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GENE RESCUE PROGRAMME TO PROTECT LOCAL FARM ANIMAL BREEDS AND ECOTYPES IN THE CARPATHIAN BASIN: “THE GENE RING” – “A GENGYURU”

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Abstract

Several protection systems of farm animal genetic resources (AnGR) have been elaborated to accomplish conservation programmes. However, conservation practice may differ region by region even within one country, according to the local environment, climate, agricultural traditions and unique for the region local breeds and ecotypes. The paper introduces the Hungarian protection system, which consists of gene banks, gene protection and gene conservation as main elements of local farm animal breed protection with an important additional element of the system for the Carpathian Basin: *gene rescue*. It is aimed to retain all precious heritage of local livestock being out of the scope of the current gene conservation programmes (critically endangered varieties, landraces, ecotypes, specific populations or even individuals with fixed characteristic properties). Next to the brief introduction of the Hungarian protection system and HáGK research scopes of AnGR conservation, the authors provide examples of local breeds and ecotypes for which the gene rescue programme have been or should be started in *Szeklerland, Transylvania*. The programme is called “*The Szekler Gene Ring*” or in Hungarian “*A Székely Géngyűrű*”. Some technical details of the *Gene Ring* programme are also mentioned. It is concluded that urgent action and the co-operation of breeders, conservationists of related countries are required to start special gene rescue projects with the aim of collecting animals, starting nucleus stock breeding *in situ*, supporting existing and elaborating new gene conservation programmes of distinct local breeds and ecotypes traditional for the Carpathian Basin. Introducing cases of general conservation or specific gene rescue programmes that might be useful for other regions and countries, including Southeast Asia, where unique local breeds still exist, can be a further objective of this paper.

Keywords: gene conservation, gene rescue, farm animals, breed, ecotype, Carpathian Basin

Introduction

Gene rescue is an important additional element of the protection system of farm animal genetic resources (AnGR). It is aimed to retain all precious heritage of local livestock being out of the scope of the current gene conservation programmes including endangered varieties, landraces,

ecotypes, specific populations or even individuals with fixed characteristic properties (Szalay et al., 2012). Until the end of the 19th century, some local breeds, landraces, varieties and types of traditional farm animals had existed in large numbers in the Carpathian Basin. They still might be present there, despite the radical transformation of agriculture, rural habitats and the rural way of life (Matiuti, 2010). Therefore, urgent and complex action is required in order to save the landraces and their living conditions mostly because of the everyday practice of crossing local livestock with exotic breeds. Conservation and breeding programmes should be elaborated by collecting individuals, preparing and developing of gene conservation programmes, nucleus (gene bank) herds or stocks (Bodo and Szalay, 2007). Small populations of gene bank value should be reproduced as quickly as possible in order to increase the registered number of the population. Registered small populations have to be incorporated in the protection system of farm animal genetic resources, proposed by the conference held at HaGK in 2011 (Szalay et al., 2012) and in subsequent research programmes.

The aim of this paper is to draw attention to landraces, ecotypes and breeds of local livestock and poultry of different species which are characteristic for certain regions of the Carpathian Basin. Examples for local breeds in gene rescue programmes and research references of the protection system are mostly taken from the professional practice of HaGK.

Materials and methods

The basics of the Hungarian breed protection system

In order to maintain specific genetic diversity of individuals and agrobiodiversity of certain regions in general, the protection system of fAnGR should include preservation, maintenance, collection, protection, registration and utilization of all existing genetic resources. The protection system is made up of three basic elements or sub-systems, in which the permanent link between the elements should be sustained in both directions. All elements are connected to an additional, fourth sub-system called gene rescue (*see Figure 1*).

Main elements of the Hungarian breed protection system and their research scopes

Gene bank is the heart of the protection system of fAnGR, which should be maintained and protected by governmental institutions. Gene bank is to preserve the whole set of genetic information of farm animals (species, breeds, varieties, individuals, tissues, cells, DNA). Most important methods and technics for gene bank work are: *in vitro* storage of frozen genetic material in liquid nitrogen and *in vivo* conservation of live animals in artificial conditions (*ex situ*). Main research tasks of gene bank activities are elaboration of methods in molecular genetics, reproduction biology and population genetics to develop and maintain *in vitro*, *in vivo* gene banks and small populations (e.g. Szalay et al., 2009; Revay et al., 2010; Liptoi et al., 2013; Szalay et al., 2016).

