals and other processes until preserved in liquid nitrogen at -196°C . Regular quality-checks are scheduled.

- DNA extracting from ear, hair and blood tissue techniques are carried out according to DNA extraction with kit (provided by Promega Ltd).

Result of ex-situ preservation of genetic material

Sperm:

Table 1. Results of cattle sperm production in Vietnam through National Large Livestock Center (2001 – 2007)

* In cattle

Standard	unit	Year						
		2001	2002	2003	2004	2005	2006	2007
Sperm production	dose	151.698	243.346	344.296	449.653	679.163	879.607	758.766
Sperm cryo-preservation	Dose	110,550	170,285	346,677	409,276	550.000	803.998	931.287
Sperm supply to production	dose	115.009	169.692	289.810	419.007	480.693	450.750	493.366

Table 2. Cattle sperm production in different breeds of Vietnam (2001 – 2007).

Unit: dose

Year Cattle Breed	2001	2002	2003	2004	2005	2006	2007
Dairy cattle	61.872	117.980	230.455	243.770	145.689	213.587	214.414
Beef cattle	16.014	16.820	26.273	29.308	34.359	90.420	121.797
Zebu cattle	73.812	108.546	87.568	176.575	499.115	57.5600	422.555
Total	151.698	243.346	344.296	449.653	679.163	879.607	758.766

* in Pig: In the general, pig sperms have not been preserved. After collected, sperms are mainly kept for within 2 or 3 days and taken straight to artificial iseminated. Approximately 2300 pig sperm doses from I native Pig, Yorkshire and Landrace have been preserved so far and some of them has been used to create IVF embryos in laboratories and are also frozen in straws.

Embryo cryo-preservation

In general, embryo preservation is hard and rare. There have only been several results as followed:

- Frozen dairy cattle-HF embryo: 360 embryos of which 200 are IVF and 160 are invivo.

- Frozen beef cattle embryo: 120 IVF embryos.

- Frozen pig embryo: 189 embryos of which 139 are IVF and 50 are invivo.

In general, embryo preservation is hard and rare. There have only been several results as followed:

**Breeds and populations preserved in forms of sperms, embryos, cells and DNA
in germplasm bank**

Number	Breed	Sperm (dose)	Embryo	Somatic Cells	DNA
1	Mong Cai Pig	-	50	172	142
2	I Pig	2000	58	45	25
3	Co Pig	-	-	29	29
4	Meo Pig	-	-	32	32
5	H'Mong Pig	-	-	35	25
6	Soc Pig	-	-	20	20
7	Ban Pig	-	-	200	150
8	Yorkshire	150	90	120	100
9	Landrace	150	49	200	150
10	Ba Xuyen Pig	-	-	50	50
11	Vang Cattle	-	-	40	40
12	Coc cattle	-	-	25	25
13	Red Sindhi	-	22	40	40
14	H'Mong cattle	-	-	33	33
15	Beef cattle		120		
16	F1 (Vang x HF)	-	-	120	120
17	HF cattle	-	360	500	400
18	Ri Chicken	-	-	220	220
19	Mia Chicken	-	-	235	235
20	Ho Chicken	-	-	225	200
21	Choi Chicken	-	-	241	221
22	Dong Tao Chicken	-	-	111	100
23	Ac Chicken	-	-	192	172
24	H'Mong Chicken	-	-	2300	2125
25	Thai Chicken	-	-	43	23
26	Tau Vang Chicken	-	-	150	150
27	Tre Chicken	-	-	180	150
28	Co Goat	-	-	262	210
29	Bach Thao Goat	-	-	140	140
30	Sheep	-	-	166	166
31	Sika Deer	-	-	23	23
32	Samba Deer	-	-	20	20
Total		2300	749	6169	5636

Result: Mastered several techniques and completed preservation process of frozen sperms, embryos, DNA and DNA extraction using blood and tissues.

Sperm and embryo preservation:

In total of 2300 sperm doses of which: 2000 of I pig sperm doses and 300 sperm doses of Yorkshire and Landrace and there are 749 embryos were preserved from Mong cai, I, Yorkshire, Landrace pigs and HF, Beef cattles.

DNA and somatic cell preservation

A total of 6169 cell samples of 33 livestock breeds are collected at different provinces. 5636 samples are extracted DNA, preserved and evaluated at the laboratory. Cell samples include 6169 samples from local livestock breeds and DNA samples include 5636 samples from rare breeds such as I, Mong Cai, Co, Ban pigs, Vang and Coc cows and Ri, Ho, Dong Tao, Mia, Ac and Choi chickens, etc.

Remaining problems and suggestion

1. Ex situ preservation was not accelerated or heavily invested in terms of equipment and training in order to save breeds that no longer have economic values but are exposed to extinction. Preservation of rare breeds coming to extinction such as Mini pig, Dong tao and Ho chicken should be paid more attention.

2. Frozen sperm and embryo technique should be extended to other livestock species.

3. Continue to collect more samples, classify and preserve DNA of aforementioned breeds and expand preservation of chicken breeds raised by ethnic groups: H'Mong, Soc, Muong Khuong and

Mini pigs, H'Mong, Tau Vang and Tre chickens, Bach Thao goat, Phan Rang sheep and other species such as goose and rabbit with priority given to those closer to extinction.

4. Continue to research and complete embryo cell biopsy process and preservation of biopsied embryo cell until frozen or transferred to recipients.

5. Continue to send researchers to training and practice abroad on the aforementioned techniques.

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AC CHICKEN PRODUCTION IN VIETNAM

TRAN THI MAI PHUONG¹, NGUYEN VAN THIEN²

¹ National Institute of Animal Husbandry

² Animal Husbandry Association of Vietnam

Abstract

Ac chicken is one of special indigenous chicken breed in Vietnam. They are short, mild with small and long head but short neck. It can be easily distinguished from the other chicken breeds with the following characteristics: silkies feather, tasselled head, duplicated crown, green ears, beard, hairy legs, five toes, black skin, black bone and black meat. Ac chickens are raised in scavenging type and require very little input for their survival and production. Growth rate and egg production are very low but the birds are hardy and adapted well to low input conditions. It is one of the smallest chicken breed with the body weight at 9 weeks of age is about 378.6 - 466.9gr, feed conversion is 3.0 kg/kg weight gain. Egg production is varied from 80-105 eggs/hen/year.

The Ac chicken meat is nourishing. The protein content of Ac chicken meat is higher than Ri chicken: 21.9-24.6% in comparison with 21.3-23.0%. Ac chicken meat contain many kinds of amino acid (17 amino acids including 8 essential amino acids for human body), vitamin (A, B1) mineral (Ca, P, Fe, Na, K, Mg, Zn, Cu) and a lots of fatty acids (including essential fatty acids such as: Oleic, linoleic, arachidonic...The rate between fatty acids omega6/omega3 is about 0.43 – 1.14% .

Increasing demands for poultry products and the consequent commercialization of the poultry industry has resulted in rapid decline in the number of birds and they were in vulnerable situation in the last decades. These birds do however need special attention to be paid to their conservation and improvement so as to benefit rural people.

Introduction

Rural poultry is the major source of production of egg and meat in Vietnam. Backyard poultry farming is an important practice in rural areas, using the indigenous birds, Ac chicken is one special breed among them.

Ac chickens are raised in scavenging type and require very little input for their survival and production. Growth rate and egg production are very low but the birds are hardy and adapted well to low input conditions. Increasing demands for poultry products and the consequent commercialization of the poultry industry has resulted in rapid decline in the number of birds and they were in vulnerable situation in the last decades. Rearing of few birds (10-25) in the backyard system adds significantly to the nutrition and economic of rural people. The egg and meat of Ac chicken are preferred over that of commercial birds due to their characteristic flavor, Ac chicken meat has been used as a tonic food for old people, for the women after they have baby and consequently they fetch a higher price. These chickens are known to be good foragers, efficient mothers, require less care to grow and are, therefore, most suitable for raising under village conditions. One of the special characteristic is that: they can also develop well under the intensive raising system. These birds do however need special attention to be paid to their conservation and improvement so as to benefit rural people. Under the fund of FAO and the Government, the big project on indigenous animal genetic resources was conducted, Ac chicken is one of the animal breed to be conserved.

This paper reviews briefly the available information on the characteristics of this rare, isolated and small breed, paying special attention to its conservation.

Original and distribution

Ac chicken's main area of origin is in Longan province and it is also distributed throughout Mekong River delta such as: Tiengiang, Dongnai, Ho Chi Minh city...These provinces have the hot weather and abundant rainfall that contribute to the large areas of fertile cultivation. Crops are cultivated two or three times annually, rice being the most important crops, followed by fruit and industrial plants. is is useful to develop the Ac chicken.

Ac chicken has the long history of domestication in the South of Vietnam. In the past, Ac chicken meat was only used as special dish for the king or in luxury restaurants, hotels. Ac chicken was also highly praised for its delicious meat flavor.

Since 1994, Ac chicken was distributed to Hanoi surrounding and the neighbouring provinces.

According to Mehner (1962), Black bone chicken has discovered first time in the 13th century in China by Marco Polo. These chickens were the random mutation between native chicken or from the wild chicken breeds. The male birds has the large body, strong, small head, thick breast, short leg with five toes and feather cover along the leg, the female has the thin head.

Morphometric characteristics

Ac chicken is one of the special indigenous chicken breed in Vietnam. They are short, mild with small and long head but short neck. It can be easily distinguished from the other chicken breeds with the following characteristics: silkies feather, tasseled head, duplicated crown, green ears, beards, hairy leg, five toes, black skin, black bone and black meat. AC chicken is one of the smallest breed. (see the picture)



Performance

The overall average weight of cocks and hens at 9 weeks of age are: 446.7g and 378.6 g respectively (table 1) and the differences were statistical significant ($P < 0.001$).

Table 1: The body weight of Ac chicken

Week of age	Male (n=99) ($\bar{X} \pm SD$)	Female (n=131) ($\bar{X} \pm SD$)
One day old	18.8 ± 2.6^a	18.5 ± 2.7^b
1	34.5 ± 3.9^a	32.7 ± 4.4^b
2	58.8 ± 7.2^a	53.9 ± 6.5^b
3	89.7 ± 11.5^a	82.7 ± 9.4^b
4	128.6 ± 18.9^a	114.6 ± 14.3^b
5	182.8 ± 25.6^a	159.7 ± 17.4^b
6	237.8 ± 34.0^a	205.5 ± 22.9^b
7	297.7 ± 44.9^a	255.0 ± 30.6^b
8	370.4 ± 59.2^a	309.8 ± 44.1^b
9	466.9 ± 72.9^a	378.6 ± 56.0^b

Source: Tran Thi Mai Phuong (2004.)

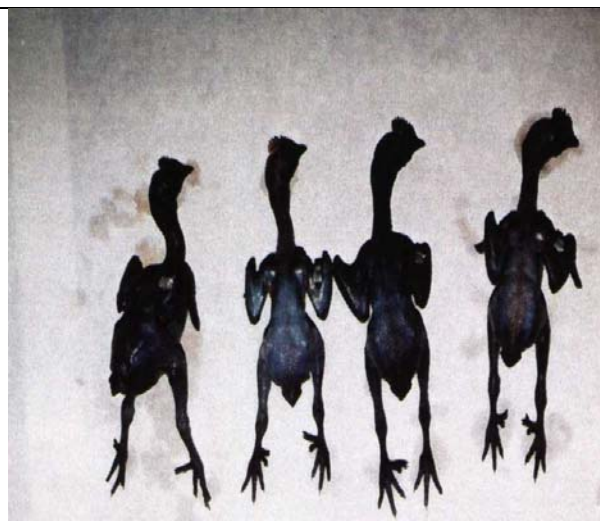
The letter a, b in each column shows the significant different between male and female chicken ($P < 0.001$).

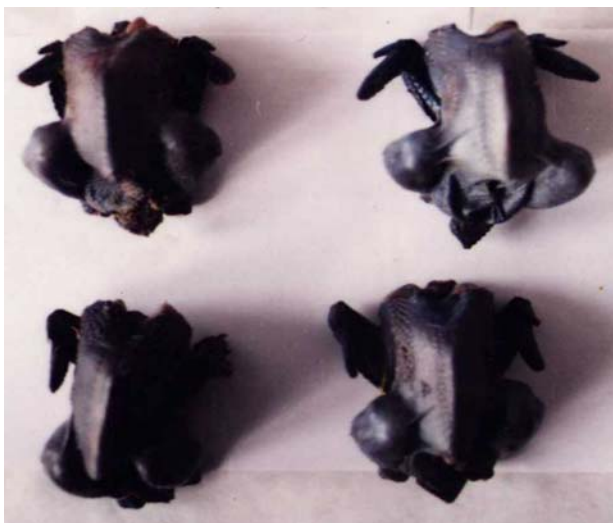
The mortality rate is varied according to the temperature. In summer the survival rate reached until 95-98% from one day old to 8 weeks of age. The feed conversion is about 1.5-3.0kg/kg of weight gain.

Ac chicken meat is nourishing. The protein content of Ac chicken meat is higher than Ri chicken meat: 21.9 – 24.6% in comparison with 21.3-23.0 %. Ac chicken meat contain many kinds of amino acids (17 amino acid including 8 essential amino acid for human body), vitamin (A, B1) mineral (Ca, P, Fe, Na, K, Mg, Zn, Cu). The Iron content of Ac chicken reaches to 21.0 mg, (15 time higher than broiler meat (1.4 mg), the mangan content is about 0.43 mg (8.6 time higher than broiler meat (0.05 mg)... and a lot of fatty acids (including essential fatty acids such as: Oleic, linoleic, arachidonic...The rate between fatty acids omega6/omega3 is about 0.43 – 1.14% (table 2)

Table 2: Fatty acid content in Ac chicken meat

Fatty acid	Thigh meat (n = 10)		Breast meat (n = 10)	
	$\bar{X}$	Xmin & Xmax	$\bar{X}$	Xmin & Xmax
C12:0	0.05	0.02 - 0.11	0.083	0.02 – 0.20
C14:0	0.08	0.01 - 0.17	0.23	0.18 – 0.30
C16:0	7.76	0.87 - 15.1	13.31	9.31 – 17.94
C18:0	6.36	1.73 – 14.51	10,24	6.89 – 15.13
C20:0	0.08	0.06 - 0.11	0,27	0.16 – 0.43
C24:0	0.20	0.10 - 0.66	0,21	0.12 – 0.36
C14:1	0.01	-	-	-
C16:1	0.49	0.14 - 0.9	0,87	0.28 – 1.51
C17:1	0.05	0.05 - 0.1	0,20	0.16 – 0.21
C18:1	14.37	3.64 – 34.78	24,78	14.97 – 34.59
C22:1	0.24	0.17 - 0.37	-	-
C24:1	1.86	1.26 - 2.34	2,30	1.03 – 3.99
C18:2	11.47	5.10 – 26.99	17,46	10.74 – 22.73
C20:4	2.93	0.24 - 8.19	3,94	1.14 – 7.33
C18:3w6	0.07	0.02 - 0.13	0,50	0.08 – 1.32
C18:3w3	0.16	0.03 - 0.31	0,37	0.29 – 0.43
C18:3w6/C18:3w3	0.43	0.17 - 0.60	1,14	0.19 – 2.93
SFA	14.53	2.79 - 30.66	24.34	16.68 – 34.36
MUFA	17.02	5.27 - 38.5	28.15	16.44 – 40.29
PUFA	14.4	5.34 - 35.18	21.40	11.88 – 30.06





Hens started laying eggs at the age of about 115-122 days, is earlier than other chicken breeds (Ri chicken: 135-144 days, Dongtao: 157-165 days, Ho 240-255 days, Mia: 177 days according to Nguyen Van Thach (1996), Le Thi Nga (1997), Le Van Tuong (1977).

In scavenging type, the clutch size is about four or five. They lay about 15-20 eggs in one laying period of around 25-30 days, then the hen become broody and incubates eggs for 21-22 days. After hatching, it broods the chicks for 30-45 days and then enters its next laying cycle. Each laying cycle takes about three months and in a year a birds undergoes a maximum of four laying cycles. the average egg production is around 60-80 eggs per year.

In intensive type, the try is made to reduce the broody time, then the egg production can reach 90.4 (population herds) and 105.6 (family herds) (table 3)

Table 3: Egg production and laying rate of Ac chicken

Laying month	Population herd (n=131 hens) (4 groups)				Individual (n=214 hens)		
	Laying rate (%)		Egg/hen/year		Rate (%)	Egg/hen/year	
	$\bar{X} \pm SD$	CV%	$\bar{X} \pm SD$	CV%	$\bar{X}$	$\bar{X} \pm SD$	CV%
1	26,8 ± 4,4	16,6	4,5 ± 3,6	80,3	29,5	8,6 ± 2,9	33,4
2	39,1 ± 1,3	3,4	11,9 ± 0,6	5,2	40,2	12,5 ± 2,4	19,4
3	32,5 ± 1,3	4,0	9,8 ± 0,7	6,8	36,1	10,2 ± 2,9	26,1
4	25,2 ± 0,9	3,4	7,6 ± 0,3	3,5	32,4	9,9 ± 3,1	31,1
5	23,7 ± 0,7	2,7	7,3 ± 0,3	4,3	28,7	8,9 ± 3,1	35,4
6	23,7 ± 0,6	2,3	7,3 ± 0,2	2,9	27,1	8,3 ± 2,8	34,3
7	24,0 ± 0,3	1,1	7,3 ± 0,1	1,5	32,7	10,2 ± 3,4	33,1
8	25,0 ± 0,3	1,1	7,6 ± 0,3	4,3	27,7	8,5 ± 2,0	23,9
9	23,7 ± 0,5	2,2	7,3 ± 0,2	2,1	25,0	7,5 ± 2,0	26,1
10	22,0 ± 0,5	2,1	6,7 ± 0,03	0,5	23,8	7,4 ± 1,4	19,6
11	24,2 ± 0,3	1,3	7,5 ± 0,2	2,5	23,3	7,3 ± 1,3	18,4
12	18,3 ± 0,5	2,5	5,6 ± 0,2	2,9	20,1	6,3 ± 1,4	22,8
Sum			90,4			105,6	

The hatchability is very high by natural way (until 90-95% and about 72.37% on total egg basis by artificial incubation).

Egg characteristics

Ac Chicken egg is very small of about 23.39 g at the first laying age and 30.53 at 38 week of laying age and the average egg weight is 30.6 g, the yolk rate is 36.8% (higher than other chicken eggs), the yolk index is 45.7, Haugh unit is also high (82.9) show the good quality of Ac chicken.

Egg composition: On average, the composition of albumen as follow: 88.3 % water, 9.3 % protein, 0.05 % lipid and 0.7 % ash as well as the composition of yolk as follow: 49.3 % water, 17.6% protein, 30.2 % lipid and 2.0 %.

Conservation measures

Since 1994, under the fund of FAO and the Vietnamese Government, a big project on indigenous animal genetic resources conservation was conducted by NIAH (National Institute of Animal Husbandry) to rescue all the rare animal breeds from the extinct and Ac chicken is one breed among them.

The first survey was conducted in the South of Vietnam (Long an, Tien Giang, HCM city and the surrounding areas) in order to document all the related information of Ac chicken.

Ac chickens were also purchased from Longan province and transferred to the North (NIAH) of Vietnam and conserved by in-situ method. They were ringed for identification and randomly allocated to 22 contiguous pens within the same shed, ten birds per pen, birds were also kept in population herds. Strict biosecurity measures were adopted and persons attending the flock had no contact with other poultry. Caution was taken to exclude the presence of other domestic animals, rodent....

The birds were kept in intensive method in opened house with concentrated feed. All the data on morphometric characteristics, performance and meat quality were collected and analysed. The results show that Ac chicken meat is very nourishing and good for human health.

How to increase the population of Ac chicken in the North? it was very difficult thing. At that time, the people did not know more about the special of Ac chicken meat. Using the good results from the experiment, we made the advertising, even gave free chicken to the consumers for testing and then now Ac chicken were accepted by farmers and consumers. They develop very fast. With many way of raising, Ac chicken is really become a very important resource of income for the farmers and contribute to alleviate the poverty and enhancing the gender balance. Some other farmers become rich from the income of Ac chicken (the price of Ac chicken meat is twice or three times more expensive than the broiler meat).

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CONSERVATION OF I PIG GENETIC RESOURCES IN THE HOUSEHOLDS AT THANH HOA PROVINCE

LE THI BIEN¹, NGUYEN NHU CUONG², PHAM CONG THIEU¹,
VO VAN SU¹, HOANG VAN TIEU¹

¹National Institute of Animal husbandry of Hanoi

²Hong Duc University of Thanh Hoa province

Abstracts

I pig breed, a local pig breed were kept by farmers for long time in almost of northern delta provinces such as: Thanh Hoa, Nam Dinh, Ha Tay, Hung Yen etc. Appearance I pig breed has many different phenotypes but the population are dominated by phenotypes of Fat I and Phase I pigs. Hair and Skin of I pig are shiny black, short mouth, wrinkle face, to close the eyes, belly to hazy down, short leg, small body, be long to fat type. Body weight at 1 day of age: 0.49 kg, Weaning at 2 months of age: 5.2 kg and one year old 61.9 kg. 2.2 litter size /sow/year

The survival rate is about 97% from the time of newborn to the time of weaning, delicious meat, well take care of their piglet, adapted well in poor nutrition hot and wet weather. Beside it, I pig has some disadvantage characteristics such as: low liveweight gain, small body, high of fat ratio. Even I pig has so many good characteristics as mentioned above, but the number is step by step decline. They need to to conserve and develop. Under the support of Vietnamese Government, one big project on rare and indigenous animal resources was conducted and I Pig is one of breed among them.

Introduction

I pig breed, a local pig breed, belongs to Mammalian. It was assumed that I Pig originated from North of Nam Dinh province. For a long time ago, fat (Mo) I and Phase I pig breed are produced by random crossing with other breeds . These breeds have been named by different local names, such as: fat (Mo) I pig, “Nhan” I pig or “Ho Bung” I pig. Phase “Pha” I pig can call “Pha” I pig, “Bot Pha” I pig or “Song Buong” I Pig. (Le Viet Ly. 1999), I pig was one of popular breeds kept in the northern provinces of Vietnam before 1970s. The breed was distributed in almost of northern delta provinces such as: Thanh Hoa, Nam Dinh, Ha tay, Hung Yen etc. At that time, they contributed of about 70% the pig population in these provinces. I pig population has been decreased since the end of 1970s. Nowadays, it becomes in endanger situation and is kept in only some communes of Thanh Hoa province with a small number. To replace this breed, farmers prefer to raise Mong Cai pig, crossbred F1 (Mong cai x Large white or landrace...) due to its high performance.

The districts of Quang Giao, Quang Dai, Quang Hai, Quang Xuong in Thanh Hoa province had been well known areas of raising I pig. I Pig was discovered first time in Quang Hai district and they were called “Quang Hai” I pig. The Population size and their distribution have been considerably decreased since the end of 1970s. Under the fund of NIAH (National Institute of Animal Husbandry), this I Pig breed has been conserved by in-situ method in some communes of Thanh hoa province.

Due to economic pressure, farmer’ prefer to raise the crossbred or exotic pig breeds with high performance and high lean meat ratio. As consequence of commercialization, I pig population were decreased and to be at risks of extinction in 1990 and the population at that time were only 169 sows and no boar. (Nguyen Nhu Cuong. 2001)

In order to conserve the I pig breed genetic resource in Thanh Hoa, since 2001, the National Institute of Animal Husbandry under the fund of Vietnamese Government have conducted the program of I pig genetic resource conservation in Thanh Hoa province by supporting for the householder to keep I pig pure bred.

Breed characteristics

Appearance

I pig breed has many different phenotypes but Fat I and Phase I pigs are dominated.

- Fat I (Black I)

Hair and Skin of I pig are shiny black, most of them has thin and small hairs, some of them has thick hair (drew hair)

The head is somewhat big. A bigger brow and creaser face is found as pig becomes fat. The neck and cheek run down at the age of 5 to 6 months. The animal shows very small eyes and a big and short mouth, which the lower lip is longer than the upper lip. The older Fat I pig has longer mouth and always shorter than Phase I. Although the breed has a well developed shoulder, deep chest, big rump, hammock back and big belly to touch ground, it's body shape and legs is shorter than those of Phase I pig. (Le Viet Ly. 1999)

Phase I: Hair and Skin of I pig are shiny black, most of them has thin and small hairs. The breed has a plane brow, little crush face and medium mouth in length. The shoulder is equal to or bigger than the brow at the age of 8 to 9 months. The body shape is longer than that of Fat I pig. The belly looks flat even when it becomes fat. The brow well develops at 6 to 7 months of age (Le Viet Ly.1999).

Productivity of I pig

* Growth performance

Live weight gain of I Pig as following the table below

Ages (month)	Live weight (kg)
1 day old	0.49
1 month	2.3
2 month	5.2

3 month	8.9
4 month	14.1
5 month	20.3
6 month	27.5
7 month	35.1
8 month	42.7
9 month	48.8
10 month	54.4
11 month	58.9
12 month	61.9

(Sources Nguyen Nhu Cuong, Le Diep Long Bien. 2004)

*** Reproductive performance**

I pig have ability to be adapted with local production system of low input – low output and good resistant with diseases. Moreover, it can take care its piglet well.

Mating activities of male can be practiced at from 3 to 4 week of age. At 40 days of age, it's sperm can impregnate. However, It is recommended that using a boar for mating should be more than 6 month of age and the mating duration to be used is better from 2 or 3 years.

Mature age of female I pig ranges from 120 to 130 days and it can impregnate at this age. However, starting to use a female as breeding first time at 7 months of age is suggested. On average, Oestrus cycle of I pig varies from 19 to 20 days (ranging from 17 to 24 days). A heat duration is from 3 to 4 days, the second day of this duration is the best day to mate. A pregnant time is from 110 to 115 days.

Regarding to Thanh Hoa I Pig breed, mature age of female is early. At 3 months of age, the female presents breeding activities and can be pregnant at 4 months of age. Oestrus cycle varies from 19 to 21 days, oestrus duration is from 4 to 5 days (ranging for 3 to 8 days). The best age giving the first birth is 8 months of age with the bodyweight from 35 to 40 kg. A pregnant duration is 110 days. The litter size/litter ranges from 8.8 to 11.3 with a value of 2.2 litter size /sow/year. A sow can be used until 10 or 11 years of age. The survival rate is about 97% from the time of newborn to the time of weaning (Le Diep Long Bien)

The current situation of protection (conservation) for I pig

Nowadays, I pig genetic resource conservation in Vietnam has faced some difficulties due to some reasons:

Firstly, The farmers are not interested to keep the breed because it's low productivity such as: small bodyweight, high fat rate compare with cross and exotic breed.

Secondly, population size of the breed is small. A total of only 50 sows conserved in Hoang Hoa district of Thanh Hoa province is really small.

Third, mating system has not yet paid an attention. Therefore, the high level of inbreeding occurs due to mating between relative animals

Fourth, financial support for the households to buy feed and breeding animals is still limited.

Recommendations

I pig is local breed to be raised by farmers in Thanh Hoa, NamDinh, Thai Binh... provinces for long time ago. It is precious local genetic resources with high quality of meat, delicious and pineapple meat. The breed is not only easy to raise but also adapted well in hot climate and local production system in Vietnam. Therefore following activities to conserve this breed are necessary:

A breeding program to avoid inbreeding and to increase the population size should be put in urgent attention.

A suitable financial support should be considered to encourage the farmer to keep this breed

Marketing and use the products of the breeds should be researched to ensure a sustainable development of the breed for the future.

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BA XUYEN PIG AND ITS CONSERVATION

NGUYEN TIEN LUC AND PHAN MINH HIEU

Department Animal Health of Soc Trang

Summary

1. Introduction

Ba xuyen was name of Soc trang province nowadays, located in Mekong River Delta.

Ba Xuyen is a composite of the Berkshire, imported from 1932-1958, and the Bo Xu that is itself a composite of the Craonnais, imported around 1920 by French planters, and Chinese pigs imported around 1900 by Chinese traders (Department of Animal Science of OSU (2008).

Ba xuyen pig with Thuoc nhieu pig were two main local types in South Vietnam. While Thuoc nhieu was lost at least before 1990, Ba xuyen was luckily to be saved in frame of National Project of Animal Genetic Resources Conservation, which was carried out since 1990.

2. Conservation method

Conservation is taken place at Daihai village. 10 families are concerned to this conservation work.

The Baxuyen pig herd is of 50 sows and 5 boar. Artificial insemination is used for mating.

Conservation fee: Annually National Institute of Animal Husbandry supply 20 million and Department of Health of Soctrang supply the same amount to help farmers of Daihai village to conserve these animals.

All animal is ear-tagged and recorded individually.

All traits are observed and recorded.

Data is managed with VIETPIG – a software for pig data management.

3. Results and discussion

3.1 Ba xuyen pig characterization

Cottony pig with base black and white, short body, medium-sized ears and small legs, with roughly similar proportion of black and white areas on the body.

Medium frame, curvy and crooked mouth, stand ears and prone, flatly back, body to steal

The average number of piglets born alive per litter is 8. Pig weighs 100 kg by 12 months of age with high back fat thickness of 42 mm (Department of Animal Science of OSU (2008).

3.2 Growing rate

age (Months)	BodyWeigh (kg)	Body lenght (cm)	Chest (cm)	High (cm)
2	7,25	50,54	46,80	29,38
3	13,54	61,74	55,88	34,27
4	19,68	70,63	64,80	39,43
5	28,10	80,88	73,19	44,75
6	43,66	88,80	80,57	48,61
7	54,40	93,15	88,49	50,98
8	65,81	100,48	93,62	52,12
9	74,84	105,70	99,23	56,60
10	83,74	109,47	104,34	58,48
11	96,25	113,80	109,13	58,94
12	100,52	115,79	111,05	62,12
>12	119,51	120,42	116,52	66,49

3.3. Reproduction traits

	Unit	Number of occurrence observed /	Rate %
Age at first heating	Day	202.7	
BW at first heating	kg	53.7	
Number born	head	8.49	
weight at birth	kg	0.71	
Number of pigs at stop suckling	head	7.68	
BW at 45 days (at stop suckling)	head	7.56	
Rate of pregnant	%	64/74	86,49
Rate of sire	%	63/64	98,44
Amount of piglet/litter	head	498/63	7,9
Amount of litter/year	litter	63/27	2,33
Weight of piglet	head		0,7-0,9
Amount of piglet feed	head	454/63	7,21
Amount of weaning	head	414/63	6,57
Rate of death before parturition	head	31/498	6,22

3.4 Semen production

Boars	Volume (V ml)	Action (A)
0538	112.5 ± 7.03	0.83 ± 0.08
0539	124.16 ± 7.69	0.83 ± 0.08
0540	127.91 ± 7.63	0.83 ± 0.08

3.5 Meat production

	Unit	Medium
Live Weigh at slaughtering	kg	97
Rate of dress	%	73.31
Thick of flat back	cm	4.36
Area of phile	cm ²	21.0

3.6. Other character

Ba Xuyen pig is adapted well to the salty-water or alum land zones of the Mekong River delta in southern of Vietnam. Most important trait is high tolerance against mosquito: Ba xuyen pigs do not need mosquito net while other exotic like Yorkshire, Berkshire

4. Conclusion and suggestions

Baxuyen pig is adapted very well and this animal can be good type of pig in salt water areas and mosquito- resistant. It is expected used widely when Mekong delta will be flooded due to climate change which is occouring.

It should be increased size of this herd as much as possible.

Reference

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GENETIC DIVERSITY OF CHICKEN POPULATIONS IN HA GIANG BASED ON MICROSATELLITE MARKERS

NGUYEN TRONG BINH^{1*}, PHAM DOAN LAN¹, DO NGOC DUY¹, NGUYEN VAN BA¹,
HOANG THANH HAI¹, NHU VAN THU¹, LE THI THUY¹, VU CHI CUONG¹ & J.C.MAILLARD²

¹ National Institute of Animal Husbandry; ² CTA of Biodiva project

*Corresponding author: MSc Nguyen Trong Binh, Key Laboratory for Animal Cell Technology
National Institute of Animal Husbandry Ha Noi – Viet Nam
Tel: 04.2132785; Fax: 04. 8.389.775; Email: binhnhiah@yahoo.com

Abstract

Genetic diversity of chicken populations in Ha Giang based on micro satellite markers

The current study aiming at accessing genetic diversity of 11 chicken populations (2305 samples in 11 districts) in Ha Giang province was undertaken. Twenty-two micro satellites were genotyped for chickens, which were randomly selected from 11 populations (11 districts), including: Bac Me (284), Bac Quang (178), Song Van (176), Hư Giang town (125), Hoang Su Phi (217), Meo Vac (237), Quan Ba (244), Quang Binh (171), Vi Xuyen (199), Xi Man (238), Yen Minh (236). A total of 190 alleles were observed in the 11 populations. The average number ($\pm$ SD) of alleles/locus was 8.48 ± 4.71 . Mean observed and expected heterozygote across all populations was 0.564 and 0.636. Overall average inbreeding coefficient (Fis) was 0.114. The overall genetic variation was low (0.01). Small Nei's (1972) standard genetic distances ranging from 0.007 to 0.044 were observed between 11 populations in Ha Giang. Genetic distance was small in phenotypic populations but large between phenotypic populations and Ho population. This study showed a low genetic variation and genetic distance but a high genetic diversity within the Ha Giang chicken population where scavenging method have been practicing.

Key words: Hagiang, micro satellite, chicken breeds, genetic distance, genetic diversity

Introduction

During thousands years of domestication, the chicken has been considerably differentiated by natural and artificial selections (Romanov and Weigend, 2001). Chicken production plays the second most important role in Vietnam livestock production. The local breeds have low performance but they are predominant in number and kept in extensive scavenging systems. In Vietnam chicken breeds are mainly kept in small households, in rural areas and are based on scavenging or foraging and they play a very important role in farmer's livelihood.

The conservation of natural genetic variation is important not only for ethical and aesthetic reasons but also for ensuring that the earth's living resources will be used even more efficient and sustainable in agriculture, forestry, food production and other industries (Karp et al., 1998). In addition to producing food, animal genetic resources serve as a "storehouse" for the wide range of desirable production traits (FAO, 1995). The genetic potential of indigenous poultry as a reservoir of genomic variation and major genes with relevance to improve adaptability has been recognized. More needs to be known about the variation that already exists and how it can be conserved and accessed effectively (Karp et al., 1998).

