

# OLD POULTRY BREEDS OF THE CARPATHIAN BASIN: TRADITIONAL AND ALTERNATIVE APPROACHES TO THEIR CONSERVATION

SZALAY I.T.

Association of Hungarian Small Animal Breeders for Gene Conservation (MGE),  
H-2100 Gödöllő, Isaszegi út 208, Hungary  
Research Institute for Animal Breeding and Nutrition, Division of Small Animal Research  
(ATK-KATKI), 2100 Gödöllő, Isaszegi út 200, Hungary

## 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 and 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, Carpathian Basin, 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, Bodó (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, Bodó 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.

### **Traditional poultry breeds of the Carpathian Basin**

*Hungarian chicken breeds.* Until the beginning of commercial chicken breeding Hungarian chicken breeds of different colours (white, speckled, yellow, partridge-colour and naked neck variants) were widespread in the country. They were preferred here not only for their relatively good egg production under harsh conditions, but for their excellent meat quality coming from the "seeking habit" of these birds, scratching for food regardless of hot or cold weather. Starting in the 1960s, breeding programmes and production of local breeds were replaced by commercial chicken hybrids, resulting in fast decrease of the population number of old Hungarian chicken breeds. Since 1973, majority of breeds and colour varieties had been maintained as official gene reserves. In 1991, based on historical literature on Hungarian poultry breed standards, Transylvanian Naked-neck chicken was declared to be an independent breed represented by colour varieties: white speckled and black, while White, Speckled and Yellow Hungarian chicken breeds having no naked-neck varieties. Since 1997, all breeds and colour varieties have been conserved as individual breeds. In 2004 – following a long time field study, collection and breeding work, the Partridge-colour Hungarian Chicken was redeveloped, making the seventh chicken breed in conservation.

*Hungarian turkey.* Turkey breeding has existed in the Carpathian basin for many centuries. In Hungary, white and black colour variants of turkey were known. Later the black variety practically disappeared after crossing with Bronze and other imported turkey breeds at the beginning of the 20<sup>th</sup> century. As the result of crossings, however, Bronze turkey became adapted to the local conditions and it is considered now as an old Hungarian poultry breed. Copper turkey used to be popular in the southern part of Hungary. Body weight of the breed is somewhat lower than that of other turkey breeds, however, it is a very strong, resistant to diseases and well adapted local breed.

*Guinea-fowl.* Landrace varieties of guinea-fowl include bluish-grey (the most popular colour variety), white, grey, bronze or black and spotted. First reports about guinea-fowl breeding in Hungary were published at the beginning of the 20<sup>th</sup> century, though it must have been introduced into the Carpathian basin much earlier and was kept as a game bird or a semi-domesticated animal around manor-houses. Meat quality, high adaptability to different conditions, disease resistance, wild nature, seeking habit and low keeping costs make guinea-fowl an excellent poultry species for ecological type production.

*Hungarian goose and its frizzled variant.* Hungarian goose is indigenous in the Carpathian basin. During the centuries it has got used to the special climatic conditions and farming

systems of the region, which made it very precious in this part of Europe. Local goose breeds of different colours (white, greyish or spotted) produced high quality fatty liver, meat and feather approved by all markets. A unique variety of Hungarian goose – the Frizzled Hungarian goose – is considered now as a typical poultry breed for the Carpathian basin. Frizzling (F) is a mutant gene which causes the contour feathers to curve outward away from the body. Colour variants are white, grey or white-grey spotted.

*Hungarian duck.* The original Hungarian duck considered as an indigenous breed in the Carpathian basin used to be found mostly in white and wild, rarely in spotted, brown or black colour varieties. Because of its juicy, delicious meat, Hungarian duck was bred all over the country being more important for domestic consumption than goose. Nevertheless, starting with the early 1960s, Hungarian duck gradually disappeared as the result of crossing with imported duck breeds. Conservation programme of local duck varieties (white and wild-colour) started in the late 1990s with the populations originated from South-east Hungary and Transylvania, while gene bank stock of black and white variety of the Hungarian Duck, characteristic for some eastern regions of the Carpathian Basin is under development.

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).

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 the *Appendix*.