Gene protection is the second level of the system. Stocks are registered by the breeding authority and breeding organisations. Gene protection of livestock and poultry species means live maintenance and breeding with no change in the genetic background of stocks representing gene bank value. Stocks are kept in their natural, original breeding conditions (*in vivo*, *in situ* methods). Main research areas of gene protection consist of both basic and applied research in molecular genetics, reproduction biology and population genetics of small populations. Gene protection needs applied research in genetics and reproduction to operate *in vitro* and *in vivo*

gene banks, as well as to study production and reproduction traits of small populations (Bodzsar et al., 2009; Varadi et al., 2013; Lan Phuong et al., 2014; Szalay et al., 2016).

Gene conservation is the third element of the protection system, which includes the two previous ones. Gene conservation in this interpretation means further reproduction of protected animals or breeds and their utilization in commodity production. Setting up herds and flocks of conserved breeds and crossings for production purposes can be included here if the basic principles of conservation are taken into consideration. HU-BA (abbreviation of *Hungarikum Baromfi* which means *Hungaricum Poultry* in English) programme can be an example for utilisation within gene conservation of old Hungarian poultry breeds in rural development and production in Hungary (Szalay et al., 2009) and in Southeast-Asia (Dong Xuan et al., 2015; Dong Xuan et al., 2016).

Gene rescue is an additional element of high importance of the protection system. Gene rescue programmes are designed to collect, save, maintain and describe all precious biological, environmental and ethnographic heritage of local livestock: critically endangered ecotypes, varieties, landraces, specific populations or even individuals with fixed characteristic properties, as well as to protect local environment and traditional methods of animal breeding and production, or to collect and save either unexplored or known valuable heritage of farm animals in its original form (Szalay et al., 2015).

Gene rescue for gene bank means to explore, determine, store rare genes *in vitro* and collect individuals with rare genes for gene bank stocks to start conservation programme *in vivo*. Gene rescue for gene protection and gene conservation purposes means that explored individuals of the same breed which carry rare genes and traits are introduced into *in vivo* breeding stocks to protect genetic diversity of the population and to improve traditional use and production.

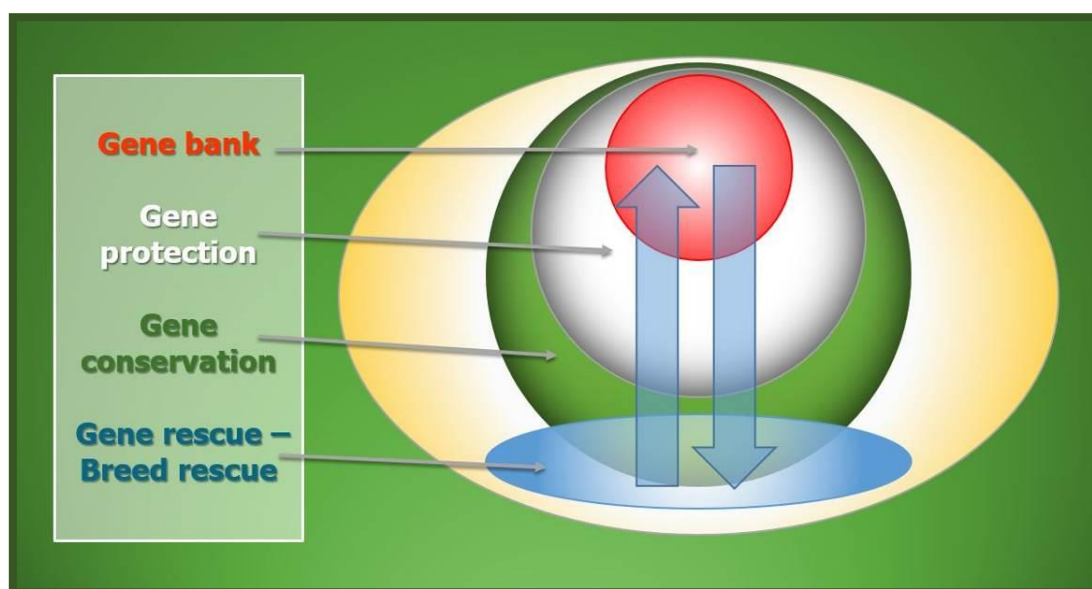


Figure 1: Scheme of the Hungarian breed protection system of farm animal genetic resources.

(Source: Szalay et al., 2012; 2015)

Results

Gene rescue in the Carpathian Basin: The Gene Ring – A Gengyuru

“The Gene Ring”: Programmes are organized in the Carpathian Basin in a way that primary gene bank stocks collected in the region are kept in the original locality traditionally, ensuring

the conditions of local conservation, while the offspring of such a stock can be used as replacement of the original or foundation of a new stock for the breed/ecotype. In the next paragraphs, local ecotypes rescued and conserved within the *Szekler Gene Ring (Szekely Gengyuru) Programme* are briefly discussed. (For Gene Ring-Gengyuru logo see Figure 2.)