Based on analysis done in DNA pools of a wide range of populations, genetic diversity among chicken breeds seems to be lower than in other domesticated species (Hillel et al. 2003). Genetic marker polymorphisms are a reliable way of assessing the differences within and among chicken populations. Within population diversity is an important component of species variation, particularly in domesticated species (Caballero & Toro, 2002). Between- population diversity is usually assessed using genetic distance measures (Nei, 1972; Reynolds et al, 1983). Alternatively, mean kinships between population (Ending and Meuwissen, 2001) provide a statistic that relates directly to quantitative genetic variation. The aim of our study was to access genetic diversity of chicken population in Ha Giang based on micro satellite marker. The study was support by Biodiva project.

Materials and Methods

Materials

Blood sample from each individual of chicken were collected by radial vein puncture (wing vein) using syringe with 25G needle contained 100 $\times$ l 0.1M EDTA (anticoagulant). The blood were cooled under ice and transfer to the laboratory and kept at -20°C until use.

A total of 2305 birds were collected in 11 districts- Hagiang province: Bacme (284 blood samples), Bacquang (178), Dongvan (176), Hagiang town (125), Hoangsuphi (217), Meovac (237), Quanba (244), Quangbinh (171), Vixuyen (199), Ximan (238), Yenminh (236).

Methods

The DNA extraction method by Qiagen Kit (Germany)

DNA polymorphism: The DNA polymorphism was determined using a set of 22 microsatellite markers. The marker loci correspond to the revised set of microsatellites which were suggested by FAO (1995, 2002) for the MoDAD project (<http://dad.fao.org/en/refer/library/guidelin/marker.pdf>).

Polymerase chain reaction (PCR) was used to amplify the specific DNA fragments containing microsatellites. 4 to five pairs of primers were run in one tube. Each PCR tube contained 1 μ l (10pmol/ μ l) forward primer labeled, 1 μ l (10pmol/ μ l) reverse primer, 1.2X buffer, 200nm dNTP; 15mM Mg^{++} ; 1.5U Taq-polymerase; 100ng of genomic DNA and distilled water.

The amplification protocol involved initial denaturation of DNA and enzyme activation, at 94° (5min) followed by 35 cycles of denaturation at 94° (45seconds), primer annealing at temperature varying between $55-60^{\circ}$ (1min), extension at 72° (1min), and final extension at 72° (10 min) using an automated thermal cycler. Fluorescent and-labeled (fluorescent dye: D2 (black), D3 (blue), and D4 (green)), PCR primers were use and size characterization of PCR product was performed by an CEQ 8000 Series-Genetic Analysis System (Beckman Coulter)

Statistical analysis

The micro satellite data set was formatted using the micro satellite toolkit for MS Excel 2000.

Measurement of genetic variation within populations: Using FSTAT version 2.9.3 (Goudet, J., 2001), Genetics version 4.03 (Belkhir K., 2004), Phylip version 3.5 (Felsenstein, 1993).

Results and Discussion

Marker polymorphisms and within- and among population diversity

Marker polymorphisms

The observed characteristics of 22 micro satellite loci use for 2305 individuals are shown in table 1:

A total of 190 alleles were observed across all populations from 22 loci surveyed. The average number of alleles ($\pm$ SD) across all loci was 8.48 ± 4.71 and ranged from 3 (MCW098 and MCW103) to 18 (MCW183).

Table 1: Characteristics of micro satellite loci: reported and observed size, number of alleles in all populations and the number of alleles unique to the Ha giang province

Locus	Reported allele range (bp)	Reported No of alleles	Observed allele No of alleles	Observed allele range (bp)	Unique alleles
MCW 295	88-106	10	11	87-107	
ADL 112	120-134	8	4	124-130	
MCW216	139-149	6	5	139-147	
MCW014	164-182	23	15	161-189	161, 185, 187, 189
MCW 098	261-265	3	3	255-259	255, 257, 259
MCW 111	96-120	13	9	97-113	
MCW078	135-147	5	5	134-144	
MCW222	220-226	4	4	216-222	216, 218
LEI094	247-287	21	17	249-285	
MCW 183	296-326	14	18	293-333	293, 331, 333

ADL 278	114-126	7	5	111-127	111
MCW 069	158-176	10	11	153-173	153, 155
MCW 034	212-246	18	14	214-244	
MCW 103	266-270	2	3	266-270	
ADL 268	102-116	8	5	101-114	
MCW 037	154-160	4	4	151-157	151
MCW 067	176-186	6	7	169-181	169, 171, 173
MCW 206	221-249	15	14	220-248	
MCW 081	112-135	10	9	110-140	140
MCW 248	205-225	11	7	213-225	
LEI 166	354-370	8	8	342-358	342, 344, 346, 348, 350, 352
MCW 330	256-300	11	12	248-288	248
Total		190			
Mean alleles per locus		8.48 ± 4.71			

There are some alleles showing that the allele size range is out of studied chickens of AVIANDIV (2004): there are alleles 161, 185, 187, 189bp for MCW014; alleles 342, 344, 346, 348, 350, 352 for LEI166... Especially, in locus MCW098 size of all alleles (255, 257, 259 bp) is out of the AVIANDIV range.

The mean number of alleles observed for all the markers in this study was 8.48. It is higher than previous reports of Cuc et al, (2006) An Assessment of Genetic Diversity of Vietnamese H'mong Chickens and lower than reports of Romanov & Weigend (2001) for domestic and jungle fowl population in Ukraine and Germany. By reports of Muchadeyi et al (2007), the average number of alleles/locus was 9.7 for chicken randomly selected from 13 populations, including the five eco-zones of Zimbabwe, Malawi, Sudan and six purebred lines.

The similar and different results in these studies derived from the difference in chosen loci and the genetic variations in the populations.

Genetic Variation

From 22 microsatellite loci, high genetic variation and polymorphism were observed in all population of Thai native chicken and hybrid layer. The number of allele per population in each locus ranged from 3 to 18. The average allele number per primer was 8.48.

Table 2: The mean number of allele frequency of 11 populations in locus MCW295

Allele	Population										
	BME	BQG	DVN	HGG	HSPHI	MVC	QBA	QBH	VXN	XMN	YMH
87	0.066	0.085	0.054	0.028	0.071	0.103	0.072	0.069	0.088	0.063	0.106
89	0.333	0.268	0.231	0.272	0.212	0.211	0.282	0.204	0.226	0.3	0.242
91	0.011	0.028	0.057	0.024	0.037	0.034	0.027	0.039	0.03	0.025	0.023
93	0.005	0	0.003	0.012	0.002	0.017	0	0	0.01	0	0
95	0.278	0.339	0.317	0.356	0.387	0.308	0.294	0.335	0.352	0.328	0.309
97	0.133	0.119	0.114	0.092	0.088	0.188	0.126	0.123	0.136	0.095	0.155
99	0.011	0.02	0.04	0.032	0.007	0.019	0.014	0.003	0.02	0.004	0.036
101	0.036	0.048	0.086	0.076	0.062	0.038	0.047	0.033	0.05	0.038	0.028
103	0.1	0.09	0.086	0.1	0.127	0.072	0.119	0.165	0.063	0.122	0.081
105	0.028	0	0.011	0.008	0.007	0.006	0.01	0.012	0.008	0.023	0.013
107	0	0.003	0	0	0	0.004	0.008	0.018	0.018	0.002	0.008

The mean number of allele frequency of all 11 populations (Bac Me, Bac Quang, Dong Van, Ha Giang town, Hoang Su Phi, Meo Vac, Quan Ba, Quang Binh, Vi Xuyen, Xin Man, Yen Minh) of MCW 295 locus are shown as an example in table 2 and figure 1.

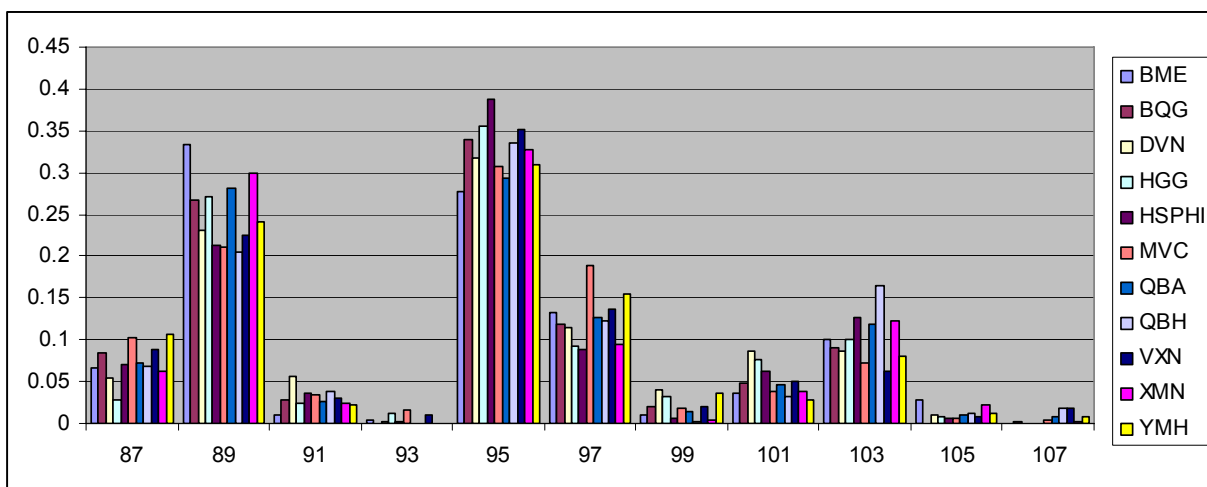


Figure 1: The histogram of the allele frequency of 11 populations in locus MCW295

The numbers of allele frequency of other 21 locus are shown in Appendix I.

Genetic diversity and Hardy-Weinberg testing

Observed and expected heterozygote, mean polymorphic information content PIC, Fis, Fst, and the Hardy-Weinberg equilibrium test for 11 populations and 22 micro-satellites were presented in tables 3 and 4:

Table 3: Observed and expected heterozygote, Fis, Fst, PIC in each marker per population

Locus	<i>Ho</i>	<i>He</i>	<i>PIC</i>	<i>Fst</i>	<i>Fis</i>
MCW295	0.705	0.791	0.76	0.004	0.109
ADL112	0.547	0.569	0.48	0.014	0.039
MCW216	0.31	0.442	0.40	0.006	0.299
MCW014	0.645	0.794	0.76	0.009	0.187**
MCW098	0.248	0.27	0.24	0.007	0.082*
MCW111	0.695	0.74	0.69	0.007	0.06**
MCW078	0.339	0.487	0.42	0.016	0.303*
MCW222	0.404	0.531	0.45	0.013	0.24*
LEI094	0.747	0.824	0.80	0.006	0.093*
MCW183	0.478	0.521	0.49	0.015	0.084*
ADL278	0.514	0.568	0.56	0.011	0.095*
MCW069	0.765	0.825	0.80	0.006	0.072*
MCW034	0.701	0.775	0.75	0.008	0.095*
MCW103	0.48	0.498	0.38	0.004	0.036*
ADL268	0.625	0.657	0.59	0.007	0.049*
MCW037	0.533	0.648	0.57	0.007	0.177*
MCW067	0.638	0.713	0.66	0.007	0.105*
MCW206	0.656	0.771	0.74	0.003	0.149*
MCW081	0.417	0.463	0.43	0.009	0.099**
MCW248	0.652	0.702	0.66	0.007	0.071*
LEI166	0.604	0.62	0.54	0.005	0.026**
MCW330	0.694	0.793	0.76	0.008	0.124*
Mean	0.564	0.636		0.010	0.114

NS: Not significant; *: Signification at the 5% level; **: Signification at the 1% level

The mean number of allele of all 11 populations is 7.52, 7.33, 7.43, 7.10, 7.29, 7.76, 7.52, 7.38, 7.14, 7.62 and 7.43 in in Bac Me, Bac Quang, Dong Van, Ha Giang town, Hoang Su Phi, Meo Vac, Quan Ba, Quang Binh, Vi Xuyen, Xin Man, Yen Minh populations, respectively (Table 4).

Mean expected heterozygote was 64%, 64%, 63%, 62%, 64%, 65%, 62%, 65%, 63%, 64% and 63%, while observed heterozygote was 56%, 58%, 56%, 56%, 56%, 56%, 56%, 55%, 58%, 57%, 57% in Bac Me, Bac Quang, Dong Van, Ha Giang town, Hoang Su Phi, Meo Vac, Quan Ba, Quang Binh, Vi Xuyen, Xin Man, Yen Minh populations, respectively (Table 4).

It is considered that, loci are highly polymorphic when $PIC > 0.5$ (Vanhala et al., 1998). Mostly, loci studied were highly polymorphic, and with the highest value 0.80 (LEI094 & MCW069). The highest heterozygote (0.825) was also belonging to MCW069. It was found that a comparing heterozygote with PIC, all PIC values of the heterozygote were consistent with that of PIC.

Table 4: Mean number of alleles/locus, observed and expected heterozygote, Fis and HWE test per population

Pop	N	Mean number of alleles/locus	He	Ho	Fis	HWE
BME	284	7.52 ± 4.11	0.64 ± 0.17	0.56 ± 0.17	0.13	NS
BQG	178	7.33 ± 3.77	0.64 ± 0.15	0.58 ± 0.13	0.09	NS
DVN	176	7.43 ± 4.02	0.63 ± 0.17	0.56 ± 0.17	0.12	NS
HGG	125	7.10 ± 3.82	0.62 ± 0.17	0.56 ± 0.16	0.10	NS
HSPHI	217	7.29 ± 3.76	0.64 ± 0.15	0.56 ± 0.15	0.12	NS
MVC	237	7.76 ± 4.22	0.65 ± 0.15	0.56 ± 0.15	0.14	NS
QBA	244	7.52 ± 4.06	0.62 ± 0.17	0.56 ± 0.16	0.10	NS
QBH	171	7.38 ± 4.00	0.65 ± 0.13	0.55 ± 0.14	0.16	NS
VXN	199	7.14 ± 3.67	0.63 ± 0.15	0.58 ± 0.15	0.09	NS
XMN	238	7.62 ± 4.07	0.64 ± 0.15	0.57 ± 0.15	0.10	NS
YMH	236	7.43 ± 3.96	0.63 ± 0.17	0.57 ± 0.16	0.10	NS

NS: Not significant

Status and trend in genetic diversity is important among domestic species (Notter, 1999). The observed mean heterozygote was lower than the expected mean heterozygote for all populations. Average mean observed heterozygote (Ho) within the 11 chicken populations across all 22 loci was 56.4%, range between 24.8% (MCW098) to 76.5% (MCW069), respectively, while the expected mean heterozygote (He) was 63.6% and range from 27% (MCW098) to 82.5% (MCW069) (Table 3). Heterozygote is a good measure of genetic variability of polymorphic loci. The higher the heterozygote values are, the broader the genetic diversity. Hagiang chicken population can be considered as genetic diversity population.

Genetic distance and phylogenetic tree

Table 5: Genetic distance matrices between all pairs of population

	BME	BQG	DVN	HGG	HSPHI	MVC	QBA	QBH	VXN	XMN	YMH
		0.03	0.01	0.02		0.01		0.03	0.02	0.01	
BME	0	2	5	3	0.017	3	0.01	6	1	9	0.009
			0.04	0.01		0.03	0.02	0.02	0.01	0.02	
BQG	*	0	4	8	0.03	9	4	6	2	2	0.03
				0.02			0.01	0.03	0.02	0.01	
DVN	*	*	0	9	0.016	0.01	2	6	5	9	0.01
							0.01	0.02	0.01		
HGG	*	*	*	0	0.018	0.02	5	6	5	0.02	0.024
						0.01	0.01	0.02	0.01	0.01	
HSPHI	*	*	*	*	0	7	3	3	7	2	0.015
							0.01	0.03	0.02	0.01	
MVC	*	*	NS	*	*	0	2	6	4	8	0.01

								0.02	0.01		
QBA	*	*	*	*	*	*	0	7	4	0.01	0.007
									0.02	0.02	
QBH	*	*	*	*	*	*	*	0	1	1	0.03
										0.01	
VXN	*	*	*	*	*	*	*	*	0	2	0.019
XMN	*	*	*	*	*	*	*	*	*	0	0.014
YMH	*	*	*	*	*	*	*	*	*	*	0

The average F_{is} value of 0.144 across all population groups indicated that there is a small deviation from random mating and that inbreeding has had very little effect on the populations.

Genetic differences between breeds and populations are created by mutation and recombination, along with genetic drift, natural and artificial selection, and migration (Eding and Laval, 1999). The overall genetic differentiation value of 0.10 is substantially small which indicated that little genetic differentiation between populations resulting from possible genetic drift. About 1% of the total genetic variation attributed to the diversity between populations was admixture between populations, 99% was found within the populations themselves.

A Pairwise F_{st} (proportion of genetic variability due to population substructuring) value is low 0.01 observed between pairs of 11 populations in Ha Giang chicken.

Nei's genetic distance of 11 population chicken in Ha Giang were listed in table 5. Small genetic distances ranging from 0.007 (between Yen Minh and Quan Ba population) to 0.044 (between Dong Van and Bac Quang).

The standard genetic distance values of Nei (1972) between the different populations were used for constructing a phylogenetic tree by Phylip software (Fig. 2).

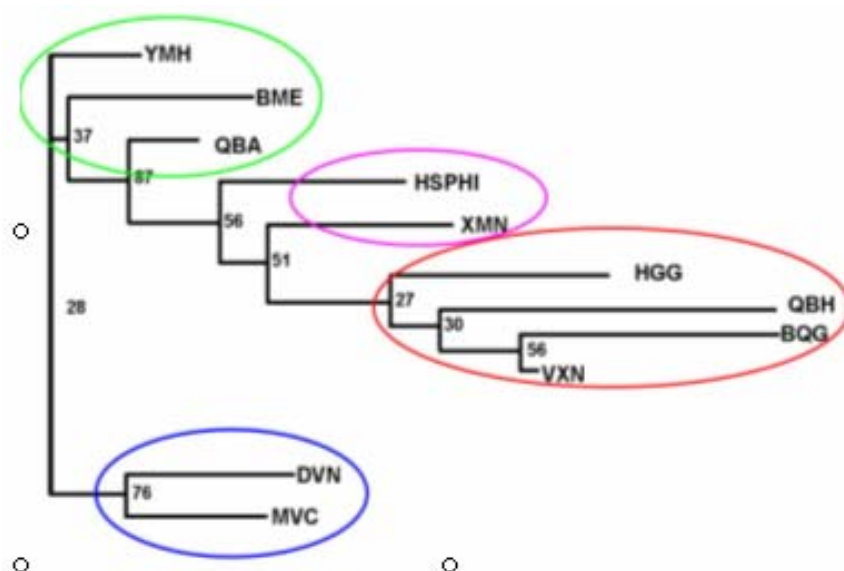


Figure 2: Phelogenetic tree constructed from genetic distance of Nei (1972) by Phylip software showing genetic relationship among 11 populations

In Ha Giang chicken populations, although higher phenotype diversity but genetic distance between orther population is small. Ha Giang chicken are raised almost as natural populations under free range backyard scavenging systems characterized by minimal management interventions in terms of nutrition, breeding (systematic artificial selection) and veterinary health care.

Conclusion

Chicken populations in Ha Gang had a high diversity of phenotype and genotype (the value H_e is 0.636)

The genetic distance between 11 districts in Ha Gang was small. The gene flow in chicken populations of Ha Gang was very high.

Acknowledgements

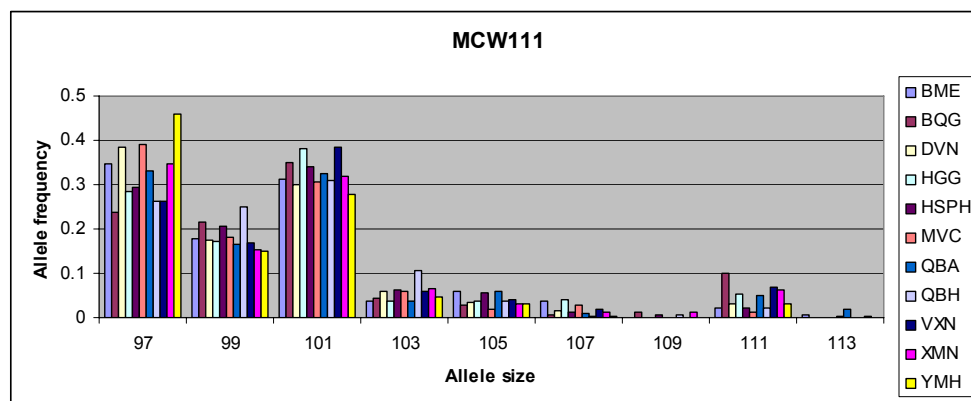
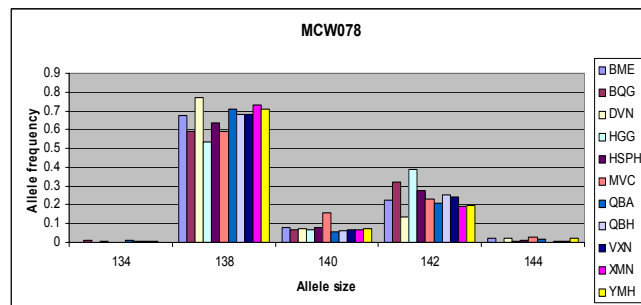
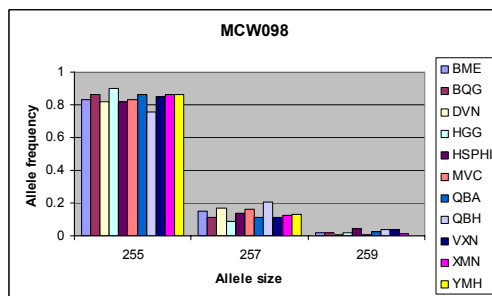
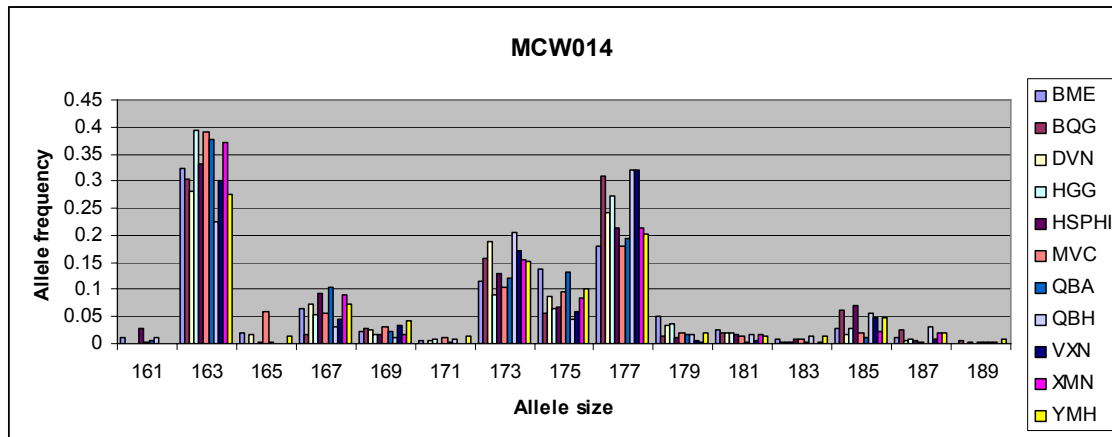
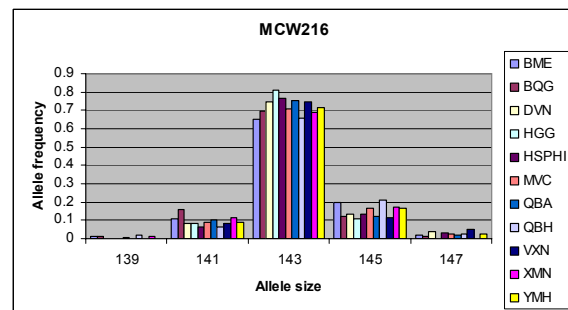
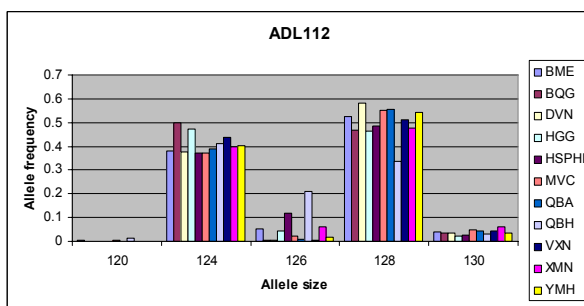
This study was apart of BIODDIVA project and was jointly funded by the French Ministry of Foreign Affairs and National Institute of Animal Husbandry of Vietnam.

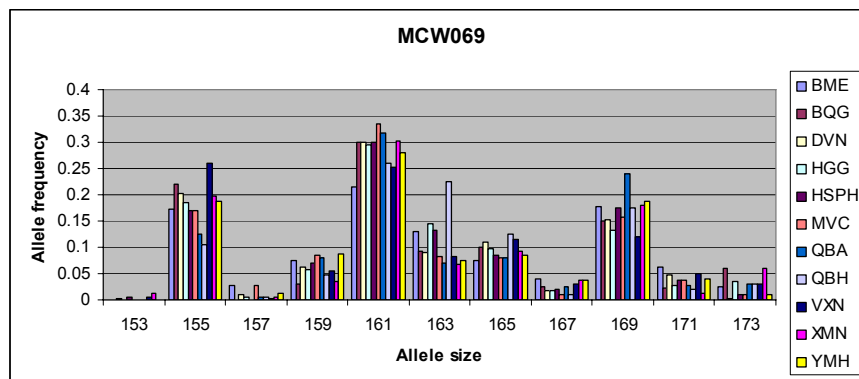
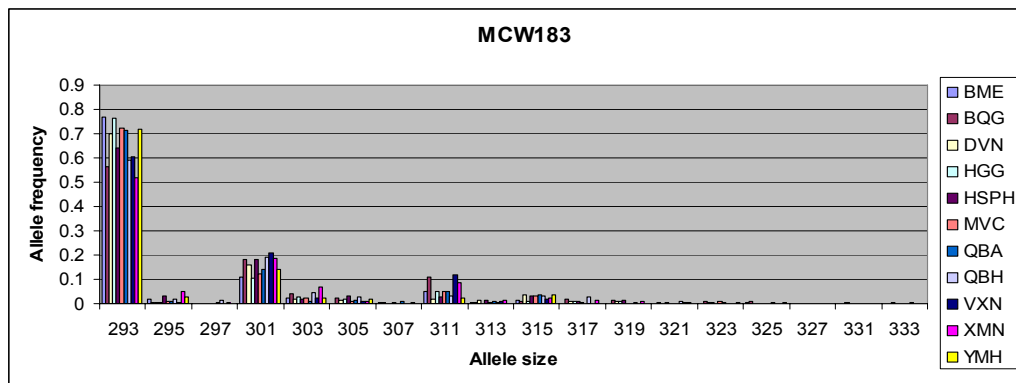
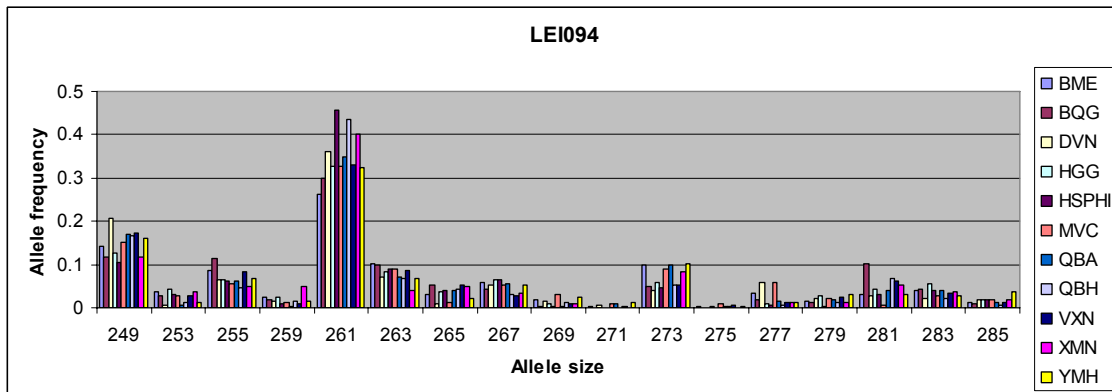
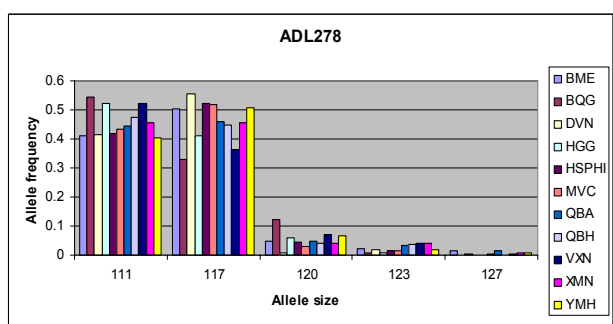
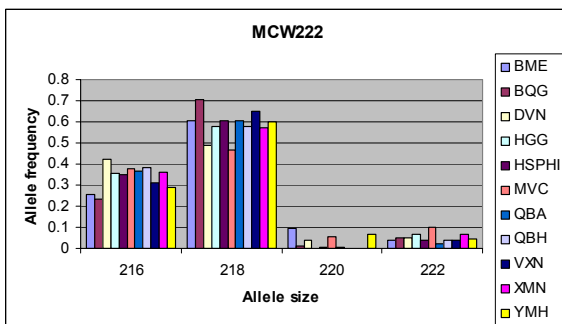
The authors wish to thank Dr. Sophie Thevenon, Dr. Johan Michaux, Dr. Michael C. Fontaine for teaching us some methods of data analysis. We also thank all membres of field group of BIODIVA project for their sample collection.