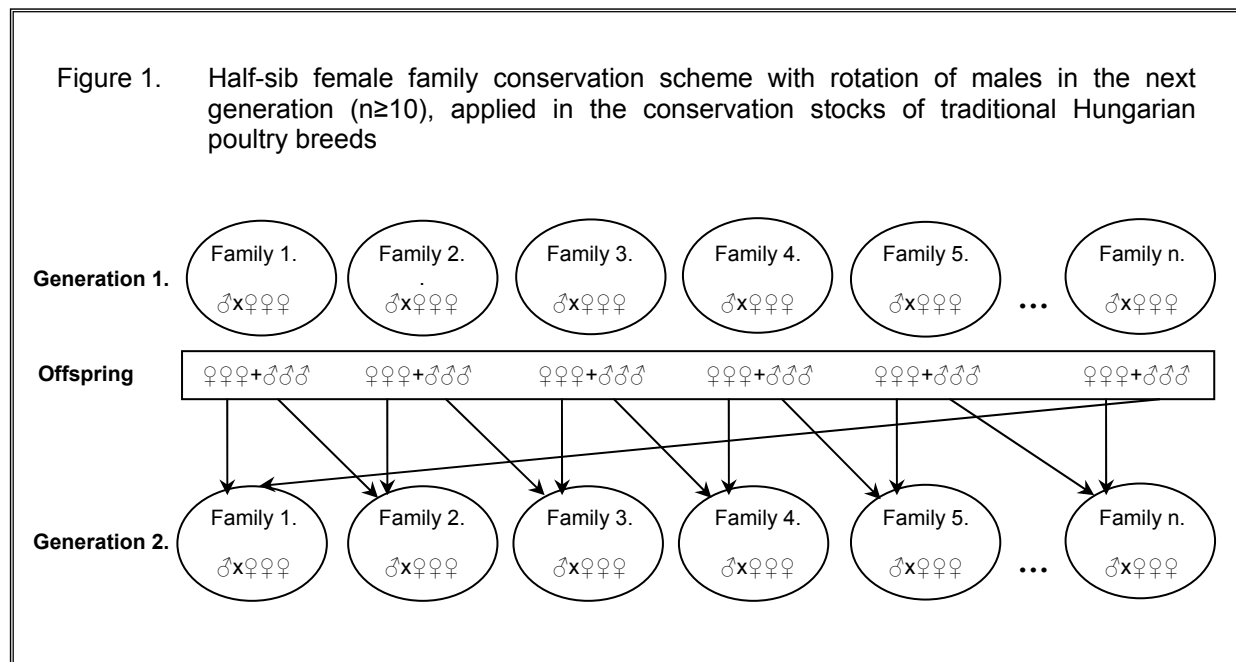
### **Official conservation program for the traditional Hungarian poultry breeds**

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; Mihók, 2004), West-Hungarian University, Mosonmagyaróvár (Yellow Hungarian Chicken; Kovácsné Gaál, 2004), Szeged University of Science, Hódmezővásárhely (Speckled Hungarian and Speckled Transylvanian Naked-neck Chicken; Sófalvy, 2005), and last but not least the Research Institute for Animal Breeding and Nutrition, Division of Small Animal Research (Gödöllő 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; Szalay, 2004). 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 (Figure 1). 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. Szőke et al. 2004, Szalay 2006, Bódi et al., 2007; Spalona et al. 2007; Szalay et al. 2007; Konrád 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 Gödöllő 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, Gödöllő, 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.

This work is a modified and completed version of the paper submitted by Szalay I.T. and Dong Xuan K.D.T. to the 7th Global Conference on the Conservation of Animal Genetic Resources, Hanoi, Vietnam, 14-18 September, 2008.