Figure 2: Logo of the “Gengyuru”–“Gene Ring” Programme.

Local cattle ecotypes: Based on several field studies of the authors, a number of gene rescue programmes of farm animal genetic resources – existing mostly in Transylvania – have started recently. The ancient alpine ecotypes of cattle, e.g. the “*Mokany*” (Figure 3), used to be popular in the Carpathian Mountains till the end of the 19th century, and is still kept by local people in a quickly decreasing number. Mainly, the crossing practice of all local cattle using sperm of intensive breeds threatens the existence of old varieties. Consequently, they must be rescued as quickly as possible. Within the Gene Ring programme, the first attempt to collect and maintain this local cattle’s nucleus stock started 2 years ago.



Figure 3: “Géngyűrű” nucleus stock of alpine cattle ecotype “*Mokany*”. Csiksomlyo, Eastern Carpathians. Owner: HaGK; breeder: Dobos Attila. (Photo: Szalay I. 2016)

Another example for breed rescue of local cattle was given recently by *Polyan* Association and Debrecen University: collection and research of the small-size Carpathian Brown Cattle, called in Hungarian as “*Karpati borzderes*” (Figure 4) started some years ago (Miklos et al., 2013). One of its local predecessors must have been the *Mokany* cattle, which was crossed with imported alpine brown bulls at the end of the 19th century.



Figure 4: “*Karpati borzderes*” cattle nucleus stock at Mikohaza, North-East of Hungary. Owner and breeder: Miklos Rudolf. (Photo: Szalay I. 2016)

In The Carpathian Basin, the Hungarian spotted (“*magyar tarka*”) cattle has been a popular breed for a century. It originated mainly from the cross of local ecotypes and imported Simmental type cattle. This cross, however, resulted in different ecotypes of spotted cattle characteristic only for the Carpathian Basin, including Transylvania (Matiuti, 2010). The appearance of these ecotypes depends on the types of local varieties used in crossing process. By this way, a very special cattle ecotype, called “*Csango tarka*” still exists in the valleys of the Carpathians, kept by mountaineers. The start of the *Gengyuru* stock (see Figure 5) is originated from Uz Valley of the Eastern Carpathians (*Csinod*).

Local sheep and goat breeds/ecotypes: Covasna Yellow-face *Berke* (a local variety of Tsigai sheep, Figure 6) is in somewhat better position than *Mokany* cattle. Flocks are found in subregions of the Szeklerland. However, farmers – with a few exceptions – produce lambs for market, without special breeding goals. The same can be applied to another local variety of sheep, the Transylvanian *Gyimes Racka* or “*Erdelyi szalas juh*” (Figure 7). This sheep is a characteristic long and strait fur breed of *Csik* and *Gyimes* subregions with no specific breeding programme to maintain. The existing conservation programme in Hungary under the breed name *Gyimes Racka* can be qualified as *ex situ* conservation of a local variety. Further local livestock needs to be rescued in Szeklerland (*Szekelyfold*) is a local long and strait fur goat (“*Erdelyi szalas kecske*”, Figure 8) bred in different colour varieties. Nucleus gene bank stocks of the mentioned small ruminant breeds are conserved at HaGK *in vivo*, *ex situ* gene bank too.



Figure 5: Alpine cattle ecotype “*Csango tarka*”, presented by Dobos Attila. Csiksomlyo, Eastern Carpathians. Owner: HaGK; breeder: Dobos Attila and Kanya Florian.

(Photo: Szalay I. 2016)



Figure 6: Alpine sheep ecotype “Covasna Yellow-face *Berke*”. Gyimes Region, Eastern Carpathians. Owner and breeder: Rákossy Zsigmond, part-owner: HaGK.