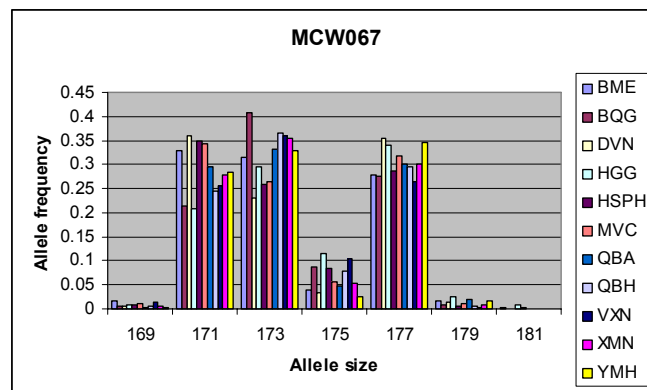
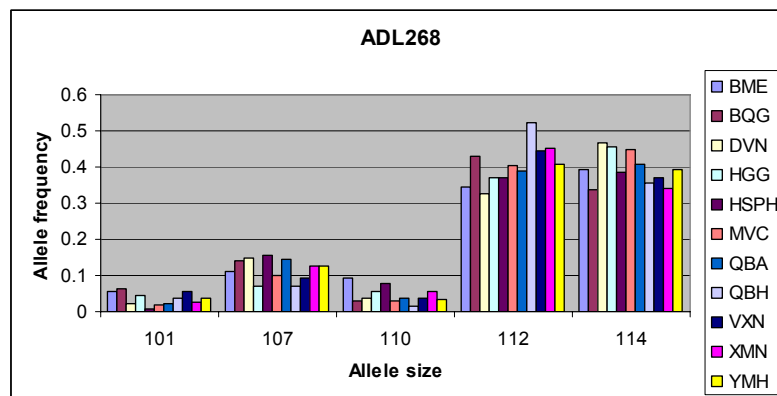
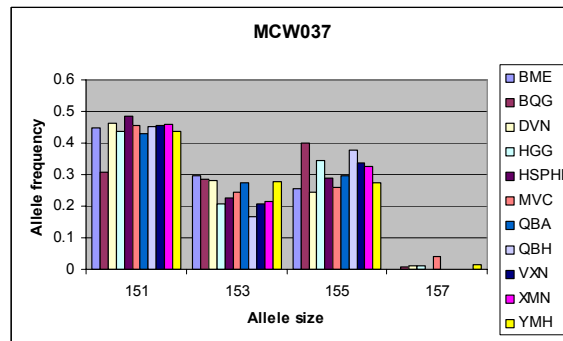
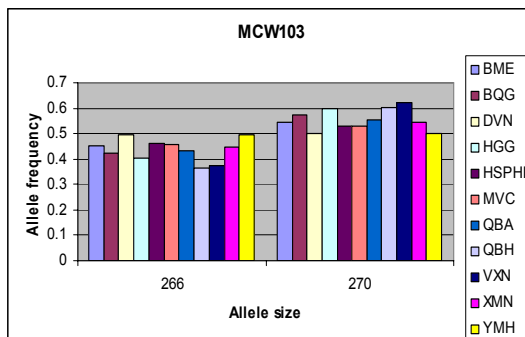
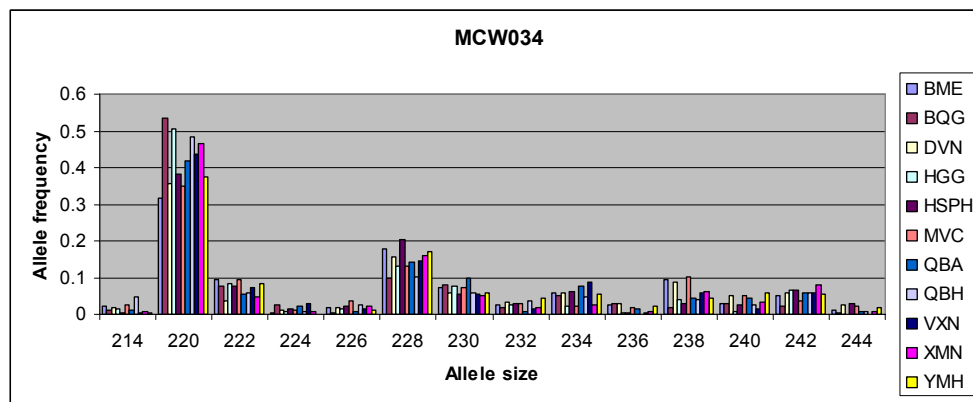
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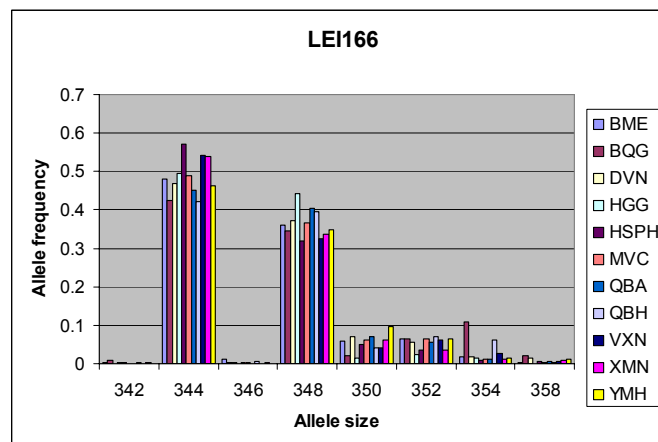
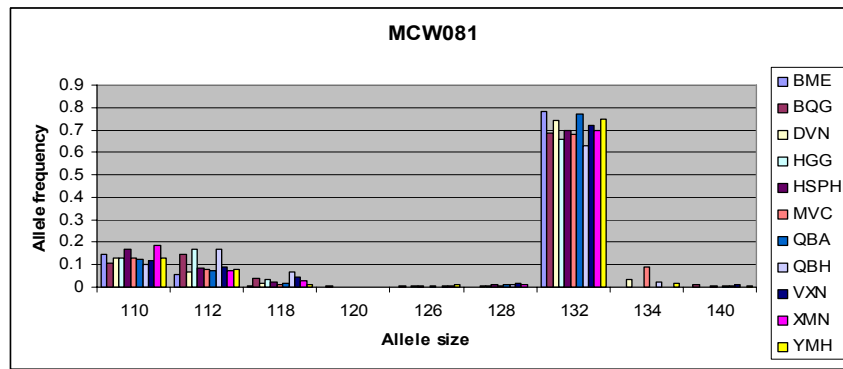
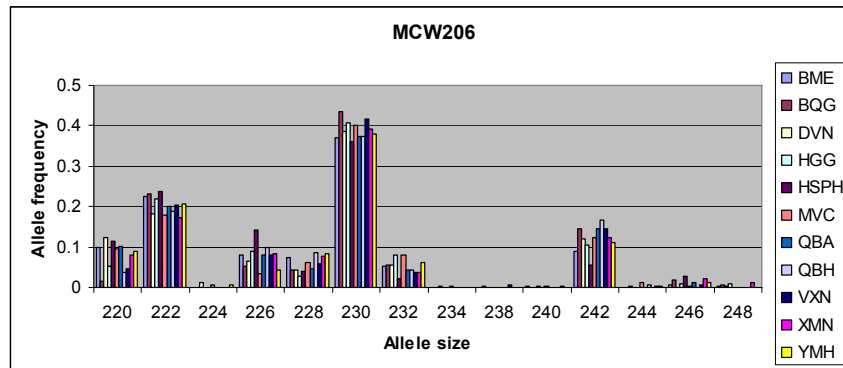
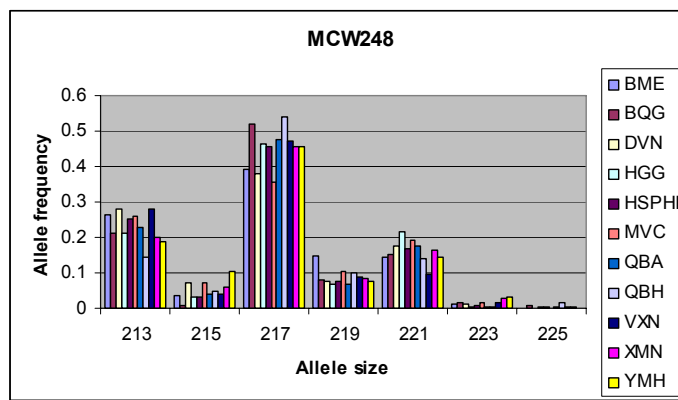
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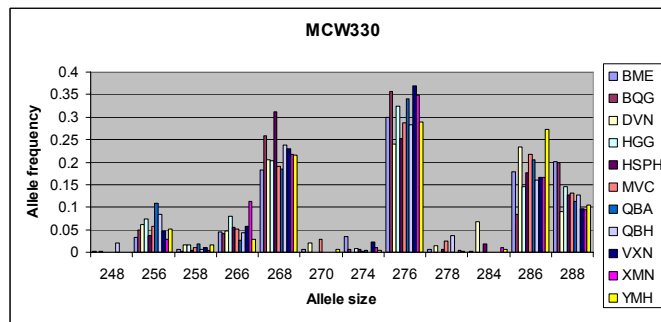
Appendix I











IMPROVEMENT OF PRODUCTIVE AND REPRODUCTIVE EFFICIENCY OF ANATOLIAN BUFFALOES THROUGH THE USE OF ARTIFICIAL INSEMINATION WITH ITALIAN BUFFALO BULLS SEMEN

Ö.ŞEKERDEN^{1*}

¹Mustafa Kemal University, Fac. Of Agric. Dept. of Animal Science, PO.Box: 31034, Antakya, Turkey

*Corresponding autor: sekerden@mku.edu.tr

Abstract

This experiment was designed to determine suitable buffalo genotype for Hatay Region of Turkey by using semen from proven Italian River Buffalo bulls at Ilıkınar Village of Kırıkhan District of Hatay Province of Turkey.

The material of the research was consisted of breedable Anatolian buffalo cows and their progenies. Buffalo cows from Anatolian breed are being inseminated with the semen of Italian River buffalo bulls artificially after being synchronized of estrus. Crossing will be continued up to G₁ genotype level. During the experiment productive, reproductive, growth performances, milk composition, in addition beginning from August 2006 rennet coagulation time, somatic cell count are being determined on Anatolian, F₁ and G₁ genotypes. Until March 2008, as a total of 105 crossbred buffaloes (65F₁, 5G₁, 7F₂, 28 F₁ x Anatolian) were born in the Project.

From now on the Project will continue approximately up to 2010. At that time it will be reached to efficient number F₁ and G₁ materials, and it will be tried to become fixed G₁ characteristics at Ilıkınar environmental conditions.

Key Words: Genetic improvement, artificial insemination, Anatolian buffalo, Italian Buffalo

Introduction

Buffalo number is getting decrease in Turkey speedily, there are 136 000 buffaloes in Turkey according to 2004 statistics (Anonymous, 2004).

Detect of oestrus and ovulation are difficult in buffaloes, because of clear slightly oestrus thanks to that application of artificial insemination is not easy (Ohashi, 1994, Seren et al, 1995). There are significant variation in duration of heat (4-64 hours) (Baruselli, 2001).

Detect of oestrus and ovulation are difficult in buffaloes, because of clear slightly oestrus thanks to that application of artificial insemination is not easy (Ohashi, 1994, Seren et al, 1995). There are significant variation in duration of heat (4-64 hours) (Baruselli, 2001).

Various heat synchronization protocols were evaluated for oestrus synchronization and ovulation in buffaloes. It is ideal that the protocols for synchronization and ovulation have to be effective, not only in cyclic buffaloes, but also non-cyclic ones and when the protocols are combined with suitable

artificial insemination, an high conception rate have to be obtained. Various literature knowledge on conception rate obtained in the end of various synchronization and insemination protocols are shown in Table 1.

Table 1. Various literature knowledge on conception rate obtained

Protocol	Researchers	Conception rate (%)
PRID+1000 IU PMSG	Zicarelli et al, 1997	29.9
PRID+PMSG+PGF2 α	Barile et al (1997)	34.8
PRID	Barile et al, 2001	51
PGF2 α	Neglia et al, 2001	45
PGF2 α + GnRH	“	48.8

The Project was realised as an outcome of Cairo Meeting that hold in 1996 of Interregional Research Network on Buffalo of FAO. Project was started at April of 2002 at Ilıkınar Village of Kırıkhan District of Hatay Province. The Project, as an collaborative Project of 2 countries (Turkey and Italy) was come in to force by using semen originated from Italian bulls which was provided by FAO. At 2005 aids (semen and chemicals) provided by FAO were exhausted, in order to continue to the Project financial support was taken from The Scientific and Technical Research Council of Turkey (TÜBİTAK) for 15 April 2006-15 April 2007 period.

This study was designed to determine suitable buffalo genotype for Hatay Region of Turkey by using semen from proven Italian Buffalo bulls at Ilıkınar Village of Kırıkhan District of Hatay Province of Turkey.

Material and methods

The material of the research was formed by various data of Anatolian and Anatolian x Italian crossbred F₁ buffaloes belong to buffalo herd of Ilıkınar Village of Kırıkhan District of Hatay Province. It can be said that, feeding is almost based on Village pasture. Some extra food are given in the evening at the units. At the beginning (2002), 8 units were included in the Experiment. Experiment have been continued from 2002 until now in 3 units. But, buffaloes in other units in the Village were leaved out of the experiment in various years beginning 2003, because of cooperation could not be continued with the farmers. Feeding and care possibilities are well in one of the 3 units (1st), but other two of them, it is poor.

Multiparous buffalo cows after being examine the cows, which had not pregnant and had not any reproductive problem, had received an drug release device (PRID) intravaginally. PRID were kept for 10 days in uterine. On the 7th day after PRID insertion, an injection of 0.15 mg cloprostenol is given. Because of buffaloes were non-cyclic also 1000 I.U. Pregnant mare serum gonadotrophin (PMSG) were given. Cows were artificially inseminated at 48, 72 and 96 hours with 2 doses semen after the removing of PRID. The cows, which were not heated during both of insemination times, were accepted estrus synchronization was been unsuccessful. The protocol that we applied in last four years as follows (because of exhausting of Dalmazin that had been provided by FAO);

2 cc estrumate (PGF2alpha) injection after 7 days from PRID insertion intravaginally, PRID removing after 10 days from its application, 2 cc dalmarelin (GnRh) injection and insemination artificially at 48, 72 and 96 hours with 2 doses semen after removing PRID

Classification of semen of bulls to cows were realized randomly. Until 30 days after insemination buffalo cows were kept in the barns, because of however most of the bulls are F₁, but some of them are Anatolian on the village pasture.

Pregnancy diagnosis was assessed at 90 days from the insemination by rectal palpation of uterine contents. Pregnancy rates were calculated for animals that were pregnant at 90th days. Calving dates of pregnant cows are estimated, by assuming of pregnancy period as 310 $\pm$ 15. It is accepted that the cows, that calved after $\geq$ 20 days from estimated date, could be synchronized of their oestrus, but, they conceived in the pasture (with Anatolian or F₁ bulls). Calves can be estimated if they have Anatolian or F₁ sires by make use of shape of their noise structure and their behavior to the own owner.

Because of feeding is based on the pasture, increasing of numbers of F₁ and G₁ animals are slow. In addition animals in F₂ and Anatolian x F₁ genotypes are also born. But, the determinations are also done for F₁'s and G₁'s.

Inseminations have been continued 2002, 2003, 2004, 2005, 2006, 2007 and 2008 years. For the last time (April 2008), 23 buffalo cows, that 12 of them are F_1 , were inseminated. So, as a total of 184 buffalo cows inseminated artificially.

Measuring body measurements in 1, 3, 6, 9 and 12 month-ages of the calves that were born in TÜBİTAK support period and monthly milk tests were continued. Total dry matter (TDM), solid non fat (SNF), protein analyses were done in the milk samples of Anatolian and F_1 cows which were taken in the morning milking of milk test days. In addition beginning August 2006, somatic cell score could also be possible in the same samples.

Fattening was applied on 3 F_1 and 6 Anatolian male calves which they were in almost the same ages. In addition various body measurements and live weights were determined of all the calves on not only project's material, but also their contemporaries from Anatolian breed, and in addition on the monthly milk test days milk samples have been taken individually, and milk analyses have been performed for milk components and somatic cell count (SCC). Protein and fat contents were determined by Formol Titration (James, 1998) and Gerber Methods (Kurt, 1984) respectively.

The means and correlation coefficients of the characteristics were calculated. SPSS programme (standard version, SPSS Inc.) were used in the statistical analysis.

The Project will also continue from 2008 approximately up to 2010. At that time it will be reached to efficient number F_1 and G_1 materials, and it will be tried to become fixed G_1 characteristics at Ilikpinar environmental conditions.

Results

Italian crossbred buffalo numbers which were born in 2002-2008 period and the averages of various characteristics are shown in Table 1 and Table 2 respectively.

In the Project until March 2008, as a total of 105 crossbred buffaloes (65 F_1 , 5 G_1 , 7 F_2 , 28 F_1 xAnatolian) were born (Table 1).

Table 1. Italian crossbred buffalo numbers which were born in 2002-2008 period

Genotype	Sex		Total
	Male	Female	
F_1	36	29	65
G_1 (Italian x F_1)	3	2	5
F_2	2	5	7
F_1 x Anatolian	12	16	28
Total	53	52	105

Table 2. The averages of various characteristics (x).

Characteristics	Genotype				
	Anatolian		F_1 (Anatolian buffalo cow x Italian buffalo bull)		
	N	$\bar{X} \pm S_{\bar{X}}$	N (xx)	$\bar{X} \pm S_{\bar{X}}$	Superiority (%)
305-day milk yield (kgs)	81	961.6 $\pm$ 342.13	5	1386.2 $\pm$ 282.84	44.2
Daily milk yield (kgs)	81	3.1 $\pm$ 1.12	5	4.52 $\pm$ 0.92	45.8
Fat %	81	7.2 $\pm$ 0.82	5	6.18 $\pm$ 0.02	-14.1
Protein%	53	4.74 $\pm$ 0.91	5	3.12 $\pm$ 0.65	-34.1
TDM%	81	17.1 $\pm$ 0.81	5	15.61 $\pm$ 0.11	-8.71
SNF%	17	9.7 $\pm$ 0.76	5	10.64 $\pm$ 0.17	9.7
Lactose%	19	5.2 $\pm$ 0.39	5	5.27 $\pm$ 8.485E-02	1.34
SCC (μ /lt)	17	230 $\pm$ 120	5	69 $\pm$ 120	70

(x) Data obtained in April 2002- 15 April 2008 period were evaluated together.

(xx) Data are belong to only 1st unit and 1st lactation milk yield

Until May 2008 ten F_1 buffalo cows (two of then 2 times) calved. And at that time 8 lactation (1st) were completed. In one unit that feeding conditions are the best, and 5 first lactations were completed. In this unit lactation average is 1386.2 lt. General average, 8 units together, is 1203.0 lt. Lactation yield average of 81 Anatolian buffaloes are calculated as 961.59 $\pm$ 342.13 kg

Discussion

Until now 6 times (in the May mounts of 2002, 2003, 2004, 2005, 2006 and 2007) inseminations were applied. 50.0%, 55.2%, 57%, 52% (Şekerden et al, 2003), 42.2% and 61.5% (Anonymous, 2007) pregnancy rates (at only first inseminations after being synchronized) were obtained in 2002, 2003, 2004, 2005, 2006 and 2007 inseminations in Ilikpınar Village herd. In the April 2008, 23 buffalo cows, that 12 of them are F₁, were inseminated. It is interesting, it was determined that 5 of 23 buffaloes were conceived. It means that conception rate is 78% in the last insemination time.

Because of In Turkey artificial insemination first time applied, the rates were perfect compared with the results obtained in other countries which had applied the same synchronization protocol (Baruselli et al., 1997; Zicarelli et al., 1997; Barile et al., 2001; Neglia et al., 2001).

Lactation milk yield of F₁'s (general average) is higher 25.18 % than Anatolian cows. But for only the unit that have good feeding possibilities is higher 44.18 % than Anatolian (Table 2). In addition, the lactation milk yields of F₁ are belong to 1st lactation order, although the milk yield average of Anatolian cows were calculated from 81 various lactation (1st-6th) milk yields, and the average of F₁ lactation milk yield was calculated by using 8 first lactations milk yields.

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ASPECTS OF GENETIC DIVERSITY IN AFRIKANER CATTLE OF SOUTH AFRICA BASED ON PEDIGREE INFORMATION

A. MAIWASHE^{1*}, T.L. NEDAMBALE¹, AND T.C. CHOKOE²

¹Agricultural Research Council: Animal Production, Germplasm and Reproductive Biotechnologies,
Private Bag X2, Irene, 0062, South Africa

²Department of Agriculture, Private Bag X138, Pretoria, 0001, South Africa

*Corresponding author: norman@arc.agric.za

Abstract

Accurate knowledge about the status of genetic diversity of farm animal genetic resources is a prerequisite to design and implementation of an effective and sustainable conservation programme. Recently, considerable research effort has gone into aspects of genetic diversity either using molecular genetic markers or pedigree data. However, more research is still needed particularly on indigenous breeds of livestock that are prone to breed substitution. The purpose of this study was to assess genetic diversity in the Afrikaner cattle of South Africa using pedigree information. Pedigree data (n = 221 328) dating between 1949 and 2004 on registered Afrikaner animals were obtained from the South African national livestock database – the Integrated and Genetic Information System. About 70.4% of the animals had their ancestry known to the grand-parents generation. Annual registrations averaged 4 953 animals for the period 1994-2004. The actual number of founders was 29 660 animals. The effective number of founders and ancestors were 404 and 229 animals, respectively. About 223 ancestors explained 50% of the genetic variability in the reference population. The effective population size computed from regression on birth date was 87.35. The mean level of inbreeding for animals born in 2004 was 2.7%. It is clear that based on the average annual registrations in the last 10 years a different conservation plan could be arrived at than when both the annual registrations and effective population size were used jointly. Results from the current study re-enforces the importance of both demographic and genetic information in prioritisation of conservation activities.

Keywords: pedigree, genetic, diversity, Afrikaner, conservation.

Introduction

South Africa has a variety of indigenous beef cattle breeds. These breeds include the Afrikaner, Bonsmara, Drakensberger, Nguni, and Sanganer. Majority of these breeds have breed societies whose primary responsibility is to ensure purity of the breed. The Bonsmara is the most popular beef breed within the country, followed by the Nguni. However, at one point the Afrikaner was the most popular beef cattle breed with an estimated population of about 30% of the beef cattle population in South Africa. In the current study, the Afrikaner is of particular interest due to concerns primarily from industry and government about the rapid decline in the number of this breed.

The Afrikaner developed from native cattle of the Khoi-Khoi people of South Africa. It is a light tan to deep cherry red, medium-size breed with long lateral horns and has a cervico-thoracic hump typical of Sanga cattle. Some of its good characteristics include: heat tolerance, low maintenance, adequate tick resistance, good temperament, draft power and walking ability. A typical Afrikaner cow and bull weighs between 450 to 600 kg and 820 to 1090 kg respectively. An Afrikaner calf weighs between 30 and 35 kg at birth.

The Afrikaner is amongst the oldest cattle breed in South Africa. In fact, the Afrikaner Cattle Breeders' Society of South Africa was one of the first breed societies in the country. It was established in 1912. Historically, the contribution of the breed in the beef industry has been immense. The Afrikaner formed the basis of the Bonsmara and Drakensberger breeds. Currently, the Afrikaner cattle populations are found in most of Southern African countries. There are also herds of Afrikaner cattle in Australia and Brazil. Despite the distribution of the Afrikaner in other countries, there are concerns in South Africa about the decline in popularity of the breed. The current study examined the trend in census population size and genetic diversity of the Afrikaner breed using pedigree information.

Materials and methods

Pedigree data (n = 221 328) including animal identification (ID) and its sex, sire ID, dam ID, and their respective date of birth were obtained from the South African livestock national database – Integrated Registration and Genetic Information System (INTERGIS). The records included animals born between 1949 and 2004. The Afrikaner herdbook is still open and registration of animals with unknown ancestry is allowed.

Consistency checks were conducted on the data to ensure quality of the data. These checks included ensuring that animals that had inconsistent date of birth with their parents (e.g. animals born before their parents) were excluded from the analyses. In the data analysed, about 70.4% of the animals had their ancestry known to the grand-parents generation. The grand-parent generation is the minimum number of generations required to detect inbreeding using pedigree information. The animals considered in the analysis were progeny of 4 902 sires and 63 247 dams. It should be noted that there were 38 646 animals with unknown parents. The degree of endangerment - an estimate of the time to reach critical female population size - was estimated using the criterion proposed by Gandini et al. (2004). The critical population size was defined to be 100 breeding cows.

Inbreeding coefficients for individual animals were computed using the ENDOG v4.5 computer package (Gutiérrez and Goyache, 2005). ENDOG is a pedigree-based software for calculating parameters for monitoring genetic diversity and prioritization of conservation actions. Parameters estimated in the current study included effective population size (N_e), effective number of founders (N_f) and ancestors (N_a). Effective number of founders represents the number of equally contributing founders that would be expected to produce the same genetic diversity as in the population under study (Lacy, 1989). On the other hand, effective number of ancestors refers to the minimum number of ancestors - not necessarily founders - that explain the complete genetic diversity of a population (Boichard et al., 1997). The two parameters are complimentary. In the current study, the actual number of founders was defined as all animals with both parents unknown. In addition, a missing parent of animals with one parents unknown was also considered a founder animal. This definition is similar to that of Sørensen et al. (2005). The reference population in the current study was all animals with both parents known.

Effective population size computed in the current study was based on the individual rate of inbreeding proposed by Gutiérrez et al. (2008). This method provides a standard error for the estimate of the effective population size. In addition, the trend of the number of registered animals per year of birth was assessed for the period 1985 to 2004.

Results and discussions

The number of animal registrations, cows and sires for the period 1985 to 2004 are provided in Figure 1. The trends show a decline in the number of annual registrations, cows and sires in the last 19 years in Afrikaner population. Specifically, the population was more than halved during this period i.e. 59.44%, 59.33% and 57.68% decline in birth notifications, cows and sires. Considering the number of breeding cows and sires in 2004, the Afrikaner could be considered a breed that is not at risk using the criteria of at least 1000 and 20 breeding females and males respectively.

Fitting a linear regression on the number of cows used per year indicates a rate of decline in the cow population of about 305 cows per year ($y = 9475 - 305x$). The time to reach a female population size of 100 animals (critical population size) was estimated using the number of breeding Afrikaner cows in the years 2003 (n = 4 052) and 2004 (n = 3 561). The time to endangerment was calculated to be 28 years which is about 4.3 generations in Afrikaner breed. The result indicate that the will be about 100 breeding Afrikaner cows in the year 2036. Thus, necessary conservation actions should be taken by both industry and government to prevent loss of an important genetic resource.

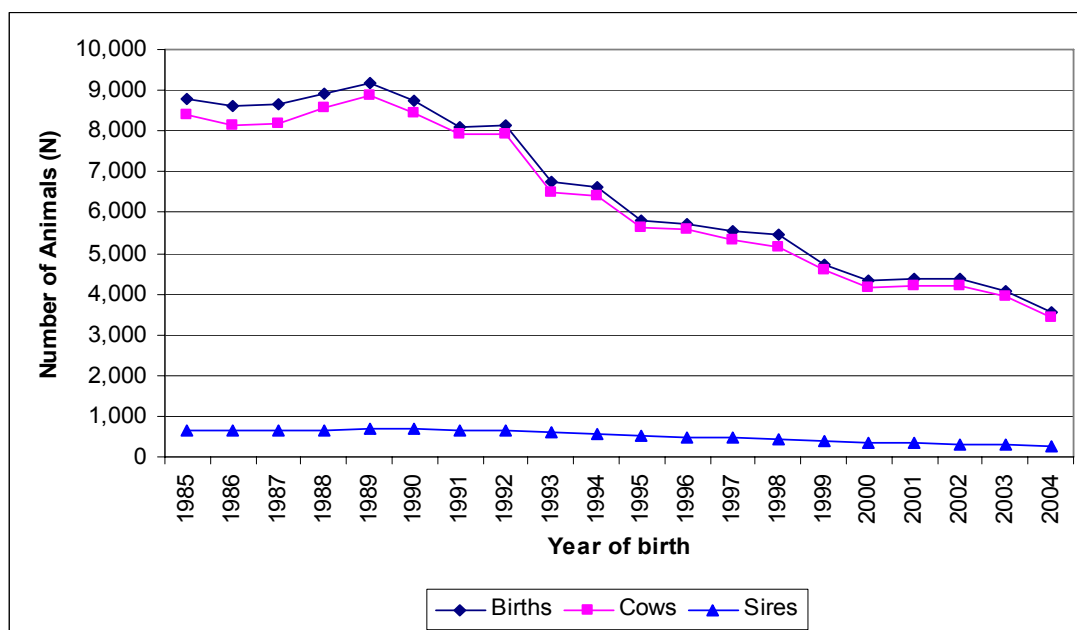


Figure 1: The number of the birth registrations, cows and sires in the South African Afrikaner breed between 1985 and 2004

The accumulation of inbreeding in the Afrikaner over the period 1985 to 2004 is provided in Figure 2. There is an unfavourable positive increase in the level of inbreeding (rate of 0.09% per year) suggesting a mild decline in the genetic diversity of the Afrikaner population. Using the standard formula of Wright (1931) for effective population size ($Ne = \frac{1}{2\Delta F}$) and assuming a generation interval of 6.5 years, the effective population size was calculated to be 85.47. The effective population size computed using the ENDOG package was 87.35. The two estimates of Ne are consistent even though they were calculated using slightly different formulas. Using the criteria given in Duchev (2006), the Afrikaner breed was classified not at risk i.e. the $Ne > 66$ animals.

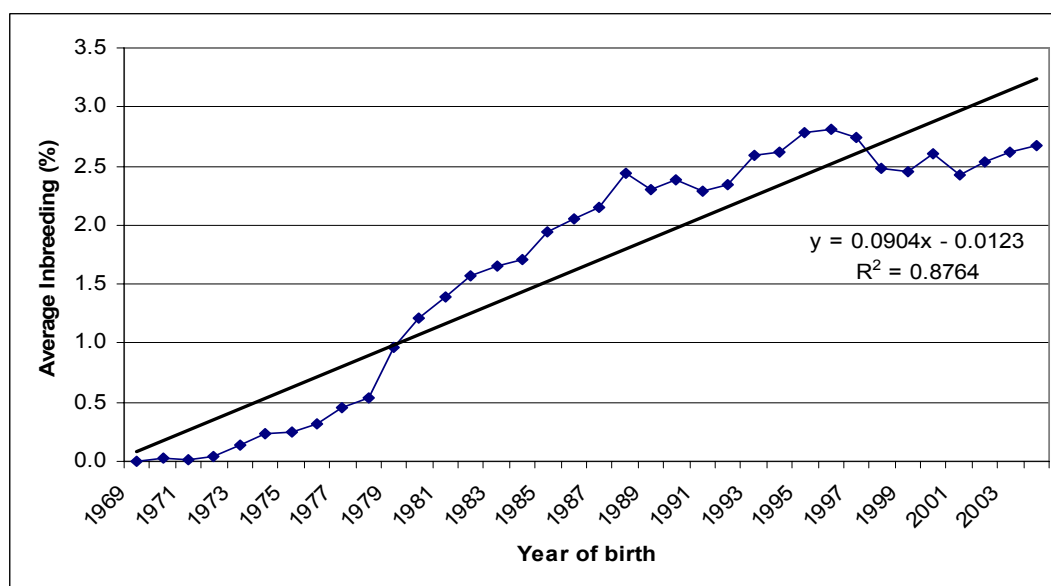


Figure 2: Average inbreeding in the South African Afrikaner breed.

The actual number of founders or base animals was 38 646. The calculated effective number of founders and ancestors were 404 and 229 animals, respectively. There is a discrepancy between the number of actual and both effective founders and ancestors. This result indicates unequal genetic contribution of founders to the reference population. Certain founders have been used extensively than others. This result is confirmed by the fact that 223 ancestors explained 50% of the genetic

variability in the reference population. The difference between the effective number of founders and ancestors indicate that the Afrikaner cattle population underwent bottlenecks (or reduction in population size followed by increase) in the past.

Conclusion

Parameters for monitoring population genetic diversity were estimated in the current study. The results indicate that while genetic components such as effective population size indicate that the Afrikaner breed is not at risk of endangerment, the demographic component (change in census size) suggest that immediate conservation intervention is required. The effective number of founders and ancestors suggest that bottleneck have occurred since the commencement of recording of pedigree information. It should however be noted that the pedigree information was not complete and therefore results should be interpreted with caution.

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INDIGENOUS CHICKEN BREEDS IN THE NORTH VIETNAM: DONG TAO CHICKEN, MIA CHICKEN AND MONG CHICKEN

NGUYEN HUY DAT, HO XUAN TUNG, VU THI HUNG, VU NGOC SON, VU CHI THIEN

Livestock Research and Training Centre (LIRTC) - NIAH
Van Phuc - Ha Dong - Ha Noi

Tel: 034.3825582 – 3824719 Fax: 034.3825582
Email: VPPoultry@gmail.com – TTNCGCVP@fpt.vn

Abstract

Indigenous chicken breeds (Dong Tao, Mia and Mong), it delved into the cultural character of locals which created these breeds. This is the precious source of genes which were preserved to serve the breeding cross research. Now, these chicken breeds survive at a few locals with small number and not purebred. In the years, the state concerned and to gave these chicken breeds to preserved (In-situ) at the locals and a few research centers. However, expenses within limits, these breeds were raises with number of laying chicken from 100 – 150, which produced egg number not high. Usual, to take care of these chicken breeds must replace new flock at 38 – 40 week of age. Some researches utilized genetic resource of these breeds used only the cocks into hybrid formula.

Keyword: Indigenous chicken breeds, Dong Tao, Mia, Mong, In-situ.

Introduction

Domestic chicken breeds in the North Vietnam as Dong Tao, Mia, Mong, and Ho with the specific external appearance; high body weight; and the quality of meat are delicious smelling. It delved into the cultural character of locals that created these chicken breeds. These valuable chicken breeds must preserve to attend to research of creating new breeds. However, producing of these chicken breeds are low and hard to multiply of number, almost these survive with small number at families of locals which created them. Through, it isn't to pay attention to choose and multiply these breeds which crossing with another breed. In the years, Ministry of Agriculture and Rural Development (MARD) and Notional Institute of Animal Husbandry (NIAH) invested capital in livestock genetic conservation. A board of chairman for the national scheme of livestock entrusted Livestock Research and Training Centre keeping and conservation indigenous chicken breeds' genetics: Dong Tao chicken, Mia chicken, and Mong chicken.

Contents and Methods

Contents

- Keeping and conservation indigenous chicken breeds' genetics: Dong Tao, Mia and Mong
- Situation of utilization and exploitation of indigenous chicken breeds' genetics

Methods

- To apply the raising and choosing micro population method at the centre and farmer household (In-situ method).

Results and Discussions

Situation of conservation indigenous chicken breeds

From years of 1991 then on, the concern of state and MARD, they invested capital and entrusted NIAH to sponsor the scheme for conservation the gene's fund of national animal. A lot of researches for conservation chicken breeds: Dong Tao, Mia and Mong. The theme of chose and raised productivity of 2 chicken breeds: Dong Tao and Mia by Bui Duc Lung (1994). Some themes were researched for preserving gene's fund of Mia chicken (Nguyen Huy Dat, 2005; 2006). Do Van Dien (2005) carried out conservation gene's resource of Mong chicken.

However, the methods were applied for conservation gene's fund of these chicken breeds choosing population essentially. They were raised at locals which created them (Bui Duc Lung, 1994; Nguyen

Huy Dat, 2005; 2006; Do Van Dien, 2005). Some scientific research centers raised these chickens also (Nguyen Huy Dat, 2005; 2006). The sires of chicken of flocks were little because the capitals were invested for conservation was low, for each of locals kept 100 – 150 hens only. It was hard to multiply for populations by producing of hens were not high and must change for new flock at 38 – 40 week of age. Preserving at the locals were difficult because capital was not issued more, the sire of flocks were restricted. Through, it was not to pay attention to choose these chicken breeds, which crossing with other breeds continuously.

Some technological parameters of chicken breeds: Dong Tao, Mia and Mong

Parameter	Unit	Chicken breed		
		Mia ⁽¹⁾	Dong Tao ⁽²⁾	Mong ⁽³⁾
Body weight	g			
- DOC		30 - 32	35	35
- 20 wks				
+ Cock		2,390 - 2,495	2,782	-
+ Hen		1,490 - 1,585	1,913	2,200 - 2,500
Standard weight	kg			
+ Cock		3.0	4.5	-
+ Hen		2.3	3.5	-
Viability	%	86.2	95.1	-
Feed consumption	g			
+ Cock		8.488	8.818	-
+ Hen		8.125	8.318	-
Maturity age	day	142 - 145	-	165
Egg production/45 wks	eggs/♀	43.15	-	-
Egg production/year	eggs/♀	60 - 65	55 - 65	85
Egg weight	g	47.5	52 - 62	50 - 55
Feed conversion for 10 eggs	kg	3.5	-	-
Hatchability	%	75	60 - 70	-

(1): Nguyen Huy Dat, 2005; 2006; (2): Bui Duc Lung, 199; (3): Do Van Dien, 2005

Situation of utilization of indigenous chicken breeds' genetics

Beside of conservation of genetic source of Dong Tao, Mia, and Mong breeds there were also many studies about using of these indigenous genetics in crossing breeds and specially using indigenous males crossed with different imported breeds. Nguyen Huy Dat (2005) studied crossing combination between Dong Tao chicken and improved Ri to create a cross F₁ for farming households. Vu Ngoc Son (2006) studied in using indigenous males (Dong Tao and Mia) crossed with Luong Phuong and Kabir's females to create a meat type combination. Nguyen Huy Dat (2006, 2007) studied in using Dong Tao's males crossed with Luong Phuong's females to create a broilers with special comb VP2.

Some parameters of cross chicken using Dong Tao's genetics.