## References

- Bartosiewicz, L. (2006) Are “autochthonous” animal breeds living monuments? In E. Jerem – Zs. Mester – R. Benczes eds. Archaeological and cultural heritage preservation within the light of new technologies. Archaeolingua, Budapest. 33-47 p.
- Bódi, L., Dong Xuan, K.D.T. and Szalay I.T. (2007) HU-BA production system for special poultry products in Hungary. Proc. 5th Vietnamese-Hungarian International Conference on Animal Production and Aquaculture for Sustainable Farming, Can Tho University, Can Tho, Vietnam, 11-15 August, 2007. 61-65 p. [www.mge-hu.com](http://www.mge-hu.com)
- Bodó, I. (1985) Hungarian activities on the conservation of domestic animal genetic resources. AGRI 4:19-25.
- Bodó, I., Kovacs, G. and Ludrovsky, F. (1990) The Naked Neck Fowl. AGRI 7:83-88.
- Dong Xuan, K.D.T. and Szalay, I. (2003) Possibilities and aspects to introduce foreign poultry genetic resources to Central Vietnam. Proc. 3. Vietnamese-Hungarian Conference „Domestic animal production and aquaculture – Quality and rural development” pp. 47-54.
- Dong Xuan, K.D.T., Szalay, I., Su, V.V., Tieu, H.V. and Dang Vang, N. (2006) Animal genetic resources and traditional farming in Vietnam. AGRI 38:1-17.
- Dong Xuan, K.D.T., Szalay, I.T., Duc Tien, P. and Minh Thu, P.T. (2007) Adaptation experiments of Hungarian turkey breeds and their crosses in Vietnam (MGE-NEFE project, Hungary–Vietnam, 2006-2007). Proc. 5th Vietnamese-Hungarian International Conference on Animal Production and Aquaculture for Sustainable Farming, Can Tho University, Can Tho, Vietnam, 11-15 August, 2007. 33-41 p. [www.mge-hu.com](http://www.mge-hu.com)
- Dong Xuan, K.D.T., Szalay, I.T., Duc Tien, P., Minh Thu, P.T. and Dang Vang, N. (2008) Adaptation of old Hungarian poultry breeds in South-East Asia. An Alternative way of conservation. Proc. 7th Global Conference on the Conservation of Animal Genetic Resources, Hanoi, Vietnam, 14-18 September, 2008 (accepted paper)
- Foose, T.J. (1983) The relevance of captive populations to the conservation of biotic diversity. Genetics and Conservation, edited by C.M. Schonewald, Cox, S.M. Chambers, B. MacBryde and L. Thomas; 374–402. p.
- Horn, P. Foldi, P., Bastek, V. and Luksanova, P. (2002): Poultry production in the Czech Republic, Hungary and Slovakia. 11th European Poultry Conference 6-10 September 2002 Bremen, Germany. CD ROM
- Konrád, Sz., Kovácsné Gaál, K. and Vitinger, E. (2008) The effect of genotype, keeping technology and sex on the textural attributes of chicken meat. Allattenyesztes es Takarmanyozas (Hungarian Journal of Animal Production) 57(3):249-256.
- Kovácsné Gaál K. (2004) A sárga magyar tyúk génmegőrzése és fajtafenntartása Mosonmagyaróváron. [Gene conservation and breeding of the Yellow Hungarian Chicken in Mosonmagyaróvár. In Hungarian] A Baromfi 7(1):21-24. [www.mge-hu.com](http://www.mge-hu.com)
- MGE (2008) [www.mge-hu.com](http://www.mge-hu.com)
- Mihók S. (2004) Őshonos és réghonosult baromfifajok fenntartása a Debreceni Agrártudományi Centrumban. [Conservation of indigenous and adapted poultry species in the Centre of Agricultural Science of the Debrecen University. In Hungarian]. A Baromfi 7(2):8-13.
- Radics, L. (ed.) (2006) Summarised results of CHANNEL project. Szaktudás Publishing, Budapest. [www.channel.uni-corvinus.hu](http://www.channel.uni-corvinus.hu)
- Spalona, A., H. Ranvig, K. Cywa-Benko, A. Zanon, A. Sabbioni, I. Szalay, J. Benková, J. Baumgartner, T. Szwaczkowski (2007) Population size in conservation of local chicken breeds in chosen European countries. Arch.Geflügelk., 71(2):49–55.



- Sófalvy F. (2005) Az őshonos kendermagos magyar tyúk tartása Hódmezővásárhelyen [Conservation of the indigenous Speckled Hungarian Chicken in Hódmezővásárhely. In Hungarian]. *A Baromfi* 8(1):4-13.
- Szalay, I. (2002) Régi magyar baromfifajták. Old Hungarian Poultry. (In Hungarian and English) Mezőgazda Publishing, Budapest. 111 p.
- Szalay I. (2004) A régi magyar baromfifajták tenyésztése és génvédelme a KÁTKI-ban. [Breeding and conservation of old Hungarian poultry breeds in KATKI. In Hungarian]. *A Baromfi* 7(3):22-25.
- Szalay, I., Biskup, F., Barta, I. and Koppány, G. (1992) Present status of the native Hungarian chicken breeds. In: L. Lawrence and I. Bodó (ed.) *Genetic Conservation of Domestic Livestock*. Vol. 2., Chapter 22. C.A.B. International, Wallingford, UK. 223-231. p.
- Szalay, I., Biskup, F., Barta, I., Barna, J. and Koppány, G. (1995) Protected Hungarian chicken breeds. In: *Conservation of Domestic Animal Genetic Resources*. Ed: R.D. Crawford, E.E. Lister and J.T. Buckley. (Proc. Third Global Conference on Domestic Animal Genetic Resources, Kingston, Canada), Rare Breeds International. 278-280. p.
- Szalay, I.T. and Dong Xuan, K.D.T. (2007) Sustainability and gene conservation as guiding principles of the Hungarian-Vietnamese poultry research for development. Proc. 5th Vietnamese-Hungarian International Conference on Animal Production and Aquaculture for Sustainable Farming, Can Tho University, Can Tho, Vietnam, 11-15 August, 2007. 21-25 p. [www.mge-hu.com](http://www.mge-hu.com)
- Szalay, I., Bódi, L., Dong Xuan, K.D.T., Szentes, K., Barta, I., Stompné Molnár, I., Kustos, K. and Horel, K. (2007) A hungarikum baromfihús termelési rendszerének kidolgozása – a projekt 2006. évi gödöllői eredményeinek összefoglalása. [Elaboration of the production system for special quality Hungaricum poultry products – summarised results of the project obtained in Gödöllő in 2006. In Hungarian, with English summary] *A Baromfi (Baromfitudomány)* 10(1):34-47. [www.mge-hu.com](http://www.mge-hu.com)
- Szőke, Sz., Komlósi, I., Korom, E., Ispány, M., Mihók, S. (2004) A statistical analysis of population variability in Bronze Turkey, considering gene conservation. *Arch. Tierz. Dummerstorf* 47(4):377-385.
- Wright, S. (1931) Evolution in Mendelian populations. *Genetics* 16:97-159.

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.