(Photo: Szalay I. 2015)



Figure 7: Alpine sheep ecotype “*Erdelyi szalas juh*”. Csikmadaras Region, Eastern Carpathians.
Owner and breeder: Gall Levente. (Photo: Szalay I. 2014)



Figure 8: Alpine goat ecotype “*Erdelyi szalas kecske*”. Homorodalmás.
Owner and breeder: Kobolkuti Lorand, part-owner: HaGK. (Photo: Szalay I. 2014)

Local poultry: Successful gene rescue programmes can be integrated into the poultry breed protection system if gene banks for the given breed have been founded and both basic and applied research has also been started to study the stocks. In the co-operation of MGE, HaGK (formerly KATKI) and other institutions, several old Hungarian poultry breeds have been saved in specific programmes, which doubled the number of registered breeds in 15 years. Examples for successful gene rescue programmes are the Hungarian Landrace Guinea Fowl, the Partridge Coloured Hungarian Chicken, local goose and local duck breeds (Szalay et al., 2009; Szalay, 2015). Some new poultry gene rescue programmes are also on their way. “*Garammenti*” goose

and Black Hungarian Turkey (in co-operation with Debrecen University) and the Transylvanian Spotted Turkey or “*Tarka erdelyi pulyka*” (within the *Szekler Gene Ring*, see Figure 9) rescue projects have started recently, while collection of other local poultry genetic resources, such as the Banat Goose (Matiuti, 2010) are also in our future plan (see also Szalay, 2015).

Other farm animal breeds or ecotypes to rescue in the Carpathian basin

Organization of gene rescue in other species, like the *Szekler* horse (“*Szekely lo*”), *Bazna* pig (*Baznai sertes*), the Transylvanian Buffalo (in co-operation with the related breeding associations and institutions) are also in the scope of *Gengyuru* and should be in progress soon.

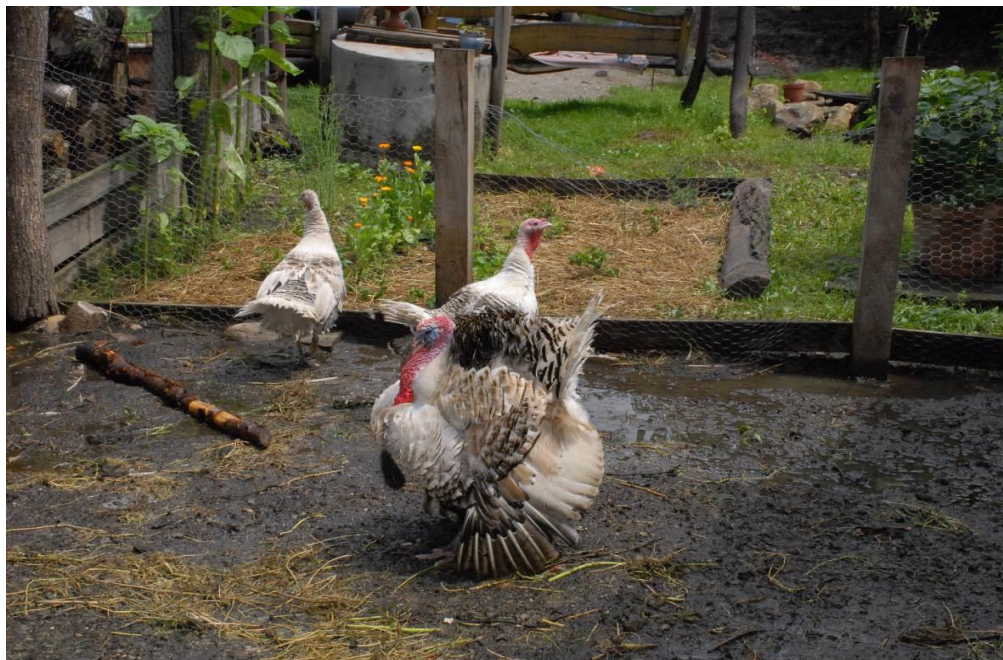


Figure 9: Transylvanian turkey ecotype “*Tarka erdelyi pulyka*”, Homorodalmás.

Owner: MGE, breeder: Kobolkuti Lorand. (Photo: Szalay I. 2016)

Conclusions and recommendation

Urgent action is needed to start specific gene rescue projects, if the present practice of crossing local ecotypes with exotic breeds and the subsequent changing in animal production in general is taken into consideration (Szalay et al., 2015). In the paper some ongoing projects in the Carpathian Basin were provided as positive examples.

One of the main principles of gene rescue of any local breed or ecotype must be the organisation of nucleus stocks in their original habitat or very similar to it. Moreover, parallel with the collection of animals, ethnographic and rural studies of the sources, related to the livelihood, habits and traditions of local people, as well as keeping, production and the use of local breeds should be of main importance.

Authorities, local and international institutions and organizations involved in gene conservation, as well as breeders and researchers of different disciplines of all related countries of the Carpathian Basin should play a crucial role in developing and improving the co-operation for gene rescue. Only by this way, saving our common and still particularly rich heritage of the existing livestock and poultry diversity together with its traditions and production practices in this very special region of Europe can be guaranteed.

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