Parameter	Unit	DTL ⁽¹⁾	DTK ⁽¹⁾	DTR ₁ ⁽²⁾
Body weight:				
- DOC	g	34.5	35.5	-
- 12 weeks	g	2,022.5	2,300.0	1,825.0
Viability	%	93.3	98.4	91.4
Feed conversion	kg	2.7	2.7	2.5
Meat quality:				
- Percent of body meat	%	74.4	71.6	-
- Percent of breast meat	%	15.5	17.3	-
- Percent of thigh meat	%	20.5	20.1	-
Production number (PN)		83.4	100.6	78.2

(1): Vu Ngoc Son, 2006; (2) Nguyen Huy Dat, 2005

Notes:

- DTL: Dong Tao × Luong Phuong

- DTK: Dong Tao × Kabir

- DTR₁: Dong Tao × Improved Ri (R₁)

Some parameter of cross chicken using Mia's genetics

Parameter	Unit	ML ⁽¹⁾	MK ⁽¹⁾
Body weight			
- DOC	g	34.0	34.6
- 12 weeks	g	1,852.0	2,226.6
Viability	%	93.3	94.8
Feed conversion	kg	3.0	2.8
Meat quality			
- Percent of body meat	%	74.9	69.9
- Percent of breast meat	%	16.2	15.6
- Percent of thigh meat	%	21.3	19.5
Production number (PN)		68.5	90.3

(1): Vu Ngoc Son, 2006

Notes: - ML: Mia × Luong Phuong
- MK: Mia × Kabir

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ASSESSMENT OF PRODUCTION AND REPRODUCTION TRAITS OF LOCAL HUNGARIAN POULTRY BREEDS AND THEIR CROSSES FOR THEIR SUITABILITY IN ECOLOGICAL TYPE PRODUCTION

L. BODI^{1,2*}, K.A. SZENTES^{1,2}, I. BARTA^{1,2}, M.I. STOMPNE^{1,2},
K.D.T. DONG XUAN^{1,2} AND I.T. SZALAY^{1,2}

¹Association of Hungarian Small Animal Breeders for Gene Conservation (MGE)
Isaszegi ut 208., H-2100 Godollo, Hungary

²Research Institute for Animal Breeding and Nutrition, Division for Small Animal Research
(ATK-KATKI), Isaszegi ut 200., H-2100 Godollo, Hungary

*Corresponding author: bodi@katki.hu

Abstract

Long term gene conservation of rare domestic animal breeds can be achieved only if they are utilized economically in production. For use, however, exact data on production and reproduction traits of the breeds should be known. In the present study the results of the trials on some production and reproduction traits of old Hungarian poultry breeds and their crosses are shown. The experiments were carried out in 2005 and 2006 in the Poultry Gene Bank farm of the ATK-KATKI in Godollo with landrace type Hungarian goose and its frizzle feathered variant (LG), Hungarian Upgraded goose (UG), four Hungarian and three Transylvanian Naked-neck chicken breeds and varieties and Hungarian turkey breeds (Bronze turkey: BT and Copper turkey: CT). Some crosses between breeds were also examined. Egg production, fertility and hatchability, body weight gain (in every 2 weeks), slaughter traits (live weight, weight after slaughter, slaughter/live weight %, breast weight, thigh weight, breast+thigh weight/slaughter weight %) and feed conversion were measured. Egg production records of the two goose breeds show that LG male × UG female cross can be economic for the production of crossbred offspring. Hatchability rate from crossing is higher than that of both parent breeds. White Transylvanian Naked Neck Chicken ♂ × Partridge-color Hungarian Chicken ♀ was found to be the best cross for *Hungaricum* (HU-BA) chicken meat production. Heterosis was found in body weight until 10 weeks of age. As regards turkey breeds, CT ♂ × BT ♀ cross produced more progenies and showed higher body weight than the reciprocal cross, therefore this cross is proposed for HU-BA production system in turkey.

Keywords: *Traditional Hungarian poultry; production traits; gene conservation*

Introduction

Sustainability is a keyword for the whole agriculture, not only for ecological type agriculture (we use ecological type farming a wider sense: it means several environmentally friendly production systems mainly with traditional, local breeds which may produce special quality products under controlled conditions). Most authors distinguish the ecological, economical and social sustainability. Two main components of sustainable agriculture are the conservation of agro-biodiversity and agro-ecosystems (Szalay and Dong Xuan, 2007; Bodo and Szalay, 2007) where conservation of agro-biodiversity comprises gene conservation of traditional breeds. As Miller (2006) stated, conservation of genetic resources is very important also from the economic point of view.

Organised poultry gene conservation started in the 1970ies in Hungary with Hungarian chicken breeds (Szalay, 2002). In these days we maintain 7 chicken, 2 turkey, Hungarian guinea-fowl, landrace type Hungarian goose and color variants of Hungarian duck breeds in the Poultry Gene Bank of the Research Institute for Animal Breeding and Nutrition in Godollo within the breeding and conservation network of the Association of Hungarian Small Animal Breeders for Gene Conservation (MGE), being the official breeding organization for all traditional Hungarian poultry breeds in the country (MGE, 2008).

In situ gene conservation can be maintained for a long time in a system of economic use of the breeds only. Productivity of rare, traditional breeds is much lower than the modern, industrial genotypes under intensive conditions, so their use can be economic if used for premium quality production under low input conditions (Bodi et al., 2002; Bodo and Szalay, 2007). For production and economic use, however, knowledge about the performance of the breeds is essential. In a research project (ALAP1-00123/2004) sponsored by National Office for Research and Technology (NKTH) we

studied the traits of traditional Hungarian poultry breeds to elaborate “*Hungaricum*” poultry production (HU-BA), which is based on the trio of gene conservation – breeding – controlling and production system. The system uses old Hungarian poultry breeds and their crosses only (Szalay *et al*, 2007; Bodi *et al*, 2007). In this study the main results of this project are presented including reproductive and productive traits of traditional Hungarian goose, chicken and turkey breeds and their crosses.

Materials and methods

The experiments were carried out in 2005 and 2006 in the Poultry Gene Bank farm of the ATK-KATKI in Godollo. The following breeds were used: landrace type Hungarian Goose and its frizzled feathered variant (LG), Hungarian Upgraded Goose (UG); Hungarian Chicken breeds: Yellow Hungarian (YH), White Hungarian (WH), Speckled Hungarian (SH), Partridge-color Hungarian (PH) and Transylvanian Naked-neck Chicken: White Transylvanian Naked Neck (WT), Speckled Transylvanian Naked Neck (ST) and Black Transylvanian Naked Neck (BT); and Hungarian Turkey breeds: Bronze Turkey (BT) and Copper Turkey (CT). Among the characteristics of the breeds we examined the crosses of LG ♂ × UG ♀ in goose, PH ♂ × WT ♀, WT ♂ × PH ♀ in chicken and BT ♂ × CT ♀ and CT ♂ × BT ♀. For goose the reciprocal cross is not recommendable, as it is not economic because of the low egg production of the LG layers (Szalay *et al.*, 2007). Progenies were reared outdoor by the conventional method. There was no difference in the technology within the species. Slaughter trials were carried out at 12 weeks of age (table goose), 12 and 16 weeks of age (spring chicken and table chicken) and 24 weeks of age (table turkey). In every trial, egg production of parents, fertility and hatchability of hatching eggs, body weight gain, feed conversion and slaughter traits of the offspring were measured.

Results

Goose

Fertility and hatchability (Table 1): UG showed significantly higher fertility and hatchability than LG. As regards the stock producing crossbred progenies the fertility barely altered, it was low, but hatchability of fertile eggs was very high, it exceeded even the hatchability of the UG.

Table 1. Egg fertility and hatchability of the traditional Hungarian goose genotypes and their crosses			
Genotype	Fertility %	Hatching rate calculated on	
		Incubated eggs %	Fertile eggs %
LG	65.0	45.2	68.4
LG ♂ × UG ♀	67.8	61.2	91.1
UG	84.9	73.8	86.8

Body weight gain: Rearing results on body weight of the two goose breeds studied are shown in Table 2. There was significant difference in the body weight of the two breeds, and the body weight of ganders was significantly higher than that of layers throughout the 36 week rearing period. Another remarkable attribute of the goose breeds is the considerable rise of the body weight gain after 8 weeks, its decline after 12 weeks, and stop after 20 weeks of age. Similar results were published for UG breed by Bodi (1994).

Table 2. Body weight of Hungarian goose breeds and their cross till 22 weeks of rearing											
Genotype	Body weight (g)										
	2 week	4 week	6 week	8 week	10 week	12 week	14 week	16 week	18 week	20 week	22 week
LG	467	1549	2225	3312	3560	4207	4300	4680	4811	5033	5131
LG♂×UG♀	549	1542	2090	3018	3171	3733	3640	3998	4094	4328	4425
UG	521	1294	1913	2710	2722	3210	3235	3501	3653	3810	3844

As regards LG, its body weight gain after 20 weeks is also almost equal to zero. The sexual dimorphism in body weight is even higher than in UG (ganders had higher body weight by 16.6%).

Body weight of crossbred progenies was about the mean of the two breeds in both sexes and all ages, and no heterosis or maternal effect was found. Sexual dimorphism in body weight of crosses was lower than in LG, and even lower than in UG at 16 weeks of age.

Feed conversion results are shown in Table 3. There was no difference in feed conversion ratio among the genotypes in the first 4 weeks, but from that time the superiority of the UG was unambiguous, so the feed conversion for the whole 22 weeks was the best in UG breed. Feed conversion of the crossbred geese – similar to body weight gain – was in between the two breeds.

Table 3. Feed conversion ratio of experimental goose flocks till 22 weeks of age				
Genotype	Feed conversion ratio (kg feed/kg body weight gain)			
	0-4 week	4-10 week	10-22 week	0-22 week
LG	2.1	4.5	24.0	6.3
LG ♂ × UG ♀	2.0	4.4	23.7	6.0
UG	2.1	3.8	18.9	5.5

Slaughter traits: The results of the slaughter trial at 12 weeks of age are shown in Table 4. The weight of the valuable body part was the highest in UG just as the body weight. On the other hand it is very important that slaughter loss was also the highest in this genotype and of the LG was the lowest, though the difference was not statistically significant. The ratio of valuable body parts (breast and thigh) per slaughter weight was higher than measured in UG (approximately 44 %) earlier by Bodi (1994).

Table 4. Slaughter results of goose genotypes studied at 12 weeks of age (males)						
Genotype	Live weight (g)	Slaughter weight (g)	Live weight/ slaughter weight %	Breast weight (g)	Thigh weight (g)	Breast+thigh weight/ slaughter weight %
LG	3867	2912	75.3	922	729	56.7
LG ♂ × UG ♀	4720	3539	75.0	1243	786	57.3
UG	5087	3806	74.8	1370	870	58.9

Chicken

Reproductive traits: Egg production of Hungarian breeds generally exceeds the egg production of Transylvanian Naked-necked ones, so we evaluate the trait within the breed groups. Among the Hungarian breeds the Partridge-color breed (PH) showed the highest egg production (difference is highly significant) and it was typical during the whole egg production cycle. There was no significant difference between the other breeds. White (WT) variety proved to be the best layer within the Transylvanian Naked Neck breed. The difference was significant, but there was no significant difference between the Black and Speckled Transylvanian Naked Neck varieties.

Fertility and hatchability of the Partridge-color breed was the highest (96.1% and 89.2%) among Hungarian breeds, and the fertility of Black Transylvanian was the highest (93.4%) among the Transylvanian Naked Neck breeds, but the percent of dead embryos was also the highest (38.3%). Hatchability calculated on incubated eggs was the highest (65.3%) in White Transylvanian Naked Neck breed (for detailed evaluation of chicken breeds and varieties, refer to Szentes et al, 2008).

Hatchability of crossings of WT ♂ × PH ♀ and PH ♂ × WT ♀ (calculated on all eggs) was 75.3% and 61.5% respectively.

Table 5. Body weight of Hungarian chicken breeds and their reciprocal crosses during the 16 week rearing period								
Genotype	Body weight (g)							
	2 week	4 Week	6 week	8 week	10 week	12 week	14 week	16 week
WH	91.2	220.4	380.1	594.8	797.9	1026.5	1245.0	1426.2
WH ♂ × PH ♀	112.9	235.6	361.9	612.6	866.6	1088.9	1333.5	1567.6
PH ♂ × WH ♀	100.5	227.6	409.2	621.7	908.3	1151.8	1409.6	1637.1
PH	108.6	244.3	395.9	621.7	888.5	1161.5	1453.5	1751.2

Body weight gain: Body weight of Hungarian chicken breeds exceeds the body weight of Transylvanian Naked Neck breed during the whole rearing. White Hungarian had the lowest weight among the Hungarian breeds, but even its weight was higher than that of the heaviest variety of the Transylvanian Naked-neck. For detailed studies of the breeds refer to Szentes et al. (2008). Examining parental breeds (PH and WT) and their reciprocal crosses, significant heterosis was found in body weight gain until the age of 10 weeks, while the PH showed the highest, WT the lowest and the two crosses intermediate results after that age. The difference between the two breeds was statistically significant.

Feed conversion: Results of the crossing trial are shown in Table 6. PH chickens showed the best and WT the worst feed conversion, while crossbred ones proved to be intermediate for this trait, but the differences were not significant.

Table 6. Feed conversion of Hungarian chicken breeds and their reciprocal crosses.				
Genotype	Feed conversion ratio (kg feed/kg body weight gain)			
	0-7 week	7-12 week	12-16 week	0-16 week
WH	4.10	4.16	5.88	4.65
WH ♂ × PH ♀	4.06	4.11	5.18	4.44
PH ♂ × WH ♀	3.92	3.94	5.36	4.36
PH	3.99	4.23	4.38	4.22

Slaughter traits: The results of slaughter trials at 12 (spring chicken) weeks of age of cockerels reared free range are shown in Table 7. Live weight, slaughter weight and the weight of breast and thigh were the highest in PH breed; the differences between the two breeds studied were significant. No difference was found between the reciprocal crosses, both showing intermediate results. The ratio of slaughter weight and the ratio of valuable body parts did not differ considerably between the genotypes.

Table 7. Slaughter results of the Hungarian chicken breeds and their reciprocal crosses at 12 weeks of age						
Genotype	Live weight g	Slaughter weight g	Slaughter weight/ live weight %	Breast weight g	Thigh weight g	Breast+thigh/ slaughter weight %
WH	1068	870	81.5	153	246	45.8
WH ♂ × PH ♀	1165	905	77.7	159	242	44.4
PH ♂ × WH ♀	1238	991	80.1	172	273	44.9
PH	1358	1080	79.6	193	292	44.9

Turkey

Reproductive traits: Egg production showed strong seasonality in both turkey breeds studied, which is characteristic for landrace turkey kept under moderate climate. Egg production started in March and stopped at the end of May. Bronze turkey (20.4 egg/layer) surpassed egg production of Copper turkey (15.7 egg/layer) significantly ($P < 0.03$), even though it had higher body weight. Peak of the production (50.8 % and 47.8 % respectively, which is regarded as good performance for landrace turkeys) was detected at 6th week of production.

There was no significant difference between the two breeds in fertility (86.1% for Bronze and 88.1% for Copper breed) and hatchability of eggs calculated on all eggs incubated (47.6% and 45.4% respectively). Low hatching results are attributable to high embryo mortality (38.5 and 41.5%) being probably the consequence of technological problems during hatching. This was affirmed by the results of hatching in 2006, when crossbred progenies were hatched with satisfactory results. Hatchability of the Bronze ♂ × Copper ♀ eggs (66.7 %) was unambiguously better than that of the reciprocal cross (53.3 %).

Body weight gain: Bronze turkeys had significantly higher body weight during the whole rearing period in both sexes. Differences are more remarkable after 12 weeks of age. In 2006 we examined the crossbred progenies of the two breeds. Our data show that there is a difference between the reciprocal crossbreds: after 16 weeks of age Copper ♂ × Bronze ♀ turkey males showed higher, while females showed lower body weight (Table 8).

Table 8. Body weight of Hungarian turkey breeds and their crosses during the 24 week rearing period							
Genotype	Sex	4 week	8 week	12 week	16 week	20 week	24 week
BT	♂	550	1670	2787	4030	5867	6947
	♀	464	1274	2110	2910	3910	4264
BT ♂ × CT ♀	♂	526	1471	2637	3740	5649	6727
	♀	444	1218	2091	2873	3889	3713
CT ♂ × BT ♀	♂	537	1549	2726	3937	5737	6793
	♀	491	1207	2022	2696	3542	3993
CT	♂	480	1295	2038	2710	4198	5220
	♀	383	980	1698	2395	3120	3413

Feed conversion: The feed conversion of Bronze turkeys was better than that of Copper turkeys. Copper ♂ × Bronze ♀ showed better results for the same trait, than the reciprocal cross (Table 9). Results correspond to the body weight records, but the differences were not significant.

Table 9. Feed conversion ratio of crossbred Hungarian turkey breeds and their crosses till 16 weeks of age			
Genotype	Feed conversion ratio (kg feed/kg body weight gain)		
	0-10 week	10-16 week	0-16 week
BT	3.40	4.41	3.86
BT ♂ × CT ♀	3.97	4.47	4.23
CT ♂ × BT ♀	3.45	4.75	4.08
CT	4.05	4.89	4.25

Slaughter traits: Live and slaughter weight and the weight of valuable parts (breast and thigh) of Bronze turkeys were significantly higher, but the difference in proportion of slaughter weight and breast+thigh weight was not significant (Table 10).

Table 10. Slaughter characteristics of Hungarian turkey breeds at 24 weeks of age						
Genotype	Live weight g	Slaughter weight g	Slaughter weight/ live weight %	Breast weight g	Thigh weight g	Breast+thigh/ slaughter weight %
BT	5595	4881	87.2	1100	1182	46.8
CT	3830	3265	85.2	735	781	46.4
BT/CT%	146.1	149.5	102.0	149.7	151.3	100.2

Similarly, live and slaughter weight and the weight of valuable parts of Copper ♂ × Bronze ♀ offspring were significantly higher, but there was no other difference between the reciprocal crosses in slaughter traits (Table 11).

Table 11. Slaughter characteristics of crosses of Hungarian turkey breeds at 24 weeks of age						
Genotype	Live weight g	Slaughter weight g	Slaughter weight/ live weight %	Breast weight g	Thigh weight g	Breast+ thigh/ slaughter weight %
BT ♂ × CT ♀ (BC)	5700	4427	77.7	1144	1101	50.7
CT ♂ × BT ♀ (CB)	7107	5681	79.9	1513	1473	52.6
BT/CT %	80.2	77.9	97.2	75.6	74.7	96.5

Conclusions

Studies to determine reproductive and productive characteristics of traditional Hungarian poultry show that Hungarian goose, chicken and turkey breeds and the recommended crosses are suitable for producing special quality Hungaricum poultry (HU-BA) meat in ecological type production systems. In goose, LG breed can be used for HU-BA goose meat production effectively in crossing with UG breed. The best crossing for HU-BA chicken meat production is WT ♂ × PH ♀. Heterosis in body weight was found until 10 weeks of age, but later the body weight of crossbred chickens (both crosses) showed intermediate inheritance. As regards Hungarian turkey breeds and crosses, Copper ♂ × Bronze ♀ cross produced more progenies, and body weight and the weight of valuable body parts of this cross was higher, than the reciprocal one. Therefore this cross is recommendable for the use in HU-BA production system.

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THE EFFECT OF THE OESTROGEN RECEPTOR (ESR) GENE ON THE REPRODUCTIVE PERFORMANCE OF TWO LOCAL VIETNAMESE PIGS REARED UNDER HOUSEHOLD CONDITIONS IN SON LA PROVINCE, NORTHWEST VIETNAM

N. V. HAU^{1, 2, *}, H. P. PIEPHO³, L. T. THUY¹, AND A. VALLE ZÁRATE²

¹National Institute of Animal Husbandry, Thuyphuong, Tuliem, Hanoi, Vietnam

²University of Hohenheim, Institute of Animal Production in the Tropics and Subtropics, Department of Animal Breeding and Husbandry, Garbenstrasse, 17, 70599 Stuttgart, Germany.

³University of Hohenheim, Institute of Crop Production and Grassland Research, Fruwirthstrasse, 23, 70599, Stuttgart, Germany

*Corresponding author: haugiang@uni-hohenheim.de

Abstract

Mong Cai and Ban are the most important indigenous pig breeds kept under smallholder conditions in the Northern Mountainous Region in Vietnam and they are primarily used as sow lines. Their reproductive performance has been evaluated to some extent but its relation to genetic markers at selected loci has not yet been determined. The aim of the present study is to estimate the effect of the genetic polymorphisms of the oestrogen receptor gene (ESR) on reproductive traits of Mong Cai and Ban sows reared under smallholder conditions in Son La province. Data on reproductive performance and tissue samples of 88 Mong Cai and 78 Ban sows with 513 litters were recorded and collected from 2001 to 2006 in the study area. DNA was extracted and the ESR polymorphisms were identified by polymerase chain reaction - restricted fragment length polymorphisms using the PvuII enzyme (PCR-RFLPs). General linear models were used to analyze the effect of the genotypes of the ESR and its additive and dominance effects on the reproductive performance of the sows. Two alleles (A and B) and three genotypes (AA, AB, and BB) of the ESR were found. Litter size at birth (NBT) and at weaning (NW) and numbers of piglets born alive (NBA) of Mong Cai and Ban sows were highly affected ($p < 0.001$) by genetic polymorphisms of the ESR gene with allele B superior to allele A. The NBT, NBA, and NW were increased per favourable allele of the ESR with additive effects ($p < 0.001$) of -1.71 (-0.83), -1.76 (-0.72), and -1.08 (-0.68) in Mong Cai sows (in Ban sows), respectively. Dominance effects at ESR locus did not affect the reproductive performance of the sows. The results of the study can be applied when setting up selective breeding programs for improving the reproductive performance of Mong Cai and Ban pig breeds.

Keywords: oestrogen receptor (ESR), PCR-RFLPs, PvuII enzyme, generalized linear models, local pig breeds, reproduction.

Introduction

Efficiency of pig production is affected by reproductive performance of sows, especially by number of piglets born and weaned per litter (Chen *et al.*, 2003). Therefore, improvement of litter size at birth and at weaning is an important goal for pig production. Unfortunately, selection for increased litter size at birth and at weaning is rather difficult because of low heritability for these traits (Omelka *et al.*, 2006; Van and Duc, 1999); conventional selection for these traits takes a long time. In recent years, because of rapid progress of molecular biology and molecular genetics, research to detect major genes or molecular markers influencing the reproductive performance of sows has gained in importance, and some major genes or genetic markers have been identified, including an oestrogen receptor gene (Rothschild *et al.*, 1996; Short *et al.*, 1997).

The oestrogen receptor (ESR) gene has been identified as a major gene for litter size in Meishan and Large White breeds (Rothschild *et al.*, 1996; Short *et al.*, 1997) as well as in Large White and Landrace breeds (Korwin-Kossakowska *et al.*, 1999; Horogh *et al.*, 2005; Omelka *et al.*, 2005). The ESR polymorphism is diallelic with alleles denoted as A and B (Rothschild *et al.*, 1996) and the different influencing levels of its genotypes on the reproductive performance were reported by several authors, e.g. Rothschild *et al.* (1996), Short *et al.*, (1997), Horogh *et al.* (2005), Omelka *et al.* (2005). The authors found that the favourable B allele and the BB genotype of ESR were associated with higher reproductive performance of sows in Meishan, Large White, and Landrace breeds.

The oestrogen receptor gene is regarded to be a promising candidate gene for improving reproductive performance of pigs. However, there is no data on the prevalence of the genetic polymorphism of ESR in the two local Vietnamese sow breeds, Mong Cai and Ban, under study in the present investigation. The objective of the present study therefore was to determine the relationship between genetic polymorphisms of the oestrogen receptor gene and the reproductive performance of Mong Cai and Ban populations kept under smallholder conditions in the Son La province, northwest Vietnam.

Materials and methods

The tissue samples and the data of reproductive performance of Mong Cai and Ban sows (including 88 Mong Cai sows with 341 litters and 78 Ban sows with 172 litters) were collected and recorded from five black Thai and two H'Mong villages from 2001 to 2006 in the Son La province, Northwest Vietnam. Determination of the ESR genotype was carried out in the laboratory of animal cell technology of the National Institute of Animal Husbandry (NIAH), Hanoi, Vietnam, and the laboratory of genebank, National Institute of Agrobiological Sciences (NIAS), Tsukuba, Ibaraki, Japan.

DNA was extracted from tissue samples by the phenol/chloroform/isopropanol method (Ausubel *et al.*, 2001). The forward primer 5'- CCTGTTTTTACAGTGAAGTTTACAGAG -3' and reverse primer 5'- CACTTCGAGGGTCAGTCCAATTA-3' were used for the amplification of the ESR gene. The polymerase chain reaction (PCR) was performed in 25 µl reaction volume in 1× PCR-buffer (Sigma, USA), containing 2 µl of 100 ng genomic DNA templates, 0.5 µl of each primer (10 µM), 0.5 µl of each dNTPs (10 mM), and 0.5 µl of Taq polymerase (Sigma, USA). The PCR reactions were carried out in a thermocycler (Perkin-Elmer, Biorad, USA) under the following conditions: 94°C for 5 minutes, followed by 35 cycles of 94°C for 30 seconds, 55°C for 60 seconds, and 72°C for 30 seconds, final synthesis of 72°C for 8 minutes and then hold at 4°C. Twenty micro litres (20 µl) of PCR product was digested with 5 units of restriction enzyme PvuII (Sigma, USA) and thereafter separated on 4% agarose gel. The result was recorded as follows: 120 bp was observed for the A allele and 65 bp and 55 bp were observed for the B allele (Short *et al.*, 1997; Linville *et al.*, 2001; Horogh *et al.*, 2005). Allele and genotype frequencies were calculated.

The effects of ESR polymorphisms and the additive and dominance effects on NBT, NBA, and NW were analysed by using the SAS software package 9.1 (SAS, 2002) with the following GLM models

$$y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + e_{ijk}$$

where y_{ijk} is reproductive trait

μ : the overall mean

α : effect of i^{th} genotype of ESR ($i = \text{AA, AB, BB}$)

β : effect of j^{th} breed ($j = \text{Mong Cai and Ban}$)

$\alpha\beta$: interaction between genotypes of ESR locus and breed

e_{ijk} : residual error.

The additive effect (a) and dominance effect (d) were estimated by linear contrasts based on

$$a = \alpha_{AA} - \alpha_{BB} \text{ and } d = \alpha_{AB} - (\alpha_{AA} + \alpha_{BB})/2.$$

Results and discussion

Two alleles (A and B) and three genotypes (AA, AB, and BB) of the ESR locus were found (Figure 1). This finding is in agreement with the results of Rothschild *et al.* (1996), Short *et al.*, (1997), Linville *et al.* (2001), Horogh *et al.* (2005), Omelka *et al.* (2005).

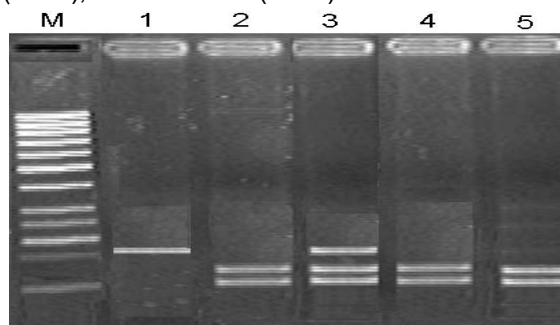


Figure 1: PCR fragments of ESR digested with *PvuII* separated on 4% agarose gel.

Lane M: Marker 50 bp ladder (1031, 900, 800, 700, 600, 500, 400, 300, 200, 150, 100, and 50 bp).

Lane 1-5: *PvuII* digested PCR products. Genotype: AA: lane 1; AB: lane 3; BB: lane 2, 4, and 5.

The allele and genotype frequencies of the ESR locus within the two sow breeds (Mong Cai and Ban) were calculated; they are presented in Table 1.

Table 1: Allele and genotype frequencies of the ESR locus in both breeds

Breed	Allele				Genotype					
	A		B		AA		AB		BB	
	n	frequency	n	frequency	n	frequency	n	frequency	n	frequency
Mong Cai	79	0.12	603	0.82	23	0.07	33	0.10	285	0.83
Ban	132	0.39	210	0.61	48	0.28	36	0.21	87	0.51

The results (table 1) show that the frequencies of the B allele and the BB genotype in the ESR locus were higher than the A allele and the AA and AB genotypes in both sow populations. The frequency of the BB genotype in Mong Cai was higher than AA and AB genotypes in Ban. These differences in allele and genotype frequencies might be one cause for the different reproductive performance of the two sow breeds. The frequency of the B allele in pigs is supposed to be positively associated with reproductive performance (Rothschild *et al.*, 1996; Short *et al.*, 1997, Linville *et al.*, 2001). It can be inferred that the higher reproductive performance of the Mong Cai breed than the Ban breed can be partly attributed to the differences between the breeds in genotype frequencies at the ESR locus.

The analysis of variance showed that the polymorphism of genotype at the ESR locus, breed, and the ESR x breed interaction had a significant impact on the reproductive traits ($p < 0.001$). Additive effects were highly significant; however, dominant effects did not affect the reproductive traits. The results (table 2) showed that the additive effect on NBT, NBA, and NW was high with B allele being favourable, but the dominance effect was never significant. The effects of the genotypes (AA, AB, and BB) at the ESR locus on NBT, NBA, and NW of Mong Cai and Ban sows were sizable and significant. The AB and BB were not different for NW in Ban sows, however they differed from AA ($p < 0.001$). The additive effects for NBT, NBA, and NW in Mong Cai sows were significantly higher than those in Ban sows; the additive effect showed that the B allele was favourably associated with the reproductive performance of sows. The present results indicate that the sows with BB genotypes had higher NBT, NBA, and NW than the sows with AA genotypes ($p < 0.001$) for both Mong Cai and Ban sows.

The additive effect associated with the B allele at the ESR locus on NBT, NBA, NW was highly significant ($p < 0.001$), whereas the dominance effect of ESR locus did not affect the NBT, NBA, and NW (table 2). The size of the effects is in agreement with previous findings by Rothschild *et al.* (1995 and 1996), Short *et al.* (1997), Linville *et al.* (2001), Horogh *et al.* (2005), Omelka *et al.* (2006) in Meishan, Large White and Landrace pigs.

Table 2: Additive and dominance effects and means for genotypes at the ESR locus for reproductive performance traits of the two sow breeds.

ESR genotype	Mong Cai			Ban		
	NBT	NBA	NW	NBT	NBA	NW
AA	7.5 ^a	6.7 ^a	6.4 ^a	5.4 ^a	5.3 ^a	4.4 ^a
AB	8.8 ^b	8.6 ^b	7.1 ^b	5.9 ^b	5.8 ^b	5.3 ^b
BB	11.0 ^c	10.0 ^c	8.5 ^c	7.0 ^c	6.7 ^c	5.7 ^b
Effect						
Additive	-1.71 ^{***}	-1.76 ^{***}	-1.08 ^{***}	-0.83 ^{***}	-0.72 ^{***}	-0.68 ^{***}
Dominance	-0.44 ^{ns}	0.25 ^{ns}	-0.46 ^{ns}	-0.30 ^{ns}	-0.19 ^{ns}	0.29 ^{ns}

LSM with different superscript in the columns differ significantly ($p < 0.05$).

*, $0.01 < p < 0.05$, **, $0.001 < p < 0.01$, ***, $p < 0.001$, and ns: not significant ($p \geq 0.05$).

In Mong Cai breed, the BB sows had higher number of 3.5, 3.3, and 2.1 piglets per litter for NBT, NBA, and NW, respectively, compared to the AA sows and 2.2, 1.4, and 1.4 piglets per litter, respectively, compared to the AB sows. In Ban breed, the BB sows had advantages of 1.6, 1.4, and 1.3 piglets per litter for NBT, NBA, and NW, respectively, over the AA sows and 1.1, 0.9, and 0.4 piglets per litter, respectively, over the AB sows (table 2). The different genotypes at the ESR locus showed the same ranking of BB>AB>AA for NBT, NBA, and NW in both breeds.

The mechanism, by which the polymorphism in the ESR gene affects litter size, is not known yet (Omelka *et al.*, 2005). Results of Van Rens *et al.* (2002) suggest that a difference in litter size between the ESR genotypes is probably caused by a difference in foetal survival. Embryos of BB gilts had a

significantly longer placenta than embryos of AA gilts. A higher chance for placental insufficiency in AA gilts could be a cause of higher foetal mortality as compared with BB gilts. According to Isler *et al.* (1999), the ESR genotype was found to be significant for number of fetuses per horn. This trait also showed a consistent trend with respect to the number of B alleles present. Animals with the AA genotype were found to have a lower number of fetuses per horn than animals with both the AB and BB genotypes. The overall effect of the B allele would therefore be an increase in reproductive efficiency of pigs (Isler *et al.*, 1999; Linville *et al.*, 2001). Omelka *et al.* (2005) found highly significant effects of the ESR locus on reproductive performance of Large White and Landrace sows and a highly significant effect of the ESR locus on NBT, NBA, and NW in the Landrace breed. An increase of 0.62 (NBT), 0.65, (NBA) and 0.51 (NW) piglets per copy of B allele of ESR was found. Horogh *et al.* (2005) found that the B allele of the ESR locus was favorably associated with NBT, NBA, and NW over the A allele. Thus, the ESR B allele appears to increase uterine length, number of fetuses per horn, and average weight of each fetus. The result of our study confirms that B alleles were more favourable than A alleles for reproductive performance of pigs of two local Vietnamese breeds. It is also consistent with the finding, that the B allele indeed produced increased NBT and NBA per litter; sows with more copies of the B allele at the ESR locus having more piglets in gestation (Isler *et al.*, 2002). In experiments in Large White sows from two elite herds in the Czech Republic the sows with BB genotypes at the ESR locus achieved the best reproductive performance; the difference between the homozygotes was about 0.8 piglets (Matousek *et al.*, 2003).

The present study has detected a significantly favourable effect on number of piglets born per litter, number of piglets born alive per litter, and number of weaned piglets per litter of the B over the A allele in both local Vietnamese breeds (table 2). The sows with the BB genotype at the ESR had a higher NBT, NBA, and NW than the sows that carried AB genotype, and these values were lowest for the sows that carried AA genotype at the ESR. This finding is consistent with several investigators, who have examined the effect of ESR locus on litter size. In Large White lines and Chinese pig crosses, Rothschild *et al.* (1996), Short *et al.* (1997), Wang *et al.* (2006) have detected a statistically significant favourable effect on litter size of the B over the A allele. They reported that the effect of the ESR locus on reproductive performance of sows was clear not only in the first litter, but also in subsequent litters. Rothschild *et al.* (1996) found, that the B allele in Meishan sows was associated with an increase in NBT and NBA of approximately 3.0 pigs per litter and the sows with the BB genotype demonstrated an advantage of 2.3 piglets between the homozygotes (BB and AA). Short *et al.* (1997) reported that the sows with the BB genotype had 0.6 to 2.0 piglets more per litter than with AA genotype.

The main finding of the study is the evidence, that the ESR B allele had a favorable influence on the NBT, NBA, and NW of the two sow breeds reared under smallholder conditions. However, this effect needs to be confirmed by analysis of a larger sample on consecutive litters. Moreover, further investigation in different local Vietnamese pig breeds is necessary to evaluate the potential of this genetic marker for the improvement of reproductive performance of sows by selection.

Implication

Two alleles (A and B) and three genotypes (AA, AB, and BB) were found in the ESR locus of Mong Cai and Ban pig populations. The polymorphic ESR gene highly influences the reproductive performance of both breeds with a positive effect of the B allele. This result can be used in marker-assisted selection to improve prolificacy in Mong Cai and Ban populations by selecting for an increased frequency of the B allele at the ESR locus.

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EVALUATING PRODUCTION CHARACTERISTICS OF THE LOCAL HUNGARIAN CHICKEN BREEDS: RESULTS OF THE GODOLLO GENE BANK STOCKS

SZENTES, K.A. - BODI, L. - BARTA, I. - STOMPNE, M.I. - DONG XUAN, K.D.T. - SZALAY, I.T.*

¹Association of Hungarian Small Animal Breeders for Gene Conservation (MGE)

H-2100 Godollo, Isaszegi ut 208, Hungary

²Research Institute for Animal Breeding and Nutrition, Division of Small Animal Research
(ATK-KATKI), H-2100 Godollo, Isaszegi ut 200, Hungary

*Corresponding author: it.szalay@gmail.com

Abstract

Evaluation of conserved populations of farm animal genetic resources for their production characteristics should be one of the major steps towards the utilization of the breeds in agricultural practice. For this purpose comparative studies of reproduction and production traits of chicken stocks of the ATK-KATKI Poultry Gene Bank in Godollo was carried out to investigate the traditional Hungarian chicken breeds (Yellow, White, Speckled and Partridge-colour) and colour variants of the Transylvanian Naked-neck Chicken (White, Black and Speckled). Following the analysis of reproduction parameters slaughtering records were examined during the rearing process of the breeding stocks. The egg yield of the Hungarian chicken breeds considerably outnumbers the ones of the Transylvanian Naked-neck Chicken, therefore, the results were evaluated within breeds groups. Among the Hungarian breeds the Partridge-colour Hungarian Chicken, whereas the White one of the Transylvanian Naked-neck Chicken proved to be the best layers. The results of the rearing studies clearly indicate that the highest body weight data are performed by the Hungarian Yellow and Partridge-colour Hungarian Chicken breed. Within the Transylvanian Naked-neck Chicken breed significantly higher body weight was observed in the case of the speckled variant by the age of 12 weeks. Rearing results also indicate that the weight of 12 week-old cocks of the Hungarian breeds generally outnumber, whereas the weight of the cocks of the Transylvanian Naked-neck Chicken reach the 1-1.2 kg of body weight which is required to produce the broiler size farm chicken.

Keywords: Hungarian chicken breeds, reproduction, production, body composition

Introduction

By these days different alternative poultry-farming systems have developed all over Europe. Their shared characteristic quality is that they all produce brand named or trademarked, original, traditional poultry-products obtained in natural or close to natural conditions. The most effective way to conserve traditional Hungarian chicken breeds supported by the national gene conservation programs is to re-explore their economic value and significance (Szalay, 2002; 2004) and generate the establishment of stock farming programs which can be maintained for a long-time, and operated on the low-input, environmentally friendly way, through which traditional, special, *Hungaricum* quality products can be produced.

As part of a comprehensive research program (GALLUS project; registration number: KF20-0192/2006), aiming to investigate the possible genetic bases for *Hungaricum* type chicken production called HU-BA (Bodi et al., 2007; Szalay et al., 2007), traditional Hungarian dual purpose chicken breeds were studied to evaluate their production characteristics. This paper deals with the results of the investigations made on egg production, hatchability and certain meat production parameters of traditional Hungarian chicken breeds.

Materials and Methods

Research on traditional Hungarian chicken breeds was carried out in the Godollo Gene Bank stocks and included investigation of reproduction parameters (egg yield, productivity, hatchability) of Yellow, White, Speckled and Partridge-colour Hungarian Chicken, and white, black and speckled colour varieties of the Transylvanian Naked-neck Chicken. All stocks are kept according to the organic regulations, with access to free range more than 4 m²/animal. Rearing studies by recording body weight in every two weeks, weight gain, feed consumption and mortality of the breeding stocks was also carried out. Rearing was performed indoors (5 birds/m²) till the age of 7 weeks, and then the

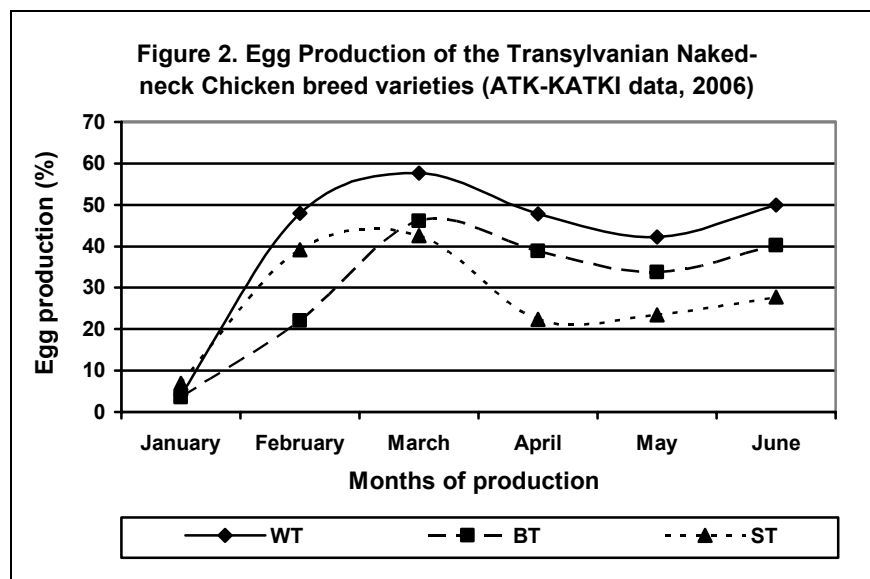
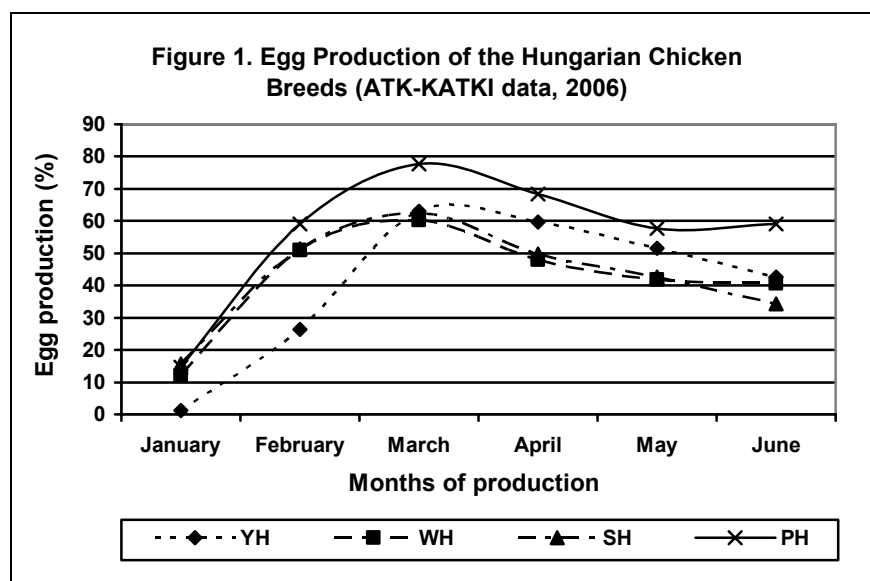
animals had the access to free-range (10 m²/animal). Slaughter tests were performed according to genotypes and experimental groups with 10-10 individuals of average weight as samples of males at 12 and 16 weeks of age. Cockerels were chosen for meat production studies because of the dual purpose character of the breeds, which means in traditional chicken breeding that females are kept for laying, while the majority of the males are used for meat production as “*spring chicken*” (about 10-12 weeks of age) or “*table chicken*” (after 16 weeks of age). Statistical analysis was performed by the use of Microsoft Excel and SPSS software.

Key to the names of breeds as abbreviations of the figures and tables presented in the paper: **YH**: Yellow Hungarian Chicken, **WH**: White Hungarian Chicken, **SH**: Speckled Hungarian Chicken, **PH**: Partridge-colour Hungarian Chicken, **WT**: White Transylvanian Naked-neck Chicken, **BT**: Black Transylvanian Naked-neck Chicken, **ST**: Speckled Transylvanian Naked-neck Chicken.

Results

Reproduction studies

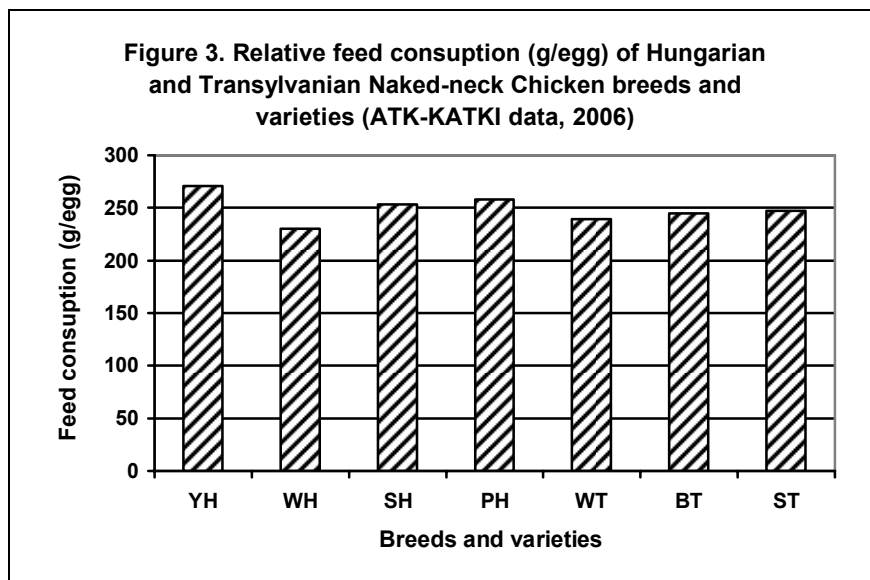
Egg production of the chicken stocks studied (White-, Black-, and Speckled Transylvanian Naked-neck Chicken) are shown within the monitored period of time (January – June, 2006) (Figure 1, and Figure 2.)



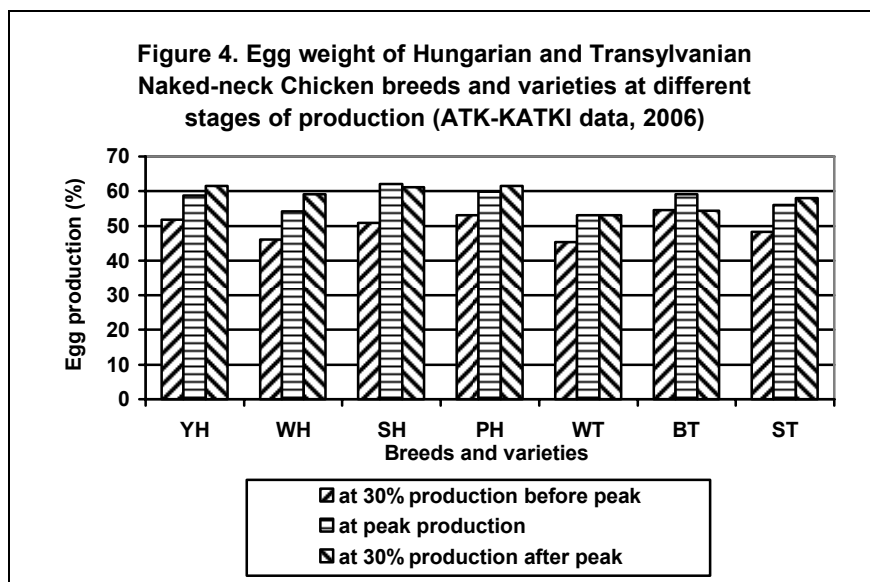
As the common and most characteristic feature for all breeds, seasonality and weather dependence are highly emphasized by the persistency of the populations studied. Egg production capability was found considerably higher in Hungarian chicken breeds than in Transylvanian Naked-neck Chicken varieties, therefore, the results were evaluated within breed-groups.

Among the Hungarian chicken breeds the Partridge-colour Hungarian Chicken proved to be the best layer (the difference is highly significant) and it was true for the whole laying season. Among the rest of breeds there were no appreciable differences found between the breeds. As regards Transylvanian Naked-neck Chicken varieties the white one was found to be the best layer. The difference is significant as compared to the other two varieties, while no significant differences were found in egg production of the Black and the Speckled varieties.

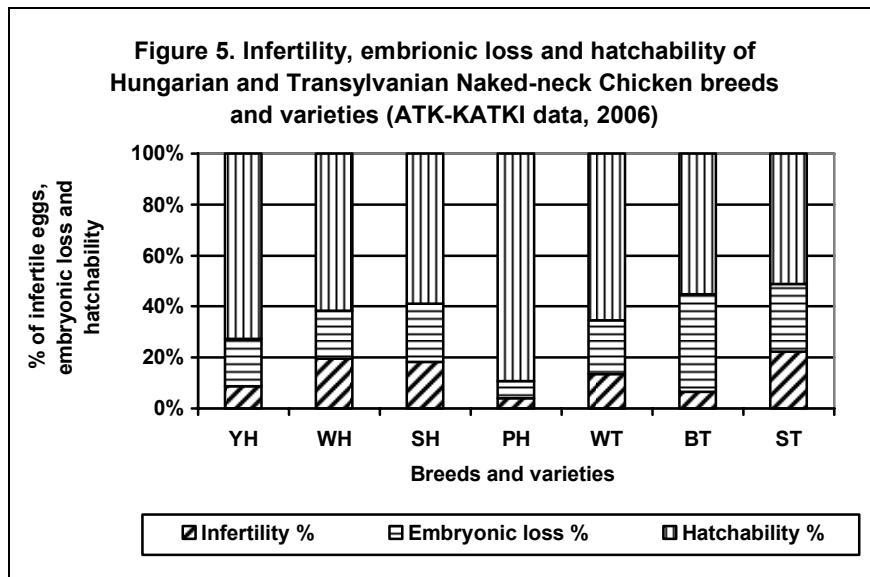
In spite of egg production records, *relative feed consumption* (g/egg) during the whole production period was significantly lower in Transylvanian Naked-neck, than in Hungarian chicken breeds, with the exception of White Hungarian breed (WH) showing the best results for this trait (Figure 3).



Egg weight of traditional Hungarian chicken breeds was recorded before (at 30% of production), at and after (at 30% of production) the peak production. Except one breed (YH) Hungarian breeds show rising egg weight throughout the production period, while it was found only in the speckled variety (ST) of the Transylvanian Naked-neck breed. The latter is also characterized by significantly lower egg weight (less than 60 grams) throughout the egg production period. Egg weight data of traditional poultry breeds and varieties are shown in Figure 4.

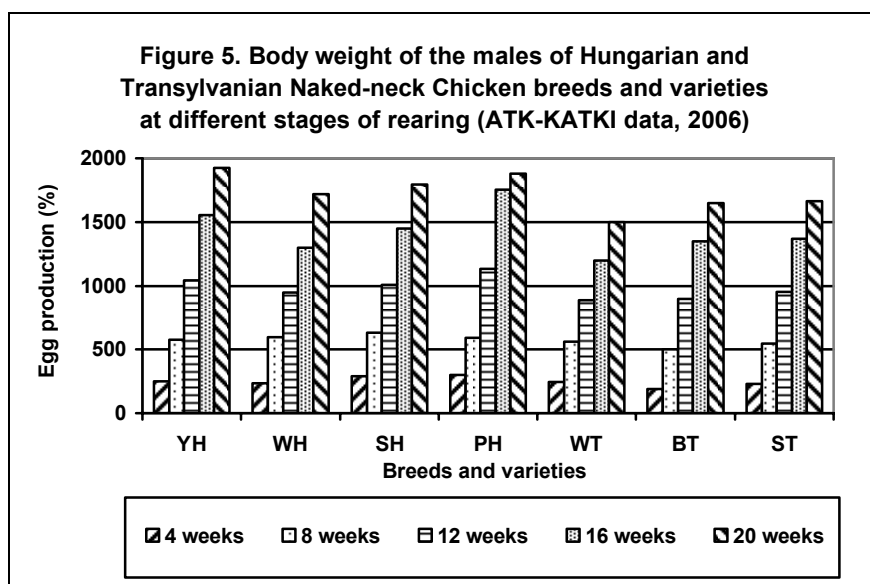


Fertility and hatchability results of the eggs of the elite stocks of the Hungarian and the Transylvanian Naked-neck Chicken breeds are shown in Figure 5. According to the evaluation of the large egg samples tested, among the Hungarian chicken breeds the Partridge-colour (PH) proved to be the best for both traits, with the white variety being the best one in the Transylvanian Naked-neck Chicken breed (the differences are highly significant in both cases). Partridge-colour Hungarian Chicken showed far the lowest embryonic loss among all the breeds and varieties studied.

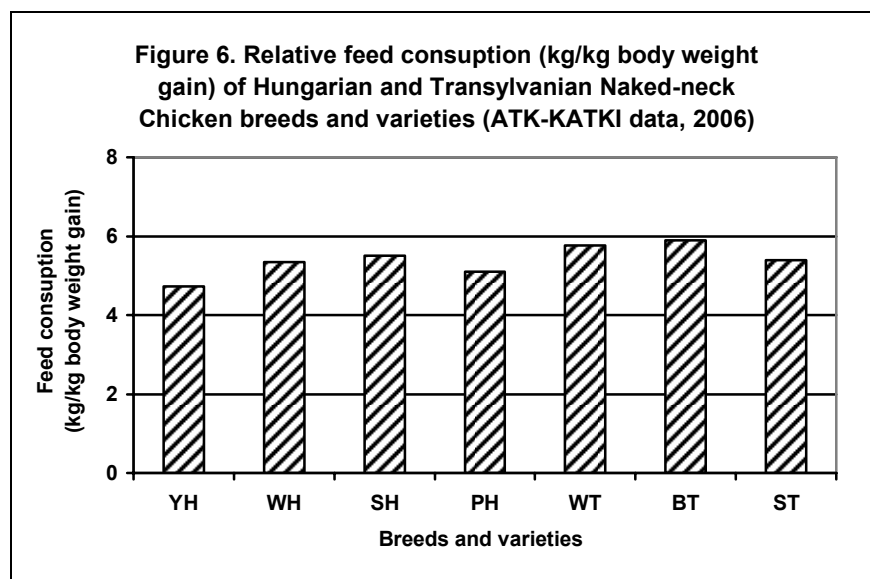


Meat production studies

To obtain the data on body weight and body composition of the Hungarian chicken breeds and varieties, young cockerels were weighed throughout the rearing period and slaughtered at the age of 12 and 16 weeks. *Body weight of males* from 4 to 20 weeks are shown in Figure 5, indicating that the highest body weight records of males were found in Yellow Hungarian and Partridge-colour Hungarian chicken flocks. Among the Transylvanian Naked-neck Chicken Breeds the Speckled ones produced significantly higher body weight by their age of 12 weeks. The raising results also show that the 12 week body weight of the males is higher, while the same record for any variety of the Transylvanian Naked-neck Chicken is lower than 1 kg, which is optimal for spring chicken production. As expected, the highest body weight results of males at 16 weeks of age were shown again by the Yellow and the Partridge colour Hungarian chicken breeds.



Corresponding to the body weight records, feed conversion (kg/kg body weight gain) during the whole rearing period (from 0 to 20 weeks of age) was significantly higher in Transylvanian Naked-neck, than in Hungarian chicken breeds, the Yellow Hungarian breed (YH) and the Partridge-colour Hungarian (PH) showing the best results for this trait (Figure 6).



Slaughter tests of Hungarian chicken breeds were performed at the ages of 12 and 16 weeks to study the body composition of young cockerels raised to produce chicken meat for traditional dishes. The summarized results of slaughter tests for the two age groups are shown in Table 1. Results indicate that slaughter yield of traditional Hungarian chickens is much higher at 16 weeks of age if compared with the yield at 12 weeks of age (81 vs. 70%). Live weight results are proportional with the age, demonstrating the linear growth of the chickens (135%) between the two ages, however all other data show the relative advantage of the 16 week slaughter, which is most emphasized in breast and thigh weight, where the relative growth proved to be significantly higher (174 vs. 164% respectively), as compared to the 12 week slaughter results.

Age	Live weight	Slaughtered weight	Slaughter yield (Slaughtered weight/Live weight %)	Grill weight	Grill weight/ Live weight %	Breast weight	Thigh weight	Breast+Thigh/ Grill weight %
12 week	1207	843	70	784	65	151	229	48
16 week	1632	1318	81	1118	69	263	376	57
16/12 %	135	156		143		174	164	

Conclusion

As part of the conservation program of traditional Hungarian chicken breeds, MGE and its institutional partners have been working on the elaboration of the genetic bases, management and quality control of production of the *Hungaricum* type quality poultry products. For any type of utilization, studies to determine reproductive and productive characteristics of the breeds are essential. The most typical feature for all breeds is seasonality and weather dependence in egg production of all breeds, which was found considerably higher in Hungarian chicken breeds than in Transylvanian Naked-neck Chicken varieties. Concerning meat production of cockerels, they are suitable for the production of chicken meat needed for special dishes as farm spring chicken and table chicken, however, the latter

age shows some advantages in slaughter tests. If used for egg and meat production, great differences can be expected between breeds, with the Partridge-colour Hungarian Chicken breed showing the highest results in both cases. Utilization of traditional, local Hungarian chicken breeds in organic or ecological type mixed farming is also a good opportunity for the breeds in Central Europe as well as in Southeast Asia, as indicated by two recent surveys (Radics, 2006; Dong Xuan and Szalay, 2007), which provides good opportunity also for their conservation in the future.

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PHENOTYPE DIVERSITY AND CHARACTERISTICS OF LOCAL CHICKEN POPULATION IN HA GIANG PROVINCE

**HOANG THANH HAI^{1*}, CECILLE BERTHOULY⁴, NHU VAN THU¹, TRINH VAN BINH³,
TRAN LONG¹, DANG VU BINH², VU CHI CUONG¹ AND J. MAILLARD⁴**

¹National Institute of Animal Husbandry (NIAH); ²Ha Noi Agriculture University NoI;

³Agriculture Extension Station of Meo Vac district - Ha Giang province;

⁴CTA of Biodiva project

*Corresponding author: Msc. Hoang Thanh Hai - Department of Animal Genetics and Breeding
National Institute of Animal Husbandry - Thuy Phuong - Tu Liem - Hanoi - Vietnam
Tel: (+84).04-7.572.174; (+84) 0977.455.897; Fax: (+84) 04-8.389.775; Email: hthanhhai@yahoo.com

Abstract

Phenotype diversity and characteristics of local chicken population in Ha Giang province

This study, which covered 352 villages, 44 communes and 11 districts of Hagiang province with 2,914 chicken and lasted from March 2005 to September 2006, was aimed at evaluating the phenotype diversity of local chicken population in Hagiang province. The results showed that chicken in Hagiang had diversified appearances and were distributed in different ecological conditions. The

average mature body weight of chicken was around 1.58 kg and 1.76 kg. All phenotypes were observed in high soil mountain and high rocky mountain areas (Dongvan, Meovac, Quangba, Yenminh, Hoangsuphi and Ximan). Feather phenotypes included fuzzy feather, smooth feather and striped feather. Fuzzy feather chicken concentrated on high rock mountain areas. Percentage of fuzzy feather and smooth feather chickens was 16.38 and 17.72% in Dongvan, respectively (the average of Hagiang province was only 4.26% and 3.32% respectively). The special black chicken breed reared by HMong ethnic group (black skin, bone, meat) occupied 4.56% and mainly concentrated in Dongvan and Xinman. There were four types of crest: single, rose, pea and strawberry crests. The percentage of chicken with orange, brown and black eyes was 81.45; 16.90, and 1.65%, respectively. Estimated allele frequencies at locus C for C and c⁺ were 0.753 and 0.247, respectively. Estimated allele frequencies at locus I for I and i⁺ were 0.041 and 0.959, respectively. Estimated allele frequencies at locus F for F and f⁺ were 0.753 and 0.247; at locus H for H and h⁺ were 0.194 and 0.806 and at locus Pg for Pg and pg⁺ were 0.883 and 0.117, respectively.

Key words: local chicken population, chicken breed, Feather phenotypes, Gene frequencies

Introduction

Biological diversity and gene resources play an important role in maintaining and developing a sustainable agriculture, ensuring the food security and protecting environment. Viet Nam is not only one of the countries which has a richest natural resource diversity of high creatures but also one of cradles for the first animal domestication of human being. Recent surveys have shown the rich of the biodiversity in Viet Nam. It was estimated that there are 310 species of mammals, 840 species of birds, 286 species of reptiles, 162 species of amphibians, 3120 species of fish, 7500 species of insects and invertebrates (Department of environment protection, Ministry of Resources and Environment, 1995 - 2005).

The special diversity of the fauna is currently being threatened due to the development of the market economy as well as human's uncontrolled exploitation and usage. In addition to the destruction of the living environment and illegal hunting, intensive livestock production systems with more investment and introduction of exotic breeds of high productive animals has led to a decrease in use or disappearance of domestic breeds of animals, which were low productive animals but well adapted to harsh environments of a hot and humid climate in Vietnam.

Therefore, numerous of animal breeds possessing invaluable and specific genes are being eroded and disappeared. Under the French Govt. funded BIODIVA project: "Characterization and valorization of farm animal biodiversity in the mountainous regions of North Vietnam (from 15/10/2004 to 15/10/2007), National Institute of Animal Husbandry conducted a study aimed at estimating the genetic diversity of local animals in Ha Giang province.

Ha Giang is a North mountain province, which has 11 districts and 24 ethnic groups living together. Each ethnic group has its own animal husbandry practice, depending on the customs, natural conditions in which animal husbandry systems were established. The genetic diversity of animals and the traditional animal husbandry practices have been maintaining for a long time. It seemed that animal breeds are comparatively homogeneous and local animals are well adapted to local climatic conditions. How to maintain, valorise the animal biodiversity and reduce losses of animal biodiversity is a necessary and urgent need.

Thank to centuries of domestication and oriented selection, different breeds of chicken have different appearances, however, appearances of chicken within a breed are similar. Because of long term selection some traits have been eliminated from the population and the genetic diversity are narrower.

To answer the question: What the biodiversity of chicken breeds in Hagiang is now, this study, which aimed at estimating the distribution of Ha Giang chicken population, evaluating genotypes determining the some appearance traits of Ha Giang chicken population and estimating allele frequencies of the appearance traits was undertaken.

Materials and Methods

The study started on March 2005 and finished on March 2007. All 11 districts of Hagiang including Hagiang town was involved in the study. Observations were based on individual chicken recording sheets with 62 parameters. Total 2914 mature chicken from 44 communes (2-5 communes in each district), 352 villages (8 villages in each communes) were investigated. Data collected were used to estimate the distribution of Ha Giang chicken population. Data on appearance collected and document: "Les poules - Diversité Génétique" of INRA (2003) were also used to estimate allele frequencies. Allele

frequency was calculated according to Hardy Weinberg law. Data obtained were subject to statistically analysis using Minitab software, Version 14 at Department of Animal Genetics and Breeding, National Institute of Animal Husbandry.

Results and discussions

Chicken population in Ha Giang province by groups

The local chicken population in Ha Giang province can be grouped by color of feather, feather structure, color of skin, body weight.

Percentage of white and colorful feather chicken was 6.01 and 93.99% of total population, respectively. Colorful feather chicken can be divided in seven different forms. Percentage of fuzzy feather and smooth feather chicken was 4.26 and 3.32% of total population, respectively. Although fuzzy feather and smooth feather chicken were not productive, they were used as pet animals. The average body weight of chicken with different phenotypes and feather color ranged from 1.3 to 1.8 kg. White feather chicken had a lower body weight (average of 1.58 kg), while colorful feather chicken were slightly heavier (1.62 to 1.76 kg). Black chicken had the lowest body weight (average of 1.58 kg) and yellow skin chicken were the heaviest body weight (2.08 kg).

The percentage of chicken with the black skin, bone, meat and viscera reared by H'mong ethnic group, which had three types of feather colors: striped, white and black, was 4.56% of total chicken population. They were considered as invaluable chicken preferred by customers because of tasty meat. These chickens were often used as tonic foods for human and had higher price in markets. In summary, the local chicken population in Ha Giang province had diversified phenotypes of feather colors, feather types and skin colors.

Phenotypic diversity of feather colors

Feather color:

The Chicken population investigated had diversified feather colors. 93.99 % of chicken had a colorful feather such as brown; black, red feathers. Percentage of chicken with a colorful feather in Hagiang town and Dongvan was 100 and 88.47 %, respectively.

White feather chickens were only 6.01%. Percentage of chicken with a white feather in Dong Van, Bacquang and Vixuyen was 11.26; 9.56; 1.02 and 2.82%, respectively. It appeared that the feather colors of chicken in Dongvan were more diversified than these in other districts.

Allele frequency of some of genotypes of feather color:

Estimated allele frequency was conducted on loci having contrast genes. Locus C has two alleles: C^+ and c , of which, allele C is dominant and its expression is colourful feathers such as brown, black, red and light yellow; allele c^+ is recessive and its expression is the white feather. The percentage of local chicken population in Ha Giang province with colorful feathers was 93.99% (due to the presence of C), and the percentage of local chicken population in Ha Giang province with a white feather was 6.01% (because of the resessive homozygote c^+c^+)

Based on Hardy Weinberg law with locus C, the percentage of white feather chicken was 6.01% and percentage of colourful feather chicken was 93.99%, so the individual frequency carrying genotype c^+c^+ was $q^2 = 0.0601$. Allele frequency of c^+ is:

$$q(c^+) = \sqrt{0,0601} = 0.247 \text{ and then allele frequency of } C \text{ is:}$$

$$p(C) = 1 - q(c^+) = 1 - 0.247 = 0.753.$$

Locus I has two alleles I and i^+ , of which allele I is dominant and its expression is the while feather, i^+ is recessive and its expression is the black feather. The percentage of local chicken population in Ha Giang province with a black feather was 92.14% (because of the resessive homozygote i^+i^+), the percentage of local chicken population in Ha Giang province with a white feather was 7.86% (because of the presence of I).

So, the individual frequency carrying genotype i^+i^+ is $q^2 = 0.9214$.

Allele frequency of i^+ was: $q(i^+) = \sqrt{0,9214} = 0.959$ and then allele frequency of I is:

$$P(I) = 1 - q((i^+) = 1 - 0.959 = 0.041.$$

Results from the above calculation were presented in Table 1.

Table 1: Allele frequencies at C and I loci

Locus	Genotype			Gene	
C	CC	Cc+	C+c+	C	C+
		0.9399	0.0601	0.753	0.247
I	II	li+	i+i+	I	I+
		0.0786	0.9214	0.041	0.959

Phenotypic diversity of chicken feather*Feather phenotypes*

The local chicken population in Ha Giang had different feather types such as fuzzy feather, smooth feather and striped feather.etc. Percentage of feather phenotypes of chicken population in Ha Giang province was presented in Table 2.

Table 2: Feather phenotypes of local chicken population in Ha Giang

Ecologic regions	N°. chicken	Fuzzy feather (%)	Smooth feather (%)	Striped feather (%)	Normal feather (%)
Low soil mountain	1123	1.43	0.65	11.03	86.89
Highsoil mountain	657	1.97	4.51	21.30	72.24
Highrocky mountain	1134	8.87	5.98	28.29	56.77
	2194*	4.26**	3.32**	19.26**	73.49**

Note: *Total, ** Average

As can be seen from the table, feather phenotypes of chicken population in Ha Giang were very diversified. Beside the normal feather type, there were three other types of feather such as fuzzy, smooth and striped feathers. Among three types of feather: fuzzy, smooth and striped feathers, percentage of chicken with the striped feather was highest (19.26%), followed by percentage of chicken with the fuzzy feather (4.26%). The percentage of chicken with the smooth feather was lowest.

While chicken with fuzzy and smooth feathers concentrated mainly on high rocky mountain areas, chicken with a striped feather can be found in low soil mountain, high soil mountain and high rocky mountain areas.

The above observations indicated that phenotype of feathers of chicken was more diversified in high areas.

Allele frequency of some genotypes of feather types

Feather type trait of chicken is determined by genes on F, H and Pg loci. Locus F has two alleles F and f^+ . Of which allele F is dominant and its expression is fuzzy feather chicken, Allele f^+ is recessive, its expression is a normal feathers. The percentage of fuzzy feather chicken was 5.52% (due to the presence of gene F), percentage of normal feather chicken was 94.48% (because of recessive homozygote f^+f^+). According to Hardy Weinberg law, the individual frequency carrying genotype f^+f^+ is $q^2 = 0.0552$, so the allele frequency of f^+ is: $q(f^+) = \sqrt{0.0552} = 0.235$ and therefore, the allele frequency of F is: $p(F) = 1 - q(f^+) = 1 - 0.235 = 0.765$. Locus H has two alleles: H and h^+ , of which allele H is dominant its expression is smooth feather chicken, allele h^+ is recessive its expression is normal feather chicken. The percentage of normal feather chicken was 96.23% (because recessive homozygote hh) and percentage of smooth feather chicken was 3.77% (due to the presence of gene H⁺).

Table 3: Allele frequencies at F, H⁺ and Pg loci

Locus	Genotype			Gene	
F	FF	Ff+	f+f+	F	F+
		0.0552	0.9448	0.028	0.972
H+	H+H+	H+h	Hh	H+	H
		0.0377	0.9623	0.194	0.806
Pg	PgPg	Pgpg+	Pg+pg+	Pg	pg+
		0.7803	0.2197	0.883	0.117

Similarly, the individual frequency of genotype of hh $q^2 = 0.0377$ so allele frequency of h is $q(h) = \sqrt{0.0377} = 0.194$, and then allele frequency of H is $p(H^+) = 1 - q(h) = 1 - 0.194 = 0.806$. Locus Pg has two alleles: Pg and pg^+ of which allele Pg is dominant and its expression is a striped feather, allele pg^+ is recessive and its expression is non-striped feather. The percentage of striped feather chicken was

21.9% (due to the presence of the recessive homo-gygote pg^+pg^+ and percentage of non-striped feather chicken was 78.03% (because the presence of gene Pg). So the individual frequency carrying the genotype pg^+pg^+ is $q^2 = 0.7803$. Allele frequency of pg^+ is: $q(pg^+) = \sqrt{0.7803} = 0.883$ and then allele frequency of Pg is: $p(Pg) = 1 - q(pg^+) = 1 - 0.883 = 0.117$. Results from the above calculation were presented in Table 3.

Phenotypic diversity of chicken skin color

The skin color depends on the presence at different levels of xanthophylles and melanin in the outer skin layer. It was found out that the local chicken in Ha Giang province had three main skin colors: white, yellow and black. The percentage of chicken with the yellow, white and back skin was 57.9, 37.54 and 4.56%, respectively. The population of black skin chicken reared by H'Mong ethnic minority is very small now distributed mainly in two districts: Dong Van and Xin Man. (see Table 4).

Table 4: Distribution of chicken skin color phenotypes in Ha Giang province

Region	No of chicken	Black skin (%)	White skin (%)	Yellow skin (%)
Low soil mountain	1123	0.78	22.16	77.06
High soil mountain	657	7.84	44.23	47.92
High rocky mountain	1134	7.64	53.43	38.93
	2194*	4.56**	37.54**	57.90**

Note: *Total, ** Average

It appeared that black skin chicken concentrated on high rocky and soil mountain areas and that most of local chicken in Ha giang had a yellow skin.

Phenotypic diversity of a special bunch of hairs

While 89.07% of local chicken in Ha Giang province had normal feathers, 10.03% of local chicken in Ha Giang province had a special bunch of hair on the head, fauces, thigh and legs (Table 5).

As can be seen from Table 5, the percentage of local chicken with a special bunch of hairs on the fauces, head, and thigh, leg was 4.04; 3.01 and 2.27, respectively. Among regions, the high rocky mountain region had more chicken with a special bunch of hairs on fauces, head, and thigh, legs than others.

Table 5: Phenotypic diversity of a special bunch of hairs of local chicken in Ha Giang province

Ecology region	No chicken	Special bunch of hairs (%)		
		on the head	on fauces	on thigh and leg
Low soil mountain	1123	2.71	2.68	0.66
High soil mountain	657	2.91	4.73	0.16
High rocky mountain	1134	3.43	5.38	5.33
	2194*	3.01**	4.04**	2.27**

Note: *Total, ** Average

Phenotypic diversity of chicken crest

There were several types of crests of the local chicken population in Ha Giang. They were single, strawberry, pea and rose crests. Within rose crests, there were several sub-types of rose crest such as normal rose, lumpy rose... The phenotypic diversity of chicken crest was presented in Table 6.

In general, the percentage of chicken with a single, rose, strawberry and pea crest was 83.58; 10.06; 4.19 and 2.17%, respectively. However, the percentage of chicken with different types of crests was different from one region to another. The percentage of chicken with a rose, strawberry and pea crest was highest in the high soil mountain region and the percentage of chicken with a rose, strawberry and pea crest was lowest in the high rocky mountain region.

Table 6: Phenotypic diversity of chicken crest in Ha Giang province

Region	No of chicken	Single crest (%)	Pea crest (%)	Rose crest (%)	Strawberry crest (%)
Low soil mountain	1123	83.07	2.01	11.20	3.72
High soil mountain	657	74.59	4.79	13.54	7.07
High rocky mountain	1134	88.71	1.07	6.89	3.33
Mean	2194*	83.58**	2.17**	10.06**	4.19**

Note: *Total, ** Average

Phenotypic diversity of ear-lap colors

The phenotypic diversity of ear-lap colors of local chicken in Ha giang was presented in Table 7. As shown in Table 7. There were four main colors of ear-lap of Ha giang local chicken. They were back, red, white-red and white. In general, the percentage of chicken with red, white-red, white and black ear-laps was 62.99; 24.64; 9.19 and 3.18%, respectively.

Table 7: Phenotypic diversity of ear-lap colors

Region	No chicken	Black (%)	Red (%)	White-red (%)	White (%)
Low soil mountain	1123	0.4	75.44	14.72	9.44
High soil mountain	657	3.84	71.72	15.89	8.55
High rocky mountain	1134	6.32	43.08	41.41	9.19
	2194*	3.18**	62.99**	24.64**	9.19**

Note: *Total, ** Average

The percentage of chicken with different colors of ear-laps was different from one region to another. While the percentage of chicken with red ear-laps was highest in the low soil mountain region, the percentage of chicken with white ear-laps was also highest in the low soil mountain region. The percentage of chicken with white ear-laps was highest in the high soil mountain region, the percentage of chicken with white-red and black ear-laps was highest in the high rocky mountain region.

Phenotypic diversity of colors of chicken eyes

From the total of 2914 chicken studied, it was found out that there were three main colors of chicken eyes in Ha giang. They were orange, brown and black eyes. The percentage of chicken with orange, brown and black eyes was 81.45; 16.90, and 1.65%, respectively. The high rocky mountain region had the highest percentage of chicken with black and brown eyes, while percentage of chicken with orange eyes was highest in the low soil mountain region.

Phenotypic diversity of hairs on legs and number of toes

The phenotypic diversity of hairs on legs and number of toes was shown in table 8. As can be seen from Table 8, while there were few chicken with more than four toes (1.87%), there were 22.60 % of chicken having hairs on legs. It was also revealed that the phenotypic diversity of hairs on legs and number of toes was different from one region to another. The percentage of chicken with hairs on legs and with more than four toes was highest in the high rocky mountain region.

Bảng 8: Phenotypic diversity of hairs on legs and number of toes

Region	No of chicken	Hairs on legs (%)	Number of toes (%)	
			4	> 4
Low soil mountain	1123		98.67	1.33
High soil mountain	657	10.31	99.24	0.76
High rocky mountain	1134	21.72	96.91	3.09
	2194*	38.39	98.13**	1.87**
		22.60**		

Note: *Total, ** Average

Conclusion

The local chicken population in Ha Giang province was very diversified in phenotypes. Appearance and are distributed in different ecological and conditions. At the high low and rock mountain areas (Dong Van, Meo Vac, Quan Ba, Yen Minh and Xin Man) have all of phenotypes. Especially, colorful feather: white feather chicken occupies 6.01%, other color feather 93.99% with seven main groups of color feather: black feather, non – black feather, silver gold feather, non - silver gold feather, with white point at the top of feather, without white point at the top of feather and colorful feather with white point at top.

Feather phenotypes: normal feather (73.49%), striped feather (19.26%), fuzzy feather (4.26%) and smooth feather (3.32%). Fuzzy feather chicken concentrated at high rock mountain area, the highest in Dong Van and Yen Minh districts.

Chicken skins: Color skin chicken (37.54%), yellow (57.90%) and black (4.56%).

Traits at the head and leg: white chicken cerulean (9.19%), white – red (24.64%), red (62.99%) and black (3.18%).

Orange chicken eyes occupied 81.45%, brown 16.9% and black 1.65%. Chicken with leg feather occupies 22.6%, the highest in Dong Van (49.15%). Chicken with number of toes more 4 occupies 1.87%, the highest in Meo Vac district (5.56%).

Gene frequencies at loci

Locus C: Gene frequencies of C and c⁺ were 0.753 and 0.247
Locus I: Gene frequencies of I and i⁺ were 0.041 and 0.959
Locus F: Gene frequencies of F and f⁺ were 0.753 and 0.247
Locus H: Gene frequencies of H and h⁺ were 0.194 and 0.806
Locus Pg: Gene frequencies of Pg and pg⁺ were 0.883 and 0.117

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INDIGENOUS PIG POPULATION IN THE MOUNTAINOUS REGIONS OF NORTH VIETNAM

DANG DINH TRUNG, NGUYEN VAN DUC

Department of the Animal Genetics and Breeding (DAGB), National Institute of Animal Husbandry (NIAH), Chem - TuLiem - Hanoi, Vietnam.

Abstract

The pig is one of the oldest domesticated animals in Vietnam. Vietnam has abundant and diversified resources of pig breeds with distinct characteristics, which are from a large natural gene pool. Vietnamese native breeds have better utilisation of low quality feedstuffs, enhanced resistance to local disease organisms and better adaptation to environmental but also have lower growth rate, higher Feed Conversion Ratio (FCR) and higher Back fat (BF).

The Mong Cai (MC), I, Tap Na, Lung Pu and Muong Khuong are regionalised mainly in the northern Vietnam with variety performance depending upon the differing conditions. They are much more popular, important and well adapted in northern Vietnam.

Keywords: Mong Cai, Tap Na, Lung Pu, indigenous, pig breed

Introduction

The pig is one of the oldest domesticated animals in Vietnam and Asia is one of the oldest centres of domestication and rearing of pigs. The Vietnamese native breeds were developed from a different wild strain than the European breeds. In Vietnam, there are abundant and diversified resources of pig breeds with distinct characteristics, which are from a large natural gene pool. Many published papers dealing with Vietnamese native breeds have shown that most of them have better utilisation of low quality feedstuffs, enhanced resistance to local disease organisms and better adaptation to environmental conditions than European breeds, but also have lower growth rate, higher Feed Conversion Ratio (FCR) and higher Back fat (BF) than European breeds.

Vietnam still possesses a number of indigenous breeds. These breeds are regionalised with the Mong Cai (MC), I, Tap Na (TN), Lung Pu (LP) and Muong Khuong (MK) mainly in the northern Vietnam; Phu Khanh (PK), Tau Pha and Co in the central provinces; and Thuoc Nhieu and Ba Xuyen in the southern Vietnam. There is considerable variability in performance from one breed to another breed, depending upon the differing conditions including climatology, social and economical conditions, to which they have been subjected. Among these indigenous breeds, MC, I, TN, LP and MK were used in this study because they are much more popular, important and well adapted in northern Vietnam.

Characterisation of Native Pig Breeds in northern Vietnam

The Mong Cai breed

Introduction: Mong Cai is the best known and the most important indigenous pig breed in north and central Vietnam. MC originated from the Dam Ha, Ha Coi and Tien Yen districts, belonging to Quang Ninh province. Today, it is distributed and maintained widely in all provinces of the Mountain Region and Midland, the Red River Delta, and has spread to some provinces of the Central Coastline. The head of the MC breed is big with a small but long mouth and the neck is short. The erect ears are small. The body is quite short and has a round form. The back is long, wide and falling, making a concave shape. There are 12 or more teats located along their convex belly. Colour is black with a white band, which originates from one side of the abdomen, passes through the shoulder and terminates on the other side of the belly, making a "horse saddle" form. This is a typical feature of the MC breed. It has a white dot on the forehead and at the end of the tail with some in the belly area.



Mong Cai pig breed, female (left) and male (right)

Reproductive performance of MC: Early sexual maturity of the gilts is likely to have a beneficial influence on the economic efficiency of pig production. Thus, MC has become the most prominent native pig breed of Vietnam because of its early maturity. The prolificacy of the MC breed compares favourably with that obtained in other Vietnamese native breeds as well as European breeds. MC boars reach their puberty at the age of 2 months. By that time, they can produce mature sperm, and

are capable of mating with and fertilising females. Maturity age of female is 5 months age. Age of first farrowing (AFF) is 11-12 months age. It may be due to MC's small body size or low body reserve and people do not allow them to be mated at the first two or three oestruses.

MC has become the most useful local breed in northern Vietnam, due to its number born alive (NBA) averaging 10.1-12.8 piglets/litter, 10-14 piglets per litters (Duc, 1997; Duc, 2005). In specific cases, Litter size (LS) of 28 piglets/litters is reported (Duc, 2005). The reason for that may be MC boars have better adaptation to the stressful environment of Vietnam.

Birth interval is short, 165-175 days. Reproductive capacity is 2.1-2.2 litters per year (Duc, 2005). Using time is long, 10-15 litters per sow (Duc et al, 2000). Birth weight (BW) and piglet weaning weight (PWW) at 60 is low, 0.5-0.6 and 5.5-6.5 kg, respectively (Duc and Ha, 2000).

Production and carcass performance of MC: the growth rate of MC breed is low, at 327 g/day. Lean meat percentage (LMP) is low, 33-35% in a selected herd with high quality feedstuffs (Duc et al, 2000b). After several generation selections, average daily gain (ADG) of MC is improved, 333 gr/day (Duc, 2005). Due to the very low ADG compared with exotic breeds, their body weights are also lighter than those of exotic breeds of the same age. MC are characterised by a thick BF (44-54 mm) (Thien and Luan, 1994) and a low LMP (33-35%) (Duc, 2005). During the fattening period of MC breed, FCR is high, 4.5-5.5kg (Duc et al, 2000b). LW at 8 months age is 65-75 kg (Duc, 2005). In addition, DP recorded an average of 68.0-70.9% (Thien and Luan, 1994).

After little generation selection, 2 lines of MC were selected for high reproduction (MC₃₀₀₀) and high production performance (MC₁₅): ADG of MC₁₅ is 400gr/day and LMP is 38%. NBA of MC₃₀₀₀ is 12,75 piglet/litter. (Duc, 2005)

MC with high reproduction is used mainly as dam to mate with exotic pig breed.

The I breed

Introduction: I is the second most dominant native pig breed in the Red River Delta and some provinces in Northern Vietnam, accounting for 2,500,000 pigs. It is a black pig and has a small body (0.45, 4.5, 15 and 35-40 kg at birth, 2, 6 and 8-10 months, respectively). The females are smaller than the males. Adult live weight and wither height of males and females are 50, 48 kg and 36, 35 cm respectively. The snout is concave, the front is narrow, the back usually bends in front of a hammock and the belly of pregnant and lactating sow is very developed and drags on the ground. The legs are slender and the animal is usually plantigrade. The breed is well adapted to live in the local humid flooded areas and to poor nutritional conditions. Feeding for adult I are agricultural by-products, poor quality fodder and a small amount of concentrate.



Reproductive performance: It is quite good but production performance is not acceptable. It is remarkable for its early sexual maturity. For females, the oestrus appears at about 4 months and for male the first mating may be at only 2 months. The average teat number is 10.7 and LS is 9-11 piglets. AFF and FI were 407-445 and 188-199 days respectively (Thien and Luan, 1994). LS is about 9.6 piglets/litter.



Production and carcass performance of I: ADG was low (139-208 g/day) (Thien and Luan, 1994). However, it could reach up to 372 gr/day. LMP and fat percentage was 32.3-39.2 and 40.0-46.2%, respectively. FCR was high, at about 4.87-7.68 (Thien and Luan, 1994). The I breed could be used as the purer, crossbred dam with LR, Berkshire and LW for slaughter stock in some places, where the conditions for pig husbandry are not so good.

The Tap Na breed

Introduction: Tap Na pig breed originated from Thong Nong – Cao Bang province. Tap Na is kept only in this region because of poor traffic and trade condition. Some of characteristics of Tap Na are similar with MC except "horse saddle" form. Black skin and hair excepts 6 points: the front, feet and the end of the tail. The head of Tap Na is normal, ru ears, straight face. Big stomach but not falling as MC. High and big feet. Straight back. There are 8-12 teats (Duc, 2002). Disease resistant is high. Casualty rate is 3-4% (Duc et al, 2006).

Reproductive performance: Reproductive capacity of Tap Na is lower than MC. AFF is 13.6 months. In poor condition, NBA is 4-12 piglet, but 80% litters achieve 6-9 piglet (Duc et al, 2004). NWP is 6.83 piglets/litter (3-10 piglets). BW is 591.03±72.17gr/piglet (Duc et al, 2006). In compare with MC, NBA of Tap Na is lower but BW is higher. Tap NA pig breed is kept in small regions with mall population, so inbreeding of Tap Na pig breed is reported.



Production and carcass performance: In porr condition, ADG of Tap Na pig breed is 313gr per day, is normal in compare with other indigenous pig breed in Vietnam. LW of adult pig is 100-120 kg (Duc et al, 2004). In fattening period 3-10 months age, ADG can reach 400 gr per day. Dressing rate is high, 79.06%. Carcass percentage is 64.68%. LMP is low, 32.90%, Fat percentage is high, 46.82%. Bone percentage is lower than other indigenous pig breeds and skin rate is lower than other local pig breeds (Duc et al, 2006). In mountainous regions, high fat percentage of Tap Na pig breed is suitable for demand of people.

The Lung Pu pig breed

Introduction: Lung Pu is one of Vietnamese local pig breed, rearing in mountain areas of North-West of Vietnam, mainly in Lung Pu Village, Meo Vac district, Ha Giang province.

The main color of Lung Pu breed is black skin and hair, excepts 6 points: front, feet and the end of the tail. The whorl of front white cowlick tends to peak of the head is the most important and typically characterization of breed. Body size is big in comparing with other Vietnamese local breeds: weight at 1-0-12 months can be 90-100kg. The stomach is not to big as Mong Cai breed (Duc, 2005). The ears are small. Lung Pu pig breed has good ability for adapting with the hard and poor condition in the high mountain area of Vietnam (Duc et al, 2007).



Lung Pu sow



Lung Pu boar

Reproduction performance: Due to inbreeding, reproductive capacity is decrease as before. NBA is 6-10 piglets/litter, NWP is 4-7 piglets/litter. Maturity age of male is 2 months. People usually kept one of their young male pigs to mate in herd. Using young male to mate with his mother or sister is reported (Duc et al, 2007). Male pigs are used for mating early when they are 2.5-3 months age. After mating, male pig is castrated. AFF is 13 months age. Reproductive capacity is 1.5–1.6 litters/year (Duc et al, 2007).

Production and carcass performance: BW is similar with other indigenous pig breed in Vietnam, 0.6-0.7 kg. Live weight at 12 months age is 80-90 kg. ADG is equal as local pig breeds in Vietnam, 400gr/day. With better condition, ADG is 450-500gr/day. LMP is 30-36%. Taste of meat is good (Duc et al, 2007).

The Muong Khuong breed

This is a large native breed pig with black or brown hair and a white spot in the centre of forehead and on the end of the tail. Adult live weights are 150 and 132 kg, with their wither height of 50-49 cm for males and females respectively. It is mainly raised in the mountain areas of Muong Khuong and Bat Sat Districts of Lao Cai province. Its snout and body size is long. It has very thick skin. This breed is capable of using poor roughage. Age at first puberty is older than I or MC, at about 200-300 days. LS at birth and weaning of this breed is small, around 6-8 and 5-6 piglets respectively. Reproductive capacity is about 1.0 to 2.0 litters/year. Slaughtering weight is good but LMP is low and meat colour is relatively dark. FCR is very high, at 8.0 kg/kg.



Muong Khuong sow



Muong Khuong boar

Conclusions

As a result of the great variety of farm by-products amongst native pig breeds, MC, I, TN, LP and MK are each suited to certain environments in Vietnam and they are sustainable for smallholder production. They have low ADG and high BF. Nevertheless native breeds have important characteristics contributing to their good adaptability for good resistance to heat stress, excellent tolerance to dietary changes, good fertility with large LS. They can be used mainly for meat production in mountainous areas where the environment is not good and also widely for crossing with exotic breeds in order to get better meat production and reproductive performance. Therefore, it is necessary to conserve these breeds because in the future they might be very important pig genetic resources, not only for Vietnam but also for the rest of the world. As a consequence of the great economic importance, Vietnam should keep these native breeds and form them as dam lines because of their high prolificacy and good resistance to heat and dietary changes. Moreover, first cross of exotic x native sows are acceptable for slaughter stock, and also as maternal contributors to backcrosses and three-breed crosses for commercial production.

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PERFORMANCE OF TAU VANG CHICKEN REARED FOR CONSERVATION IN LONG AN PROVINCE

HOANG TUAN THANH⁽¹⁾, NGUYEN QUOC DAT⁽¹⁾ VO VAN SU⁽²⁾ AND HOANGVAN TIEU⁽²⁾

⁽¹⁾ Centre for animal science and development of Southern Vietnam

⁽²⁾ National institute of animal husbandry

Author adress: Hoang Tuan Thanh

Centre for animal science and development of southern Vietnam

Tel.: +84 8 8942474 - Email: thanhvigova@yahoo.com

Abstract

Performance of Tau Vang chicken reared for conservation in Long An province

920 (60 males+860 females) one day old Tau Vang chickens were reared for conservation in Long An province from March 2007 to May 2008. Results of the study showed that most chickens had unique straw-yellow feather, yellow skin and single crest. Body weight at 8 weeks of age of males and females were 1056.17 g and 885.50 g respectively. Body weight at 20 weeks of age of males and females was 2453.67 and 1828.96 g respectively. Average laying rate and egg number of 40-week laying cycle was 37.72% and 105.62 respectively. Feed conversion for 10 eggs was 2.82. Egg weight, fertility and hatchability of high-grade day old chickens was 49.43 g, 84.01% and 69.46% respectively.

Key words: Tau Vang chicken, West-Southern Vietnam.

Introduction

Native scavenging Tau Vang chickens are widely reared at households, especially in West-Southern provinces of Vietnam. In the recent years some colour plumaged chicken breeds such as Tam Hoang, Luong Phuong, Sasso etc. have been exported to this area for meat production but Tau Vang chickens are still preferable for farmers to rear as they have some favourite biological characteristics and meat quality.

However along with the importation of exotic breeds many Tau Vang chickens in villages have been crossed with imported chickens. In the project "Animal gene conservation of Vietnam" a study was conducted to rear Tau Vang chickens for conservation and investigate some biological and productive characteristics of the breed in Long An province.

Materials and Methods

60 males and 860 females of Tau Vang chicken breed were reared from day old of age to the end of laying cycle at 20 households. Number of chickens reared at each household varied from 30 to 160. Mating rotation of males and females between households was used to avoid inbreeding.

During rearing for conservation chickens were also selected for the appearance, colour of feather and skin and genetic improvement of some productive traits. Productive traits observed were laying rate and egg number, egg weight, fertility, hatchability, feed conversion for egg production and body weight at different ages. Data were analyzed statistically with the use of Excel and Minitab softwares.

Results and Discussion

Biological Characters

Most chickens had unique straw-yellow feather, yellow skin and single crest.

Survival ratte

Table 1. Survival rate

Week of age	Survival rate (%)
0-4	97.61
4-8	98.67
0-8	96.30

Survival rate in the period 0-8 week of age was 96.30%. It was higher by 7.9-15.1% than the results reported by Phung Duc Tien et al (2008), Nguyen Van Bac et al (2005), Nguyen Dang Vang et al (1998).

Body weight

Table 2. Body weight of Tau Vang chicken

Week of age	Mean (g/b)	Cv (%)
Male		
8	1056.17	10.05
20	2453.67	6.20
Female		
8	885.50	8.97
20	1828.96	6.04

The body weight at 20 weeks of age of males and females was 2453.67 and 1828.96 g resp.ly, higher than that reported by Nguyen Van Bac et al (2005) 7,96%. Body weight of the chickens was more homogenous than before selection.

Age at first egg and 50% laying rate

Table 3. Age at first egg and 50% laying rate

Age at first egg (day)	135 – 147
Age at 50% laying rate (day)	190 – 192

Age at first egg and 50% laying rate was 135-147 days of age and 190 – 192 days of age respectively. According to Dang Thi Hanh et al (1998) age at first egg was 154 days (22 week); Nguyen Van Bac et al (2003) age at 50% laying rate was 193-197 days.

Egg production and FCR for 10 eggs

Table 4. Egg production and FCR for 10 eggs of Tau Vang chicken

Week of laying	Laying rate (%)	Egg number (e/b)	FCR for 10 eggs (kg)
4	33.82	2.37	3.14
8	62.30	4.36	1.71
12	43.43	3.04	2.45
16	33.10	2.32	3.21
20	27.77	1.94	3.83
24	37.07	2.59	2.87
28	45.71	3.20	2.32
32	40.30	2.82	2.64
36	29.53	2.07	3.60
40	27.21	1.91	3.90
Average	37.72	-	2.82
Total	-	105.62	-

According to Nguyen Van Bac et al (2003), egg number of Tau Vang chicken was 108.1-121.6 in the period 1-12 months of laying.

Egg weight

Table 5. Egg weight of Tau Vang chicken

Week of laying	Mean (g)	CV (%)
4	47.80	4.06
8	49.36	3.28
12	51.12	3.10
Average	49.43	3.50

Egg weight of the chickens has been improved by selection. It is higher by 3.9-14.0% compared to the results studied by Lam Minh Thuan (2003), Nguyen Van Bac et al (2005).

Fertility and hatchability

Table 6. Percentage of fertile eggs and hatchability

Week of laying	Egg number (e)	Fertility (%)	No of bird hatched	Hatchability on set eggs (%)
4	1467	82.68	957	65.20
8	2687	84.09	1881	70.00
12	1861	84.92	1340	72.00
<i>Average</i>	-	84.01	-	69.46
<i>Total</i>	6015	-	4178	-

Fertility of eggs was relatively low due to rearing habits of the farmers as they usually used a low rate of males in the female flocks (1 male for 15 females). Hatchability was similar to other results studied before.

Conclusion and Suggestion

Conclusion

Tau Vang native chickens reared for conservation in Long An province had relatively homogeneous appearance and improved growth and some other productive traits. Most chickens had unique straw-yellow feather, yellow skin and single crest. Body weight at 8 weeks of age of males and females were 1056.17 g and 885.50 g respectively. Body weight at 20 weeks of age of males and females was 2453.67 and 1828.96 g respectively. Average laying rate and egg number of 40-week laying cycle was 37.72% and 105.62 respectively. Feed conversion for 10 eggs was 2.82. Egg weight, fertility and hatchability of high-grade day old chickens was 49.43 g, 84.01% and 69.46% respectively.

Suggestion

Results of the study suggested that it was necessary for further selection to improve productivity and quality of Tau Vang chickens as well as extension of rearing area of this breed to meet the demands of human consumption.

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INDIGENOUS PIG BREEDS ALONG TRUONG SON MOUNTAIN CHAIN, VIETNAM

TRUONG TAN KHANH¹, TRAN VAN DO²

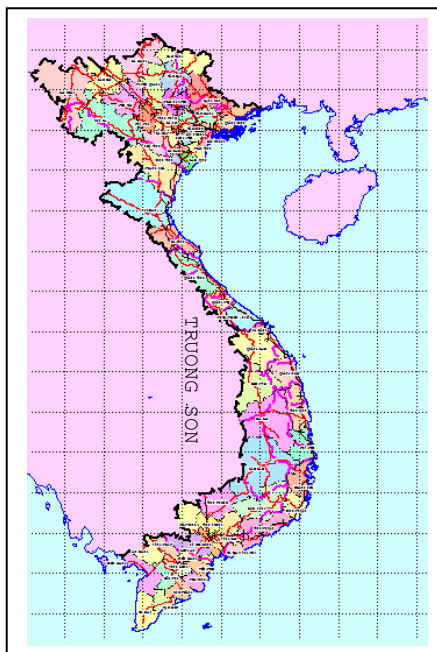
¹Tay Nguyen University, Vietnam; ²Quang Tri College, Vietnam

Summary

Truong Son is a longest mountain chain in Vietnam, more than 1,100 km, along the boundary of Lao DRP and Vietnam, where many indigenous ethnic minorities of Lao and Vietnam are residing: Lao, Van Kieu, Ba na, Ta oi, Co tu, Gia Rai, E De, M'Nong, Xo Dang, Co Ho. *Van Pa* and *Lon Soc breeds* as representatives in two areas: the North and the South of Truong Son Mountain. For a long time, local pig production becomes an important livelihood activity of indigenous people in both supplying protein source for people and cash income. However, the breeds have poor productivity so they are on step by step eliminating from the production systems and becoming the rare breeds and high risk of lost. In over ten years, the "Vietnam Livestock Genetic Resources Conservation" project cooperation with Tay Nguyen University and Quang Tri College have researched and tried to conservation the rare genetic resources. The characteristics, population and trend of the breeds were measured and described. The project was carried some important activities to conservation the breeds in their environment and production systems.

Introduction

Truong Son is a longest mountain chain in Vietnam, more than 1,100 km, along the boundary of Lao DRP and Vietnam, where many indigenous ethnic minorities of Lao and Vietnam are residing: Lao, Van Kieu, Ba na, Ta oi, Co tu, Gia Rai, E De, M'Nong, Xo Dang, Co Ho... and the immigrated people from low land (Kinh group). Truong Son is also the places with highest of biologic diversity in Indochinese region. The indigenous pigs are the original breeds that domesticated and developed during the process of economic and social development of indigenous ethnic minorities in the areas. It is said to be descended from the wild pig that resident in the Truong Son Mountain. The breeds' information was surveyed and collected from 1990s by the animal genetic resource conservation program that conducted by National Animal Husbandry Institute and its collaborators in Tay Nguyen University and Quang Tri technical college. Two breeds identified are *Van Pa* and *Lon Soc breeds* as representatives in two areas: the North and the South of Truong Son Mountain. For a long time, local pig production becomes an important livelihood activity of indigenous people in both supplying protein source for people and cash income. However, the breeds have poor productivity so they are on step by step eliminating from the production systems and becoming the rare breeds and high risk of lost. The studies to document characteristics and to conserve of the breeds are needed to keep agro-biology diversity in the areas. From 1995, the researcher groups from Tay Nguyen University and Quang Tri College conducted studies and activities to protect the breeds.



Content and Methodology

Content

The main contents of the paper is summary of the results from different researches on conservation indigenous Soc pig breed that were support by the program of conservation rare animal genetic sources:

- Describe of pig breeds are existing along the Truong Son mountain chain, Vietnam;

- Population and trend Va Pa and Lon Soc breeds;
- Production performance of the breeds;
- Activities for protecting the breeds

Methodology

The data and information in this paper base on colleting and summary results of researches during period research and from the surveys that are conducted in last two years.

Results of studies

Pig breeds existence along Truong son Mountain Chain

Two pigs breeds along the Truong Son Mountain Chain (TSMC) were described in this paper are Van Pa and Lon Soc breeds. The breeds were domesticated and developed by the ethnic minority people groups living along the TSMC and they are known as the original and pure breeds that still have been not effected by any technologies for improving.

Van Pa breed:

Vân Pa was named by Mr. Trần Văn Do and it was accepted and became official name in 2004 in Vietnam Animal Atlas in 2004. The breed was divided in two lines: black pig and grayish pig. Van Pa were formulated and developed by Van Kieu and Pa Ko ethnic minority people groups in Quang Tri province.

- Black pig: with black hairs cover all over the body, big head, pointed mouth, small ears short body and mature weight about 30 to 35 kg.

- Grayish pig: the color of pig is change during their growing up time, when pigs are young, the hairs are in strips along the body, with yellowish and black but, the strips will disappearance and hairs become uniform with grayish color (ask color) when the pig grow up. Van Pa pig has small head, pointed mouth, small ears, small front and mature weight is about 40 kg



Picture 1. Van Pa breed in Quang Tri - Vietnam

Lon Soc:

Lon Soc is the local breed that domesticated by indigenous ethnic minorities resident in Central Highlands of Vietnam. Lon Soc is name by Dr. Truong Tan Khanh in 1992 and it accepted and official registered in Vietnam animal Atlas in 2004. The appearance of the pig is very near with wild big from TSMC with black hairs all over of body or black and has some white places on the toenail. Similar with Van Pa, Lon Soc also has a small number of populations with yellow-black hair strips along the body and it will be disappeared when the pig grow up. Lon Soc has small size of mature body (30 – 40 kg), thick skin, pointed mouth, long hear, long and hard mane hairs on the neck and back. Pig has small and firm legs and move by nails. Lon Soc is quickly moving and good skills on looking for feeds from natural condition and little depending on feed supplying from the people.



Picture 2: Lon Soc breed in Central Highlands of Vietnam

Traditional management of Pigs

Traditionally, farmers let their pigs wandering for searching the feeds in natural condition. The local pigs can be looking for feeds quite far from the houses and villages. Feed supplied from natural condition depending on area of “grazing land” and feed available. The natural feeds including vegetation roots and animal in thin layer of under ground surface and vegetable, grasses on grazing lands. Feed intake of pigs from natural is very important for their demand. A survey in 2007 showed that, on average, farmers only supply only 1 kg of rice bran or other low protein concentrate (cassava, maize...) and some kg of vegetable for 1 mature sow 45 kg. This supply is very low compare to nutrition demand of the pig but pigs are still good in growth and reproduction.

Breeds' population and trend

Van Pa

Before, Van Pa pigs distributed in all the mountain districts in Quang Tri province but it is reduced quickly in recently years. Now the pigs are only existing in some commune (A Bung, A Vao, Hường Hiệp, Hường Sơn, Húc Nghi) in Huong Hoa and Dakrong districts. The number of Van Pa pig is estimated about 500 heads in farmers' production and about 100 heads in conservation farm at Quang Tri College.

Lon Soc

The population of Lon Soc is much higher than Van Ba; it is estimate about 5000 heads are keeping in small households and in some large farm. Before Lon Soc distributed in almost all ethnic minority villages and families in the Central Highlands, but it is very few villages/families are raising Lon Soc now. A survey in 2007 at Ea Kar district, Daklak province showed that the number of villages keeping Lon Soc reduced quickly in last decades. In 1995, the pigs were kept in all 31 village in district and more than 80% farmer kept pigs but in 2007 only 5 villages still keeping local pigs and only 20% of farmer in the villages keeping local pigs (table 1).

The reasons for reducing of pig population were explained by farmers and authorities in the district:

- Wandered management of pigs is not allowed in the new settle villages in recently year, because it is making pollution and danger for people health, while the pigs have low growing rate, farmers can be lost money if they keep pigs in pen and supply concentrate feeds.

- The high hybrid and exotic breeds have been introduced for ethnic minority people by extension and they have started high adopted by farmers.

Growth performance

The experiments on Lon Soc and Van Pa pigs showed the weight gain of the breeds is very low, on average the grow performance in household condition is about 95.07g/day. It is a little higher when raising the pig in pen and supplying concentrate feed with CP 12% (Feed standard for domestic pig) (121.96 g/day) but feed conversion is very high: 4.61 kg/1kg body weight gain (table 2). This result showed that when keeping the pigs in pen, farmers may be lost because of low growing. A research to identify appropriate process for raising Lon Soc and Van Pa efficiently is needed to conservation the breeds in the production and contributing to improve livelihood of ethnic minorities in mountain areas along the Truong Son.

Meat production and Market

Both Van Pa and Lon Soc pork are known as the “special food” for consumers. The lean meat rate of pigs is quite high. The lean meat rate in Lon Soc 12 months is 43.79% in wandering management, but it is much lower when confining keeping is 34.38% (table 3). In recently years, the food processing from the piglets is high adopted by high level consumers in many bigger markets: Ho Chi Minh, Da Lat... cities. This is an opportunity for improving pig production through market oriented production. A research on evaluating market opportunities and constraints for producing MINI pigs are needed to develop Lon Soc and Van Pa production more efficiency. By this ways, the breeds will be developed in production systems and reduced the risk of lost. In recently years, there are some Lon Soc enterprises in Central Highlands established and starting trading them as the “special food” benefitly.



Reproduction performance of Van Pa and Lon Soc

There are not very different between two breeds in reproduction performance. On average, the first breeding age: 7 month (rang from 6–9 months), number of litter: 1.5 litter per year, number of piglets per litter: 6–7 (range from 2–12). Inbreeding is a main problem of pig production in household system. In all villages of survey, there are no farmers raising boar for breeding. The breeding is often happening between mother and son or brother and sister. This is one of important factor led the breeds to reduce production performance of breeds.



Activities on genetic resources conservation

The activities are implemented by research groups from Tay Nguyen University and Quang Tri technical college under the support from project “Vietnam Livestock Genetic Resources Conservation” that coordinated by National Animal Husbandry Institute. Every year, we support the farmers groups (at Tay Nguyen University) or study farm (at Quang Tri College) to selected standard Sows and Boar, raise them and distribute piglets for farmers’ production. The groups also conduct the survey yearly to know any change of the breeds and suggest solution for protection to the project.

Recommendation

Lon Soc and Van Pa are breeds representative of local pig breeds existence along the TSMC. The breeds are known as the rare breeds and on high risk of lost. The actions for conservation them are imperative. From the results of researches, we have some suggestions:

- Continue activities for *in-situ* protecting of these pig breeds at Quang Tri and Central Highlands
- Identify ways to use and develop the pigs in agriculture production, this researches needed are not only on protecting the genetic resources but also developing the breeds in production systems. This achievement will impact to biodiversity of agriculture systems in the areas and contribute to improve livelihood of ethnic minorities of mountain people in areas.
- Need to conduct deeper researches on phenotype and genotype of these breeds to have detail planning on selecting and improving breeds’ production.

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Annex 1. Tables use in the paper

Table 1. Reduction of villages and farmers raising Lon Soc in Ea Kar district, Daklak province

	1995	2007
Total villages	31	31
Number of Villages keep Lon Soc (Village)	31	5
Rate of HH keeping Lon Soc in M' OA village (%)	100	20
Rate of HH keeping Lon Soc in Ea Pal village	100	6
Pig management (%)	Let wander	Let wander

Table 2. Body weight gain of Lon Soc Breed

Age (month)	Wandering		Confining		
	Body weight (kg)	Body weight gain (g/day)	Body weight (kg)	Body weight gain (g/day)	Feed conversion
2	3.38		4.15		
6	17.45	117.25	19.42	127.25	3.65
12	30.57	72.89	40.42	116.67	5.56
24	50.58	-	-	-	
Average		95.07		121.96	4.61

Table 3. Meet quality of Lon Soc meet

Item	Unit	Confine keeping	Wandering
No of pig slaughtered	head	3	3
Body weight	kg	40.55	35.33
Carcass rate	%	77.74	75.00
Lean meat rate	%	34.38	43.79

Table 4. Reproduction performance

Item	Van Pa*	Lon Soc**
Age of first breeding (month)	7.7	7
Age of first calving (month)	11.5	10.5
Body weight of first calving (kg)	20	22
No of litter/year (litter)	1.5	1.48
No of piglet/litter (head)	7	5.8
Body weight at newborn (kg)	0.35	0,35

Sources

*Data from Vietnamese Animal Atlas

**A survey in 2007

CHARACTERIZATION OF THE ITALIAN SHEEP BREED CORNELLA BIANCA

D. BIGI^{1,2*}, A. ZANON², G. PERROTTA³, M. BLASI³

¹DIPROVAL, Sezione di Allevamenti Zootecnici, Faculty of Agriculture, University of Bologna, Via F.lli Rosselli 107, 42100 Reggio Emilia, Italy.

²RARE – Razze Autoctone a Rischio di Estinzione, Italy.

³Laboratorio Genetica e Servizi, Cremona-Potenza, Italy.

Corresponding author: daniele.bigi@unibo.it

Abstract

The Cornella Bianca (CO) is a native Italian ovine breed, belonging to the Apennines breed cluster. The most recent information about the state of this sheep population is from 1983, when about 2000-2500 animals were detected, mostly reared in the provinces of Bologna and Modena. A study, including population census, morphological, productive and genetic characterization of CO, has been recently carried out with the aim to characterize and preserve this autochthonous breed.

A total number of 750 animals, distributed in 16 different stocks, were detected, located in the provinces of Modena, Reggio Emilia, Bologna, Ferrara and Rovigo. Transhumance is already utilized by some shepherds. The presence of animals of another breed, Massese (MA), reared in the same herds with CO was very often identified. This last breed, specialized for milk production, has probably been utilized in the last decades to improve the milk productivity of CO. The study revealed that milk is the main production for CO, utilized for cheese-making. Linear measures of 49 animals were collected and these data show that the current CO population meets the breed standard.

The evaluation of the genetic structure of CO was investigated using 15 microsatellites. The analyses were carried out on 31 CO individuals. A comparison with three other breeds belonging to the Apennines cluster, reared in neighbouring territories (35 Massese- MA, 29 Garfagnina Bianca-GA and 31 Zerasca- ZE) was studied. Observed and expected heterozygosity, mean number of alleles, F statistics, and Nei's genetic standard distance (Ds) were calculated. The neighbour-joining tree topology was also obtained.

A total of 140 alleles (from 7 to 16 alleles per microsatellite) were detected. Average heterozygosity was 0.693 in CO and ranged from 0.676 to 0.738 in the other three breeds. Gene differentiation coefficient (Fst) had an average value of 0.0561. Standard Nei's genetic distance values ranged from 0.132, between CO and MA, to 0.271 between GA and ZE. In the Phylogenetic tree CO and MA form a separate cluster. These data confirm the introduction of MA rams in CO population.

This study shows a strong decrease in the number of Cornella Bianca population in the last 25 years. Pursuing the use of other breeds for crossing could be very dangerous for the survival of this rare breed.

Keywords: sheep, genetic diversity, microsatellites,

Introduction

The genetic diversity within a farm species is the resource to realize required changes in phenotypic characteristics of a population, such as production traits and fitness traits (adaptation, conformation, fertility, and disease resistance). Moreover the increased market demand of specialized food from animal origin has led to a diversification of animal production system and of animal products, that require a large variability in the genetic variation of the species used. Besides conservation of genetic variation it is necessary as an insurance against the possible changes in production circumstances or the threats of new diseases (Oldenbrock, 2007).

In Italy, about 60 local sheep breeds are still present at the moment but, as in the rest of Europe, the number of sheep has declined in recent years. The lower economic value of sheep wool together with the abandonment of traditional ovine breeding methods, like transhumance, are the most important causes of this negative trend. Studies aimed at the characterization of these ovine breeds can be useful to establish efficient conservation programs of these unique genetic resources.

The Cornella Bianca is an autochthon Italian sheep breed belonging to the Apennines breed cluster. Its traditional breeding areas are the provinces of Reggio Emilia, Modena, Bologna and Ferrara, in the Northern part of Italy. In the past centuries the traditional sheep breeding system in this territory was the transhumance: flocks passed the hotter weather period, from the end of the spring to the

beginning of the autumn on the Apennine mountains and migrate to the plains of Emilia and Tuscany where they remained the rest of the year. The most recent information about the state of this sheep population is from the eighties, when about 2000-2500 animals were detected together with a large number of crosses, mostly reared in the provinces of Bologna and Modena (CNR, 1983). In the past genetic exchanges between Cornella Bianca and other sheep breeds reared in the neighbouring geographical areas of Tuscany, like Garfagnina Bianca, Massese and Zerasca, occurred, by the occasional introduction of rams of other breeds in to a flock.

In the last decades much research has been focused on determination of genetic diversity and the uniqueness of breeds in order to decide on genetic conservation priorities. Many of the measures are based on population genetic theory and use molecular data. Such measures reveal genetic diversity and support conservation decisions aiming to maintain the genetic flexibility and potential of changes (Herwin and Bennewitz, 2007).

The use of microsatellites has become a standard method to estimate neutral genetic diversity in livestock. In recent years several microsatellite studies on diversity in European sheep have been published, mainly focusing on particular European countries, such as Spain (Arranz et al. 1998, 2001; Diez-Tasco'n et al. 2000; Rendo et al. 2004; Alvarez et al. 2004), Switzerland (Stahlberger-Saitbekova et al. 2001), Italy (Pariset et al. 2003) and Finland (Tapio et al. 2003), or on regional sheep diversity, e.g. of northern Europe (Tapio et al. 2005b) or the Baltic states (Tapio et al. 2005a). A study considering a large number of breeds from Europe but also from the Middle-East was carried out by Peter et al. (2007).

We report here a study of the variation at 15 microsatellite loci in Cornella Bianca and in other three indigenous related Italian ovine breeds (Garfagnina Bianca, Massese and Zerasca).

The research included also a census of the Cornella Bianca population and preliminary morphological and productive characterization of this rare ovine breed.

Material and methods

Morphological characterization

Morphological evaluation of the detected animals was carried out by an expert of the National Association of Sheep-breeding (Asso.Na.Pa.)

Body measurements were obtained by the use of measuring tape calibrated in centimeters (cm) after restraining and holding the animals in an unforced position.

Microsatellite analysis

Hair roots were obtained from 124 unrelated individuals corresponding to four Italian sheep breeds included in the Apennine sheep group. Samples, breeds and, in brackets, number of individuals and number of herds sampled were as follows: Cornella Bianca (31; 5) Garfagnina Bianca (29; 4), Masese (35; 6), Zerasca (31; 5). At least one reproductive male was sampled in the same herd.

DNA extraction from hair roots, using proteinase K digestion, was performed for all samples.

The evaluation of the genetic structure of the four breeds was investigated using 15 microsatellites (FCB11, HSC, OARCP49, MAF214, OARAE129, FCB304, FCB20, MAF65, MCM527, CSR247, SPS113, INRA005, DS52, INRA23, INRA063); these markers are recommended for parentage testing by the International Society of Animal Genetics. Gel electrophoresis and genotype determination were performed on ABI Prism 3100 DNA Sequencer, equipped with Genscan and Genotyper software.

Estimation of allele frequencies was made using GENEPOP package, version 3.4 (Raymond and Rousset, 1995). Observed (HO) and expected (HE) heterozygosity, mean number of alleles (MNA), F statistics (FIS and FST) (Weir and Cockerham, 1984), Nei's genetic standard distance (Ds) (Nei, 1972), using all markers, were calculated with GENETIX software, version 4.03 (Belkhir et al., 2001). The neighbour-joining tree topology was obtained with PHYLIP package, version 3.65 (Felsenstein, 1989). For the validation of the tree topology, 1000 bootstraps resamples were performed.

Results and discussion

A total number of about 630 sheep were detected in the original area. The animals were subdivided in 11 herds: 4 flocks were detected in the province of Reggio Emilia, 4 in the province of Modena, 2 in the province of Ferrara and only 1 in the territory of Bologna.

Some Massese rams and a consistent number of crossbred have been found in the herds of Cornella Bianca. In the last few decades the breed has been crossbred with the Massese breed to improve milk productivity. The Massese breed is one of the most important Italian sheep breeds,

producing about 200–300 kg of milk per lactation. The breed originated in the north-west of Tuscany from where it spread to central and northern Italy.

Morphological characterization

The official morphological standard of Cornella Bianca sheep is quite concise. Here we report a more accurate description of the this ovine breed: Type: medium-heavy sized. Weight: 65-70 kg, female 80-85 kg male. Fleece: There should be a medium amount of wool. White fleece, rarely spots accepted on the head. Wool is dual coated: a fine undercoat; long coarse and wavy outercoat. Skin is pinkish. Head: rather heavy. Profile moderately convex. Narrow and horizontal ears. Horns in both sex. Neck: of medium length, the junction between head and neck is harmonious, the neck is deep in the base and well inserted between the shoulders, rising up from the withers. Withers moderately raised. Chest well developed, long and deep with oblique and slumped ribs in proximity of the spinal column. Shoulders: moderately brawny. Back: well defined and tending towards the horizontal making a smooth union between the withers and loins. Loins: short, wide, muscular, slightly convex, well connected with the back and croup with which they form a continuous harmonious line. Rump: osseous and oblique. Tail: emerges from the same line as the rump and it is inserted down. Long and subtle. Udder and teats: good shaped. Legs: well defined and proportioned without being too open, of medium length. Hooves are rounded, with a strong horn of hoof.

In Figure 1 a picture of two adult animals, a ram and a ewe, of Cornella Bianca breeds are reported. The morphological traits of the observed animals meet the standards of the breed. In addition in Table 1 the body measures of a group of 49 ewes are shown.

Figure 1: Picture of two adult animal, a ram on the right and a ewe on the left, of Cornella Bianca



Productive traits

The traditional breeding system based on the transhumance concerns at the present 30% of the animals: during the winter months the herds graze in the plane, in the summer they move to the mountains. Currently the majority of the herds lives in the Pianura Padana plain and the animals stay on pastures and fields close to the stables during the whole year. Cornella Bianca are nowadays used for milk and mutton production. In former times, animals were also used for wool production. Milk is utilized for the production of a traditional cheese called “Pecorino”. Lambs are sold at 12 to 15 kg.

Table 1 – Body measurements of Cornella Bianca sheep (ewes)

	N	Mean	±SD	Maximum	Minimum
Height at withers (cm)	49	75,08	7,35	58	90
Height rump (cm)	49	78,47	7,53	60	94
Length back (cm)	49	74,43	7,47	56	89
Width rump (cm)	49	23,90	0,90	22	26
Heart girth (cm)	49	91,24	4,12	81	101
Cannon circumference (cm)	49	9,73	0,76	8	12

Width forehead (cm)	49	10,45	0,84	9	12
Length head (cm)	49	24,08	1,22	22	28
Length ears (cm)	49	12,24	1,09	10	15
Width ears (cm)	49	6,53	0,74	5	8
Lengthchest (cm)	49	40,06	2,28	35	47

Genetic characterization

All the microsatellites were polymorphic in the four breeds. A total of 140 alleles (from 7 to 16 alleles per microsatellite) were detected.

Observed and expected heterozygosity and the mean number of alleles are reported in Table 1. Observed heterozygosity was 0.694 in CO and ranged from 0.678 (MAP) to 0.738 (HD). The MNA per sheep population varied between 7.53 (ZE) and 9.27 (MA). The relatively high level of heterozygosity and the high MNA found in CO, in spite of the small size of this ovine population, are comparable to those found in non endangered breeds, like MA and are probably due to the recent history of CO characterized by the introduction of rams of other breeds during the last decades.

Some loci (6 out of 60 locus/breed comparisons) exhibited significant deviations ($P < 0.01$) from Hardy-Weinberg equilibrium. Although it is difficult to understand the exact basis of this departure, however, the presence of low frequency null alleles segregating at these loci may be the possible reason, as described by Peter et al. (2005).

The mean value for F_{ST} is 0.061 and for F_{IS} is 0.072. The F_{ST} value obtained indicates that about 6.1% of the total genetic variation is explained by differences between breeds, with the remaining 93.9% corresponding to differences among individuals. Genetic differentiation among breeds was highly significant ($P < 0.01$) for all loci.

Table 1- Sample size (N), observed (HO) and expected (HE) heterozygosity ($\pm$ standard error), mean number of allele (MNA), calculated for each breed.

Population		N	HO	HE	MNA
Cornella Bianca	CO	31	0.693 $\pm$ 0.153	0.759 $\pm$ 0.107	8,80
Garfagnina Bianca	GA	29	0.685 $\pm$ 0.136	0.714 $\pm$ 0.101	7.87
Massese	MA	35	0.678 $\pm$ 0.133	0.758 $\pm$ 0.079	9.27
Zerasca	ZE	31	0.738 $\pm$ 0.136	0.719 $\pm$ 0.108	7.53

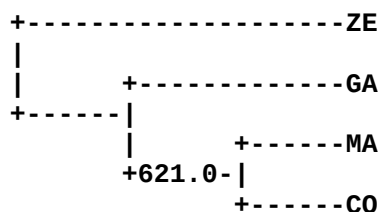
Table 2 shows Nei's standard genetic distances (Ds) among the 4 Italian sheep populations. The smallest genetic distance observed was between CO and MA; this observation is in agreement with the recent introduction of Massese rams in the Cornella Bianca herds. This practice has been useful to avoid excessive inbreeding but could be prejudicial to the conservation of genetic uniformity and identity of this small endangered Italian sheep native population.

Table 2- Nei's standard genetic distances (Ds) among 4 Italian sheep populations

	CO	GA	MA
GA	0.243		
MA	0.132	0.201	
ZE	0.263	0.271	0.237

The phylogenetic tree shows the relationship among the four sheep populations (Figure 2). The four breeds are grouped in two clusters (supported by a bootstrap value of 62.1%): one includes CO and MA breeds, the other includes the remaining two breeds. This evidence is in agreement with the utilization of Massese breed for crossing.

Figure 1 - Neighbour-joining tree of the analysed breeds obtained using Ds.



Conclusions

This study shows a strong decrease in the number of Cornella Bianca population in the last 25 years. The Morphological characterization and body measurements show that the current Cornella Bianca population meet the breed standard. The use of other breeds for crossing, in particular Massese sheep, confirmed by the genetic characterization, has been quite common in the last few decades. Pursuing the use of other breeds for crossing could be very dangerous for the survival of this rare breed.

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APPLICATION OF UP TO DATE METHODS IN THE BREEDING OF NATIVE PIGS WITH SPECIAL REGARD TO HUNGARIAN MANGALICA PIG

J. RÁTKY^{1*}, I. EGERSEGI¹, P. SARLÓS¹, H. TORNER², F. SCHNEIDER²
L. SOLTÍ³, P. TÓTH⁴, N. MANABE⁵ AND K. P. BRÜSSOW²

¹Research Unit of Reproductive Biology, Institute for Animal Breeding and Nutrition, Hungary, 2053 Herceghalom, Gesztenyés u. 1.

²Research Unit of Reproductive Biology, Institute for the Biology of Farm Animals, Germany, 19186 Dummerstorf, Wilhelm Stahl Allee 2,

³Department of Obstetric and Reproduction, Faculty of Veterinary Science, Szent István University, Hungary, 2100 Gödöllő, Páter K. u. 1.

⁴Olmos and Tóth Ltd., Hungary, 4025 Debrecen, Hatvan u. 6.

⁵Graduate School of Agricultural and Life Sciences, The University of Tokyo, Japan, 3145 Ago, Ibaraki-Kasama, 319-0206

*Corresponding author: jozsef.ratky@atk.hu

Abstract

Pig breeding in some European countries started to be more colorful than it was in the last 30 to 40 years. While big, multinational enterprises are dominating the industrial crossbred Landrace pig production, smaller (and sometimes large) companies and independent breeders try to compete by breeding special races or slaughtering the pigs with overweight, suitable for high quality meat products. Among the mentioned races we can identify the Spanish Iberian, the Italian Cinta Senese, the French Basque, the Portuguese Alentejano, the Croatian Black Slavonian and also the Hungarian Mangalica. In the last two decades, these breeds attracted the attention of the market as well as the attention of physiologists, e.g. reproductive biologists, experts in molecular genetics, nutritionists. The authors review the history of the Mangalica breed, the breeding methods, nutrition and especially reproductive management used in this race in the past, present and future. It is a story about a previously highly endangered pig race, which reached the fourth highest sow population with herd book (~9.000 heads) bred in Hungary during one and a half decade after it's a new exploitation by the breeders, researchers and consumers.

Keywords: native pig, Mangalica, breeding, nutrition, reproduction

Introduction

Industrial pig production system caused an accelerated decreasing in local pig population worldwide, and especially in Europe, after the middle of the last century. According to FAO nowadays the remained races in Europe constitute almost 30% of the whole pig genetic resources with nearly 165 pig breeds. Several breeds are still in danger of extinction, but fortunately lots of them have been re-discovered in the 1980-90ies by breeders, meat industry, consumers and researchers again. Perhaps the most known of them is the Iberian breed group, which is identified by classical, traditional high quality cured products (ham, loin, shoulder) (Lopez-Bote, 1998). Comparable opportunities are reported as a solution for conserving the genetic materials of many other local breeds from Italy, France, Croatia and Hungary too (Alfonso, 2004; Franci et al., 2005; Tóth, 2005; Butko et al. 2007). These pigs have some joint characteristics, which are not owned by the commercial races. They are all well adapted to a special climate, suited for outdoor-keeping and pasture and their special quality meat is proper for producing long time cured meat products for a niche market. For the exploitation of this potential it is essential to get more profound knowledge about the genetic, digestive and reproductive physiology of these breeds to develop and to use modern breeding methods and technology without decreasing the original characteristics of them.

The aim of this study was to summarize up to date basic and applied research results on Mangalica breeding, nutrition and reproductive management.

History of the breed

It is presumed that the Hungarian Mangalica was formed crossing Alföldi, Szalonta and Bakony breeds with the Serbian Sumadia pig, which was bred in the Valley of Morava and arrived at first in

Hungary in 1833 (Enesei Dorner and Kovácsy, 1926). The evolved new race was larger, heavier and fattened better than its extinct progenitors. The earliest describes of Mangalica had mentioned two types, namely the White and Black Mangalica (Czilert, 1859). Later five colour types were portrayed: Blond or White, Black, Swallow-Belly and Brown (Baris) one, like wild boar, and at least the Red Mangalica (Kovácsy and Monostory, 1890). Nowadays there exist only three breeds of Mangalica - Blond, Swallow-Belly and Red, which was verified by genetic analysis (Zsolnai et al., 2006).

In the past, two housing methods were conventional. In estates pigs were kept in large bunches grouped by age and sex, and supervised by herdsman. Small farmers kept their pigs in night time at home in special cages and in the day time all pigs of the village were grazed on communal pastures (Enesei Dorner and Kovácsy, 1926; Rácz, 1932). The fattening stock was kept in the forest and on the pasture till one year of age followed by subsequent 6 months fattening period. Animals were slaughtered at the weight of 150-200 kg. The growing request of the market along with the improved maize production resulted in building of industrial size fattening yards. In the 1880-1890ies 15-20,000 pigs were fattened all at once in such a yard. The Hungarian lard and salami were wanted products on the market (Enesei Dorner and Kovácsy, 1926). In the 1920ies the breeders were requested to establish an organisation, which represent their interest. So the National Association of Mangalica Breeders (NAMB) was founded in 1927, and breed's standards and the registration of breeding animals in herd book were established (Rácz, 1930, Blantz, 1938). The breeding stock increased till the 2nd World War, then decreased dramatically and the race nearly disappeared. Only 34 breeding sows were registered in the herd-book in 1975. The race was rescued from extinction by state intervention. It was enacted to breed Mangalica in gene-reserve (Baltay, 1983). After a long interruption, in 1994 the National Association of Mangalica Breeders resumed its activity and re-organised the registration of animals, the inspection and introduced a certification of origin for every Mangalica products on the market (Zengő, 1998).

Breeding and Nutrition

The Mangalica is one of the fattiest pigs in the World; generally 65-70% of the carcass is lard. The lean meat is only 30 - 35% compared to over 50% in modern breeds. However, its meat quality, taste and consistence are exceptional. During the 19th and at the beginning of the 20th century lard and bacon were the main food of the Hungarian people and the leading export products of Hungary. In the 1910ies till the 1st World War more than 500.000 porkers were exported yearly to Europe (Enesei Dorner and Kovácsy, 1926; Rácz, 1932). Beginning with the turn of the 20th century, diet and consumption habits have been changed. There was an increased demand to lean meat and the consumers preferred butter and vegetable oils instead of lard. It was a great challenge for breeders and researchers to work out appropriate programmes to develop a more prolific, faster growing and less fatty Mangalica. In 1927 the NAMB preferred selection methods for improvement of Mangalica (Blantz, 1938). In the 1950ies an intensive hybridisation of Mangalica started with different commercial breeds (Berkshire, Cornwall, Large and Middle White, Essex and Tamworth) by the Research Institute for Animal Breeding of Hungary. All crossbred animals had advantages compared to Mangalica in growing and feed conversion rate, and percent of lean meat (Horn et al., 1952a, b). The produced pork could meet well the requests of salami and sausage producers (Vincze, 1963). In spite of the initial success Mangalica was nearly disappeared. The beginning of 1990ies was a landmark in the history of the breed and several programmes and research projects have been commenced to preserve and exploit Mangalica. Nowadays, its traits like adaptive plasticity to extreme and extensive housing conditions, stress and disease resistance, motherliness and excellent meat quality (taste) are requested. For example, Mangalica are well fitted to care sensitive natural areas like dike meadows, bird preserves or chestnut-groves (Micklich and Matthes, 1999; HEA, 2006).

A large project was created under the name of "Real Mangalica" at the beginning of 1990ies (Tóth, 2005). The aim of the project was both to preserve the breed and to produce pork for high quality meat products. The animals are slaughtered at the weight of 140 – 160 kg in Hungary, whereas hams, shoulders and chops are transported to Spain to produce special cured meat products. In Hungary the rest parts of the carcasses are processed for smoked bacon, sausage and special Salami. Furthermore, there is an increase in direct sales of traditional homestead meat products from smallholders' farms and this agribusiness is mostly combined with rural tourism too. Nowadays both the Mangalica breeding stock and all porkers are kept under extensive or semi-intensive conditions on pasture or in large pens, and are fed mixture of maize, wheat, barley and green fodder. In the last decade several investigations were carried out to get more information about the carcass yields, meat quality and fatty acid profiles in Mangalica pigs. It was demonstrated that the carcass consists less than 40 % of lean meat, which is suited to produce high quality cured ham (Szabó, 2001). The fatty

acid composition and the cholesterol content of lard were determined in pure- and crossbred Mangalica compared to Hungarian Large White x Hungarian Landrace. The content of unsaturated fatty acids of lard was over 60 % in Mangalica and nearly 60% in Mangalica crossbred animals (Csapó et al., 1999; Szabó, 2001). Most of these fatty acids were oleic (43.6 - 44.8%) and linoleic acid (10.6 - 11.5%); the cholesterol concentration did not differ between breeds (Csapó et al., 1999). It was referred that 68.7% of the intra muscular fat content in m. longissimus dorsi was composed from unsaturated fatty acids, which was at least 6% more than in German Landrace and German Sattelschwein (Ender et al., 2002). It is proven that the quality of the meat and fat can be influenced at the end of the fattening phase modifying the feed components. Lugasi et al. (2006) found that Mangalica finishing pigs which were fed a diet containing a higher amount of linoleic and linolenic acid had a favourable and healthier fatty acid composition of the meat compared to commercial feed. The breed could be fit to produce so called functional food by manipulation of its diet.

It is very important to certify the origin of the Mangalica products. Since the reestablishment of the NAMB such document is given to the breeders by their registered animals. For the identification during the whole production and food processing chains, and until this product reaches the consumer some breeders provide more profound guarantee and give some additional information about their animals by permanent electronic identification (Tóth, 2008 personal communication). Besides the cured and smoked products, growing interests appears for fresh meat too, which is a new challenge in identification of meat from different breeds. Bazár et al. (2008) reported that using Near Infrared Spectroscopy (NIRS) it was possible to discriminate meat samples of Mangalica from others with high accuracy.

Reproductive characteristics and management

Generally in the past, Mangalica pigs were kept in herds in extensive conditions. The animals were fed throughout the year on pastures and in oak-beech forests. Pregnant sows were introduced only for farrowing. Breeding gilts were kept also in large groups on pasture and wasteland till the first mating (at 15 -18 months and 80-100 kg BW) (Enesei Dorner and Kovácsy, 1926; Rácz, 1932). Usually, the farrowing season was in spring and sows gave birth of 4-6 piglets. At the beginning of 1900ies for more intensive breeding, farrowing was proposed twice a year or in larger stocks three times in two years (Janish, 1908). Juhos (1912) advised to improve housing and nutrition conditions in case of intensive breeding. However, after the 1st World War the mean litter size decreased to 3.3 after farrowing twice a year but could be increased to 4-4.5 piglets by farrowing once a year. It was recommended to mark sows according to their fecundity (Kovácsy, 1918). Some good results were realized in few Mangalica breeding stocks selecting for prolificacy. The mean litter size increased from 5.5 to 6.4 piglets in a four-year interval (Téglássy, 1917), whereas 7- 8 piglets were attained with conscious selection for litter size and with improved nutrition (Kiss, 1926). In 1932 the mean litter size of 3,133 registered sows was 6.87 (Rácz, 1932). Five years later analyzing more than 7,000 sows the result of the conscious breeding was 1.3 piglets more per litter (6.3 vs. 5.0) and 20 % of the breeding sows farrowed on average 6.5 - 7.5 piglets (Blantz, 1938).

Under optimal rearing conditions the first mating of gilts could be performed at 11 month of age with a litter-size of 6.7 piglets (Gábos, 1935). It was stated that the number of piglets increased with parity until the third farrowing and slowly decreased thereafter (Rácz, 1932, Mentler, 1958). Analyzing herd book data, Csukás (1942) showed that the mean litter size was 6.7 and the "average" Mangalica sow was the most prolific at the age of 5.5 - 6 years. The larger number of offspring requires more milk for suckling the piglets. The milk yield of Mangalica sows varied between 119.3 - 190.6 kg during the 8 - 10 weeks lactation (Rácz, 1932). Horváth (1957) reported on 198 - 327 kg milk during 70 days-long period, which was sufficient to rear 8 - 9 piglets.

Several authors described that a contra selection could be the main reason of the low reproductive performance of Mangalica. The animals were selected for breeding according to its phenotype and maturity and it was enhanced with one-sided maize based nutrition (Kertész and Kovács, 1953; Tóth, 1962). The sows had the mean litter size 0.9 piglets larger after feeding higher portion and better quality diet (Kertész and Kovács, 1953).

The reason(s) of lower fecundity in Mangalica are still not elucidated and data on follicular and oocyte maturation, embryo development and reproductive hormone levels are limited. Bulatovici (1932) supposed that primarily the lower number of ovulation compared to other breeds (9.9 in Mangalica vs. 12.4 and 12.8 in Berkshire and Yorkshire sows) and a decreased number of mature oocytes could be the reason. This hypothesis was supported by results of our research team (Rátky and Brüssow, 1998; Egerszegi et al., 2001, Brüssow et al., 2004). In untreated Mangalica the number of ovarian features varied between 6.8 and 11.7 and was rather different to those of White breeds reported. On the other

hand, the Mangalica ovaries have the biological potential to grow a higher number of ovulating follicles. Using different doses of PMSG as an additional gonadotropic source to stimulate follicular growth, a mean number of ovulated follicles similar to White breeds was achieved (Rátky et al., 2001; Egerszegi et al., 2007).

In intensive breeding conditions Mangalica gilts attain puberty at the age of about 11 to 12 month (Gábos, 1935). This was confirmed in our experiments as the ovarian features of slaughtered gilts (at the age of 12 – 15 month) showed that 88 % of them were cycling ones (Brüssow et al., 2004). Besides lower ovulation rate the quality of ovulated oocytes could be a reason of lower fecundity in Mangalica. Differences were obtained concerning the morphology and maturation of cumulus-oocyte-complexes recovered from preovulatory follicles (Egerszegi et al. 2001). The per cent of oocytes with compact cumulus was higher in Mangalica compared to Landrace gilts (31 vs. 16 %) but less oocytes possess expanded cumulus (62 vs. 78 %). The chromatin configuration of oocytes was also distinct between Mangalica and Landrace gilts. The rate of oocytes with mature nuclear status (telophase I/metaphase II) was higher in Landrace sows (27 vs. 62 %). Interestingly, follicular steroid hormone milieu differed as well between Mangalica and Landrace gilts (Egerszegi et al., 2007). Nearly twofold higher oestradiol concentration (29.6 ± 6.8 vs. 16.9 ± 9.7 ng/ml) and a 5-fold higher progesterone level (2020.4 ± 1056.8 vs. 386.2 ± 113.7 ng/ml) was detected in Mangalica follicular fluid.

To answer the question if any differences in reproductive hormone secretion during the oestrous cycle are responsible for altered reproductive performance in Mangalica, we examined LH, oestradiol and progesterone concentrations in comparison to Landrace gilts (Egerszegi et al., 2003). Mangalica had demonstrated the same time course of reproductive hormone secretion as Landrace gilts. However, oestradiol peak maximum (46.5 ± 5.7 vs. 26.0 ± 6.8 pg/ml) and progesterone secretion during the luteal phase (12.9 ± 2.6 vs. 9.3 ± 2.2 ng/ml) were higher in Mangalica, although their number of corpora lutea was lower. This was confirmed in our recent study where blood samples were drawn from the *V. cava cranialis* providing a more precise evaluation of ovarian progesterone secretion. Higher progesterone concentrations despite lower number of CL and increased leptin secretion (11.3 ± 0.6 vs. 3.0 ± 0.1 , $P < 0.05$), and as a consequence altered LH secretion pattern in Mangalica could contribute to the lower fecundity of this breed (Brüssow et al., 2008, unpublished).

Since morphology data of the reproductive tract are missing, we analysed the reproductive organs of cycling and early pregnant Mangalica gilts (Brüssow et al., 2004). Mean oviduct length (23.6 ± 1.4 to 24.4 ± 1.4 cm) and weight (3.2 ± 0.2 to 4.2 ± 0.4 g), and uterine horn length (143 ± 9 cm) and weight (247 ± 12 to 372 ± 32 g) were always in the range of white breeds. In pregnant Mangalica the length of each uterine horn was significantly shorter (124 ± 5 vs. 188 ± 6 cm). Furthermore, the uterus did not grow in length during early pregnancy (days 1 to 24), whereas in pregnant Landrace gilts uterus increased continuously. Moreover, in our study uterine weight increased significantly later in Mangalica (day 12 to day 24) compared to Landrace (day 1 to day 12). Results of this study support the concept that in Mangalica besides diminished ovarian and oocyte development, uterine conditions, especially growth restricted uterine development, may influence the initial process of early pregnancy and can be another reason of lower fecundity.

Some of our results support the initial use of modern zootechnical methods in breeding of Mangalica. Nowadays, semen collection and artificial insemination is performed in few farms, and pregnancy is controlled by ultrasound investigation. Semen parameters of Mangalica boars were described at first by our group and further endocrine and testicular characteristics were reported (Sarlós et al, 2006; Rátky et al., 2008; Egerszegi et al., 2008a, b)

The testicular endocrine function was investigated with GnRH challenge treatment in 48 Mangalica boars. The effect of age, live weight, testis volume and basic testosterone level as independent factors was investigated on GnRH induced testosterone increase. The combination of these factors had a high effect on the level of testosterone increase (Sarlós et al., 2006). In another experiment moderate seasonal changes could be observed in volume and endocrine function of the testes of Mangalica boars (Rátky et al., 2008). The mean semen volume was 177.8 ± 18.92 ml with concentration of $490 \pm 160 \times 10^6$ spermatozoa/ml. Mean number of sperm cells per ejaculate was $894 \pm 308.1 \times 10^8$. High sperm motility was observed in all samples (75.52 ± 6.78 %). The volume of semen is less, whilst concentration and total number of sperm cells are much more in Mangalica ejaculate than in other commercial breeds (Egerszegi et al., 2008a).

Both the farrowing frequency of sows (from 1.55 to 1.77) and the mean number of total born and weaned piglets increased after using early pregnancy diagnosis by ultrasound. This method seems to be a useful tool in reproductive management of Mangalica and could be beneficial to increase reproductive efficiency of this breed (Egerszegi et al, 2008b).

Conclusion

Conservation and propagation of domestic animal diversity can be considered as a form of insurance since preserved stocks will possess potential economic, scientific and socio-cultural benefits. The Mangalica pig is a representative example for the success of preserving endangered breeds. Its population is continuously increasing in all breeds although the number of Swallow Belly Mangalica is still under the satisfying 1000 breeding females. The new demand for Mangalica products on the market, the valuable properties of the breed and the reminiscence to the tradition of Hungarian swine breeding will support to preserve the Mangalica as a diverse European pig breed.

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STATUS ON CRYO-CONSERVATION OF SOUTH AFRICAN INDIGENOUS ANIMAL GERMLASM

T.L. NEDAMBALE^{1*}, A. MAIWASHE¹, T.C. CHOKOE², M.L. MPHAPHATHI¹ AND M.B. RAITO¹

¹Agricultural Research Council: Animal Production, Germplasm and Reproduction Biotechnologies, Private Bagx2, Irene, 0062, South Africa

²Department of Agriculture, Private Bagx138, Pretoria, 0001, South Africa

*Corresponding author: lucky@arc.agric.za

Abstract

The aim of this review is to outline current cryopreservation efforts of South African indigenous livestock gametes, embryo, and somatic cell, including key areas of concern and strategies to achieve the greatest successes, as well as possible future directions for cryo-conservation methods. The cryopreservation of semen, oocytes, embryos, and somatic cells or tissues has the potential to repopulate live animals back in future. Recent cryopreservation technological advancement open important avenues for expanding the scope and assessing the potential value of conservation efforts for maintaining gene pool diversity of South African indigenous animals. Concurrently, the erosion of the gene pool of indigenous livestock breeds in South Africa is cause for concern as they represent a valuable contribution to the rich biodiversity of the land and have played a major role in the social, cultural and economic history of the country. It is therefore imperative to *cryo-conserve* the gene pool diversity as insurance for future needs, global genetic transport, gene banking, breeding line restoration, and for genetic rescue of rare species.

Keywords: *cryopreservation, gametes, embryos, indigenous, biodiversity.*

1. Introduction

Recent cryopreservation technological advancement open important avenues for expanding the scope and assessing the potential value of conservation efforts for maintaining gene pool diversity of South African domestic animals. Concurrently, the erosion of the gene pool of indigenous livestock breeds in South Africa is cause for concern as they represent a valuable contribution to the rich biodiversity of the land and have played a major role in the social, cultural and economic history of the country. In addition, they have the potential to supply well-adapted and alternative livestock breeds for the farmers of the future. However, these unique indigenous livestock breeds are threatened by the replacement of breeds with more productive or popular stocks, dilution of breeds through crossbreeding programs, and decreased diversity within highly selected breeds or lines that have a small number of breeding individuals. Recently it was predicted that the rate of extinction on indigenous animal's biodiversity was 2% before 1900, 16% from 1900-1999, 9% from 2000-2007 and year unknown will be 73% (FAO, 2007; Long, 2008). It is therefore imperative to *cryo-conserve* (*ex-situ in vitro* conservation) the gene pool diversity as insurance for future needs, global genetic transport, gene banking, breeding line restoration, and for genetic rescue of rare species.

South African livestock breeds such as the cattle (Nguni, Afrikaner and Bonsmara), sheep (Zulu, Pedi, Namaqua and Dorper), poultry (Venda, Potchefstroom Koekoek, Ovambo and Naked neck), pig (Kolbroek), goats (Boerbok goat, Pedi and etc) have a wide variety of gene pool diversity and they have evolved over generations to adapt to the local agro-climatic and socio-economic needs of the people. These indigenous livestock breeds are now subjected to fast genetic degradation and dilution because of unplanned breeding, crossbreeding and introduction of exotic germplasm (Scholtz, 2005). As a result, some indigenous breeds are getting threatened, while others are in the process of replacement by certain high producing strains. If this trend continues, the valuable South African indigenous germplasm would grossly be depleted or even lost forever. Thus cryopreservation of semen, embryos, oocytes, tissue and somatic cells for indigenous livestock breeds is essential due to their potentiality for production of meat or draught capability or high resistance to diseases and heat tolerance ability.

2. Conservation Strategies

There are five strategies that are currently applied to conserve indigenous animal genetic materials in South Africa. These are capacity building, measurement of genetic diversity, *in-situ*, *ex-situ in vivo*, and *ex-situ in vitro*. However, not much emphasis has been focused on *ex-situ in vitro* (cryo-conservation) until recently when National Department of Agriculture (NDA) and Agricultural Research Council (ARC) developed a cryo-gene bank programme for cryopreserving semen, oocytes, embryos, tissue and somatic cells of indigenous livestock breeds. Thus, the NDA, ARC and stake holders have joined together to strategize, plan, develop policies and actions undertaken to ensure that the diversity of indigenous animal genetic resources are being researched and maintained to contribute to food and agricultural production for future needs.

2.1. Capacity building (Human resources)

Capacity building in ARC-Irene GRB (Germplasm & Reproduction Biotechnologies) is defined as building of human resource capacity to sustainable use and cryo-conserve indigenous animal genetic resources in South Africa. The GRB is relatively a new programme that needs to address genetic diversity, cryopreservation and information system issues (database). Therefore, it will require additional staff resources. There is limited number of cryobiologist professional in South Africa. As a result, there is a need to increase awareness and develop training program for cryobiologist and livestock conservation professionals. There is also a need at the university level to train new cryobiologist professionals capable of working in this area.

2.1.2. Measurement of genetic diversity

Genetic diversity is defined as a genetic variation within a population or species. The GRB programme is also conducting research studies on determining the genetic diversity of South African indigenous livestock breeds in collaboration with its national and international partners.

2.1.3. In-situ conservation

In-situ is define as a conservation of livestock through continued use by livestock keepers in the production system in which the livestock evolved or are now normally found and bred.

2.1.4. Ex-situ in vivo conservation

Ex-situ in vivo is defined as a conservation of livestock through maintenance of live animal populations not kept under normal management conditions (e.g. private, governmental farms and zoological parks) or outside of the area in which they evolved or are now normally found.

2.1.5. Ex-situ in vitro conservation

Ex-situ in vitro is defined as a conservation of genetic materials in an artificial environment, under low temperature conditions including, cryopreservation of sperm, oocytes, embryos and somatic cells or tissues having the potential to reconstitute live animals (including animals for gene introgression and synthetic breeds) at a later date. Therefore, this paper will focus more on the viability and possibility on cryopreserving semen, oocytes, embryos and somatic cell of livestock breeds in South Africa.

2.1.5.1. Semen

Mammalian spermatozoa cryopreservation often works relatively well although some semen from other species such the boar and cock remains a challenging obstacle. Moreover, semen can easily be collected in certain livestock breeds or species and preserved through slow freezing protocols. Perhaps the ability of male or female gametes to be cryopreserved and still be viable for fertilization is also essential for rescuing endangered species or breeds (Dinnyes et al., 2007). Besides the current methods available for cryopreservation of spermatozoa by equilibrium freezing, recently, freeze drying has also been used to preserve mammalian spermatozoa, serving as an alternate method of cryopreservation (Wakayama and Yanagimachi 1998; Kusakabe et al., 2001). The freeze drying procedures for spermatozoa described earlier allow storage of the samples in sealed ampoules at 4°C or room temperature (Ward et al., 2003; Kaneko and Nakagata, 2005).

Currently, the ARC has a programme of collecting genetic materials and conducts research to find a suitable cryopreservation conditions for cryopreserving semen from South African indigenous Nguni & Afrikaner bulls, Zulu, Pedi and Namaqua rams, Venda, Ovambo, Naked neck & Potchefstroom Koekoek cocks. However, survival rate of indigenous pig and chicken semen following cryopreservation remains low. As a result, the application of frozen/thawed chicken or boar semen in a commercial artificial insemination program is limited. In addition, the development of short and long term semen storage of South African indigenous cock is necessary (Mphaphathi et al., 2008).

2.1.5.2. Oocytes.

The oocyte is one of the largest mammalian cell types and 80% of the volume of oocyte is water compared to only 50% of water in sperm. Since liquid water is considered essential to the structure and function of living cells, it is not surprising that oocytes are difficult to cryopreserve and extremely sensitive to chilling compared to their spermatozoa counterpart. Solidification of water by freezing is usually lethal (Özkavukcu, and Erdemli, 2002; Dinnyes et al., 2007). Furthermore, cryopreservation of oocytes is currently one of the greatest challenges facing female gamete cryobank and assisted reproductive technologies (Nedambale et al. 2006). The survival rate of cryopreserved and thawed oocytes in terms of development to the blastocyst stage remains low, and only few calves have been born (Vajta *et al.*, 1998). At present, research on cryopreservation oocytes of South African indigenous cattle (Raito *et al.*, 2008), sheep, and pigs are under development and there are MSc students conducting research on finding suitable cryopreservation protocol for preserving oocytes indefinitely.

2.1.5.3. Embryos

Embryo is defined as a fertilized ovum that has begun cell division, often called a pre-implantation embryo or whole genomes (diploid). The development of embryo freezing technologies in mouse revolutionized and advance cryobiology in domestic animal species such as cattle, sheep goats and pigs. Embryo collection and subsequent storage are now possible for many species. Embryos are the best choice if the purpose of the collection is to restore a desired genotype, although it may be expensive. Two methods are currently used for embryo cryopreservation: slow freezing and vitrification (Dobrinisky *et al.*, 2000). Cryopreservation of embryos enables the conservation of full genome genetic material. However, pig embryos are notorious known for their extreme sensitivity to cooling. Avian and fish embryos also have not yet been successfully cryopreserved because their embryos contain large amounts of vitellus (Blebois and Labbe, 2003). Collection and research program on cryopreservation of South African indigenous cattle, sheep, pigs and goat embryos have been recently developed at ARC-GRB.

2.1.5.4. Somatic cell

Somatic cells are cells that are non-sex cell. Examples of somatic cells are cells of internal organs, skin, bones, blood and tissues. In comparison, the somatic cells contain a full set of chromosomes (diploid) whereas the germline cells (reproductive cells or gametes) contain only half set of chromosomes (haploid) .e.g. sperm and ova. Somatic cells can be easily cryopreserved, and the procedure is cheap. It is widely used for research purposes because both thawing and DNA extraction follow simple protocols. Following the discovery of cloning by somatic cells nuclear transfer by Ian Wilmut in 1997, the technique of cloning whole organisms has been developed to other mammals, allowing identical genetic clones of an animal to be produced (Wilmut *et al.*, 1997; Kono, 1997; Tian *et al.*, 2003; Galli and Lazzari, 2008). However, somatic cells nuclear transfers still have obstacles and difficult challenges of low efficiency and high incidence of developmental abnormalities (Kato *et al.*, 1998).

In a retrospective, collection and cryobank of somatic cells of South African indigenous livestock breeds such Nguni, Afrikaner, Zulu, Pedi, Namaqua, Doppler, Venda, Ovambo, Potchefstroom koekoek and Bonsmara is hoping that one day the nuclear transfer or cloning techniques will be modified and suitable to repopulate the breed back.

Table 1. Current viability of cryopreserved genetic materials of domestic animals following thawing

Species	Current status of cryopreservation of livestock genetic materials			
	Sperm	Ova (oocyte)	Embryo	Somatic Cells
Cattle	+	±	+	+
Sheep	+	±	+	+
Pigs	±	±	±	+
Goats	+	±	+	+
Poultry	±	-	-	±

Good (+), poor (±) and not possible (-)

3. Challenges and prospects of cryoconservation

Maintaining genetic diversity of domestic animals will need all five conservation strategies to be implemented and would be a key in maintaining the most valuable genetic traits in animal populations that will provide the foundation for meeting the needs of future generations. Furthermore, isolating somatic cells from semen, and *in vitro* culture may be of value for preserving endangered species. Specifically, cells isolated and cultured from cryopreserved semen of nonliving males could be used for producing embryos by somatic cell nuclear transfer (Nel-Themaat *et al.*, 2008). However, oocyte does not survive cryopreservation process well primarily because the oocyte is larger than the sperm

cell and is comprised mostly of water and another challenging obstacle is the oocyte's cytoskeleton sensitivity to chilling. Cryopreservation of avian embryo is another daunting task. The surface-to-volume problem of the avian embryo poses an enormous barrier to the movement of solutes and cryoprotectants to effectively protect the cells from cryopreservation damages. Perhaps gonadal/tail-graft system might provide an advantage for cryopreservation because it is small. There is also problem of survival rate of sperm, oocyte and embryos due to species specific differences. Moreover, this can be overcome by conducting research specifically for indigenous animals and improve cryobiology techniques.

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HOW ABOUT THE LOCAL CHICKEN BREEDS IN EGYPT

M.A.Kosba

Department of poultry Production, Faculty of Agriculture, Alexandria University, Egypt

E-mail: mkosba@hotmail.com

Abstract

The present study aimed to evaluate some local chicken breeds in Egypt. The results indicated that the averages of fertility %, hatchability %, body weight at 4 and 8 weeks of age for males, females and combined sexes as well as age at sexual maturity, egg number and egg mass during the first 90 days of laying for these breeds were: 90.16%, 77.68%, 229.5 g, 202.9, 225.5 g, 602.9 g, 528.7 g, 582.5 g, 1628.2 g, 170.8 days, 45.5 eggs and 1459 g.

Key words: Local breeds, chicken, Egypt

Introduction

As early as 1950 many attempts were made to produce Egyptian local strains of chicks. All of them used a cross breeding between a native strain and foreign strain, followed by selection for different traits on some crosses. In 1958 cross mating was done between Fayoumi x B.R x R.I.R. x W.L. to produce the Alexandria strain (Kosba, 1966). In 1966 cross breeding was made between Fayoumi x B.R to give Doki- 4 strain (El- Itriby and Sayed 1966). In 1974 Daki- 4 x R.I.R. was crossed to produce Golden Montazah (Mahmoud, *et. al.*, 1974b). In the same year (1974) and from the same crosses selection was carried out to give Silver Montazah (Mahmoud, *et. al.*, 1974c). Doki – 4 x W.L. was crossed to produce Matrouh strain (Mahmoud, *et. al.*, 1974a). Dakki- 4 x B.R was cross mated to give Gammizah strain (Mahmoud, *et. al.*, 1982). In 1983 Abd- El- Gawad *et. al.*, (1979) made a crossing between Alex. x Dokki- 4 to give Mamourah strain. Also Mandarah strain was produced from a crossing between Alex X Dokki- 4 (Abd- El- Gawad *et. al.*, 1981). In 1982 crossing was done between Gamazah x Cornish to produce Bandara strain (Mahmoud, *et. al.*, 1982b). At 1983 (Abd- El- Gawad *et. al.*, (1983) made a crossing between Michols x Mamourah to produce El- Salam strain. Abdou and Kolstad, (1984) crossed Fayoumi x Baladi x W.L. to produce Norfa strain. Bahig strain was produced from a crossing between Alex. X Silver montazah (Mahmoud, *et. al.*, 1989).

The aim of this study was to evaluate some of the local new strains of Egyptian chickens for the reproductive and productive traits to produce a meat and egg layer strains.

Material and Methods

The present study was carried out in 2005 in the poultry production department, Faculty of Agriculture, Alexandria University.

Records were used to obtain the averages of some researchers on the Egyptian local strains of chickens on the following traits: Fertility and hatchability percentages, body weight at 4 and 8 weeks age for males, females and combined sexes, as well as at age at sexual maturity. Age at sexual Maturity, egg number and egg mass during the first 90 days of laying.

Result and Discussion

Table (2) shows the averages of 14 local strains for the 12 traits as well as the number of researchers, which gave these averages. From this table the best 3 strains in each trait were reported in Table 3.

From Table 3 represents the following:

A: To improve fertility and Hatchability percent in our local strains crossing will be done between the following strains:

Dan. , Mat. , G.M. , Mam. , Man., and Dokk_4

In all possible combinations to give a "strain No 1 with higher average on these two traits.

B: Also, to improve body weight at 21 days or other ages in our local strains crossing will be done between the following strains:

E.S, Mat. Bah and Man

In all possible combinations to give a strain No2 with higher body weights.

C: To improve the reproduction traits (Age at sexual maturity, egg number and egg mass during the first 90 days of laying) crossing will be done between the following strains.

Nov., G.M., Bah. S.M, Man. Alex and G.

In all possible combinations to give a strain No 3 with higher averages on egg production traits.

Now we have three new local strains each of them superior in definite traits. It is grandparents of a new local strain for meat and egg production on the commercial basis.

Selection must be continued for these traits on the grandparents for some years in the future. Crossing between strain (1) x strain (2) to give a meat strain and between strain (1) x strain (3) to give a layer strain.

Table (1): List of The abbreviation of strains

Population	Abbreviation
Alexandria	Alex.
Bahig	Bah.
Bandarah	Ban.
Dandarawy	Dan.
Dokki-4	D-4
El-Salam	E.S.
Fayoumi	Fay.
Gimmizah	G.
Golden Montazah	G.M.
Mandarrah	Man.
Matrouh	Mat.
Mamourah	Mam.
Norfa	Nor.
Silver Montazah	S.M.

Table (2): The averages of some reproductive and productive traits in the Egyptian local strains of chickens

Traits	Alex.		Bah.		Ban.		Dan.		D-4		E.S.		Fay.		
	N.*	X̄	N.	X̄	N.	X̄	N	X̄	N	X̄	N.	X̄	N.	X̄	
Fertility percentage (%)	10	88.17	-	-	2	89.65	3	93.87	2	91.5	4	88.1	12	89.7	
Hatchability percentage (%)	10	76.82	-	-	2	79.45	3	67.3	3	84.1	2	79.2	8	79.2	
Body weight at 4 weeks (g.)	M.	4	196.7	-	-	1	287.6	1	189.3	-	-	-	-	-	
	F.	4	179.7	-	-	1	263.6	1	165.5	-	-	-	-	-	
	Comb.	6	192.9	1	305	1	208.7	4	161	3	185.7	2	317.6	3	208
Body weight at 8 weeks (g.)	M.	8	515	1	593	-	-	-	-	1	765	2	834.7	1	306.7
	F.	8	439.7	1	536	-	-	-	-	1	662	2	738.6	1	267.4
	Comb.	4	451.8	1	800	2	531.2	5	423.4	4	472.3	1	904	4	494.5
Body weight at s.m.(g.)	16	1516	2	1884	1	1181	2	1095	5	1483	2	2526	10	1130	
Age at sexual maturity (d.)	15	171.8	1	162	2	170.7	7	170.3	5	166.6	3	179.7	18	178.2	
Egg number	15	47.4	-	-	-	-	2	45.3	-	-	1	48.8	8	41.1	
Egg mass (g.)	9	1987	-	-	-	-	-	-	-	-	-	-	1	627	

Traits		G.		G.M.		Mam.		Man.		Mat		Nor.		S.M.	
		N.	X̄	N.	X̄	N.	X̄	N.	X̄	N.	X̄	N.	X̄	N.	X̄
Fertility percentage (%)		9	90.81	6	91.83	3	90.27	7	90.43	2	92.85	-	-	5	90.56
Hatchability percentage (%)		9	82.3	8	78.6	1	84.7	6	84.5	4	77.3	-	-	5	82.2
M.		3	303.6	1	262.4	-	-	2	286.4	2	151.4	1	146.5	2	278.1
F.		3	263.9	1	230.8	-	-	2	256.5	2	137.9	1	131.6	2	251.2
Comb.		4	250	4	262.9	1	277.8	3	261.2	2	331.8	1	145	3	287.5
M.		4	702.1	1	812.6	1	868.4	3	734.3	2	450.4	1	419.3	2	728.9
F.		4	569.3	1	695.2	1	686.8	3	606.9	2	345.3	1	354.8	2	592
Comb.		4	598.2	4	643.2	-	-	4	711.7	1	655	2	361.2	3	657.3
Body weight at s.m.(g.)		7	1627	5	1492	3	1751	11	1614	4	1336	5	1219	6	1578
Age at sexual maturity (d.)		9	170.9	7	162.8	5	174.2	12	167.7	5	165.7	6	161.2	8	166.9
Egg number		5	46.4	4	44.6	-	-	5	52.9	3	46.3	8	50.6	4	60.7
Egg mass (g.)		2	1762	-	-	-	-	1	1460	-	-	-	-	-	-

* N = number of researches which used to estimate the average (x).

Table (3): The best local strains in the reproduction and production traits.

Fertility percentage (%)	Dan.		Mat.		G.M.	
	N.*	X̄	N.	X̄	N.	X̄
	3	93.87	2	92.85	6	91.83
Hatchability percentage (%)	Mam.		Man.		D-4	
	N.	X̄	N.	X̄	N.	X̄
	1	84.7	6	84.5	3	84.1
Body weight at 4 weeks (g.) (Male)	G.		Ban.		Man.	
	N.	X̄	N.	X̄	N.	X̄
	3	303.6	1	287.6	2	286.4
Body weight at 4 weeks (g.) (Female)	G.		Ban.		Man.	
	N.	X̄	N.	X̄	N.	X̄
	3	263.9	1	263.6	2	256.5
Body weight at 4 weeks (g.) (Comb)	E.S.		Mat.		Bah.	
	N.	X̄	N.	X̄	N.	X̄
	2	317.6	2	331.8	1	305
Body weight at 8 weeks (g.) (Male)	Mam.		E.S.		G.M.	
	N.	X̄	N.	X̄	N.	X̄
	1	868.4	2	834.7	1	812.6
Body weight at 8 weeks (g.) (Female)	E.S.		G.M.		Mam.	
	N.	X̄	N.	X̄	N.	X̄
	2	738.6	1	659.2	1	686.8
Body weight at 8 weeks (g.) (Comb)	E.S.		Bah.		Man.	
	N.	X̄	N.	X̄	N.	X̄
	1	904	1	800	4	711.7
Body weight at S.M. (g.)	E.S.		Bah.		Mam.	
	N.	X̄	N.	X̄	N.	X̄
	2	2526.5	2	1884	3	1751
Age at sexual maturity (d.)	Nor.		G.M.		Bah.	
	N.	X̄	N.	X̄	N.	X̄
	6	161.2	7	162.8	1	162
Egg number 90 days.	S.M.		Man.		Nor.	
	N.	X̄	N.	X̄	N.	X̄
	4	60.7	5	52.9	8	50.6
Egg mass 90 days. (g.)	Alex.		G.		Man.	
	N.	X̄	N.	X̄	N.	X̄
	9	1987.2	2	1762.4	1	1460.5

* N = number of researches which used to estimate the average (x).

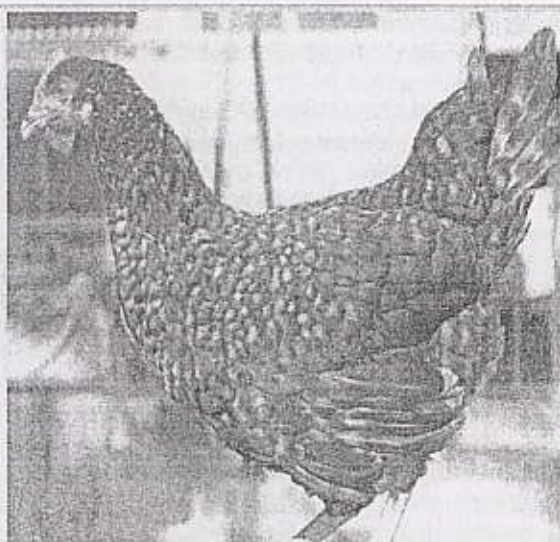
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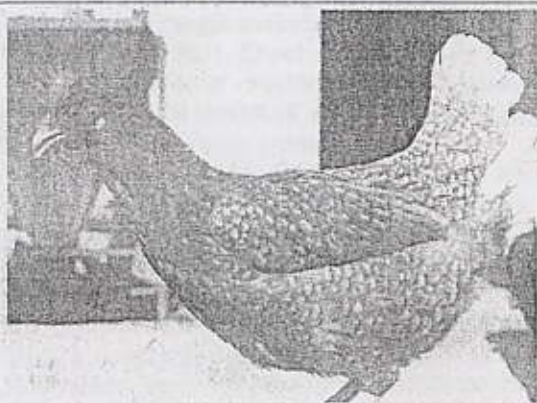
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Gimmizah female



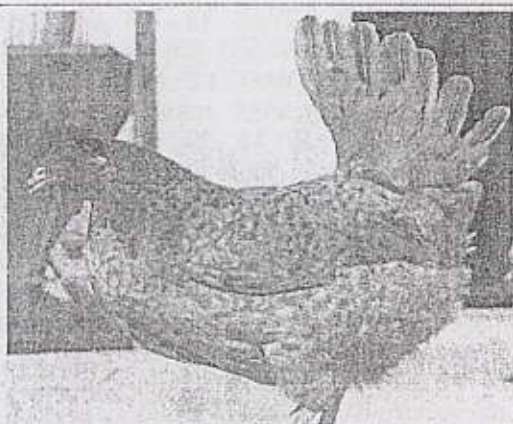
Gimmizah male



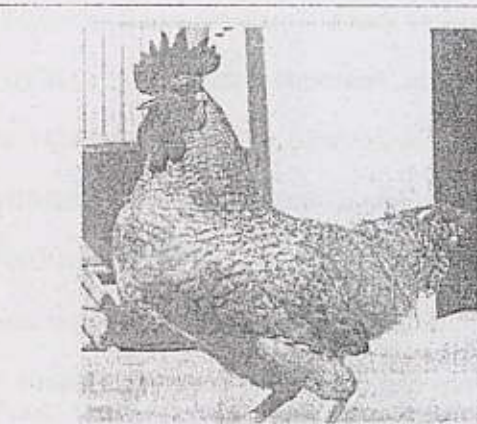
Mandarah female



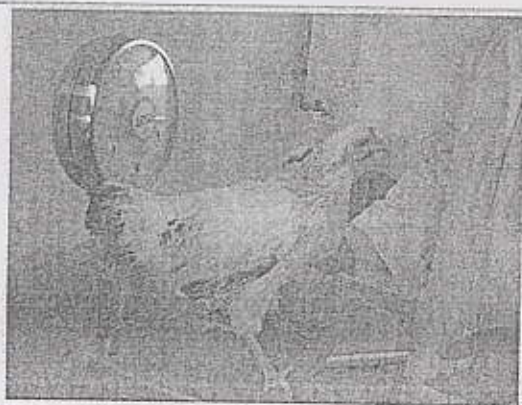
Mandarah male



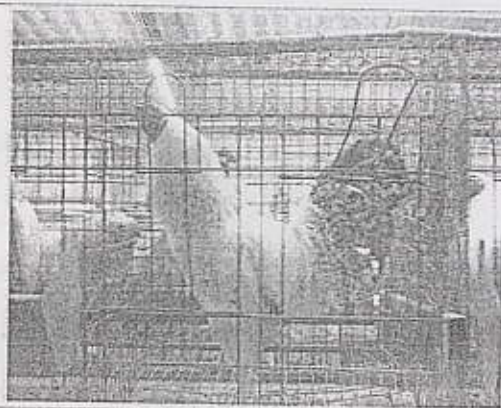
Golden Montazah female



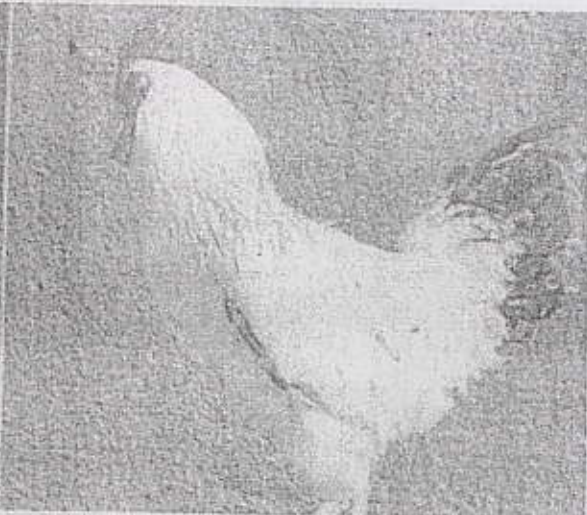
Golden Montazah male



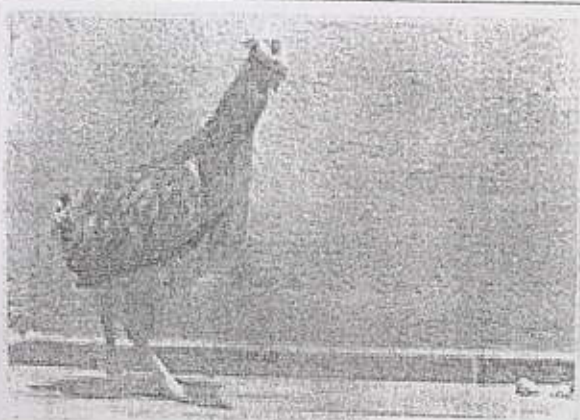
Bahij female



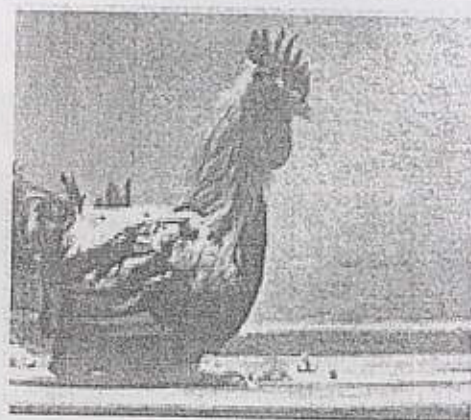
Bahij male



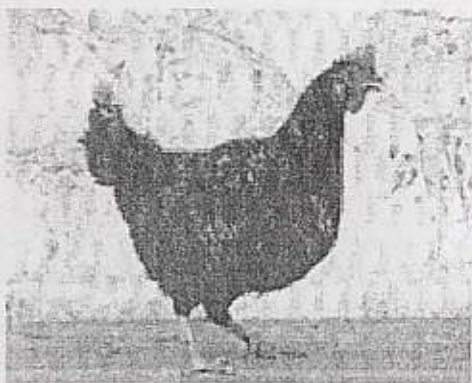
Silver Montazah female & male



Dandarawy female



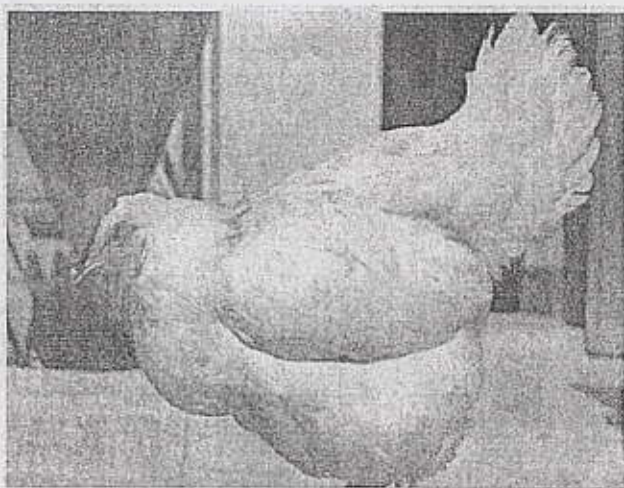
Dandarawy male



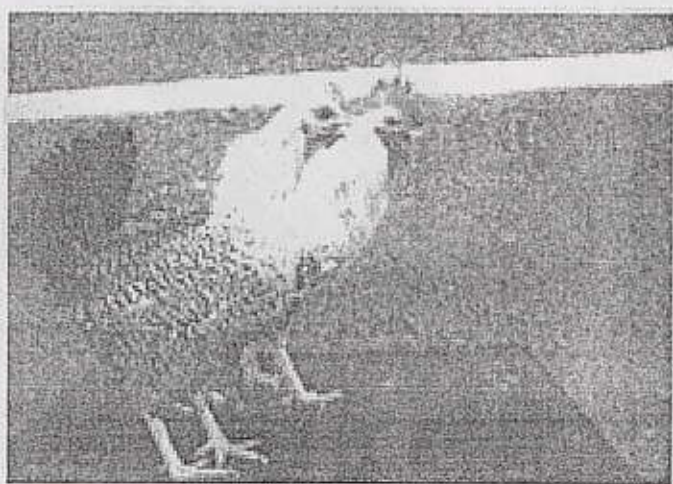
Matrouh female



Matrouh male



Bandaraha male



Dokki-4