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CONSERVATION PROGRESS OF OLD HUNGARIAN POULTRY BREEDS

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Abstract

This study aims to provide information on the Hungarian poultry conservation strategy as well as summarise briefly the characteristics, effective population size (N_e), inbreeding rate (ΔF) and the number of registered breeding stocks (*n*) of old Hungarian poultry breeds between the years 2000 and 2015. The success of Hungarian poultry conservation programme is the results of several historical events. After approximately 40 years of executing conservation programme, the total number of 14 old Hungarian poultry breeds have been registered. Special European subsidy system was introduced for conservation of all officially registered old breeds. Additionally, both institutional and individual breeders have been encouraged to take part in the conservation programme for either research or production purposes. Most of Hungarian poultry breeds are resistant and good in food searching ability. They have acceptable productivity and most importantly fine-fibred, excellent palatable meat. The success of Hungarian poultry conservation programme has been shown also through population data such as effective population size (N_e) and in breeding rate (ΔF). 11 breeds have N_e higher than 500. No breed has N_e below 50. The ΔF of old Hungarian poultry breeds can be considered fairly low compared to other European native poultry breeds. Population data also indicate the significance of the number of breeding stock in the conservation programmes.

Keywords: old Hungarian poultry, in vivo gene bank, conservation, population size.

Introduction

Over the past decades, many studies have shown that various existing poultry genetic resources are in critical or endangered status (Scherf, 2000; Woelders et al., 2006). Although traditional, unselected poultry breeds are widely heterogeneous populations (Hillel et al., 1999; Tixier-Boichard et al., 1999), there has been a significant decrease in the number of individuals (Gandini and Villa, 2003), as well as a noticeable disappearance of breeds (Geerlings et al., 2002). Conservation activities focus on genetic management, maximizing the effective number of individuals in the gene pool, raising the awareness of practices that may increase inbreeding coefficients and help in preventing erosion of animal genetic diversity are essential (Szalay et al., 2009). This study aims to provide information on the Hungarian poultry conservation strategy and progress as well as summarise briefly the characteristics, effective population size (N_e), inbreeding rate (ΔF) and the number of registered breeding stocks (*n*) of 14 local Hungarian poultry breeds from the year 2000 to 2015.

Hungarian poultry conservation strategy

Table 1: Major historic events of Hungarian poultry conservations programmes

Year	Events
1897	The Hungarian Royal Poultry Breeding Farm (HRPBF, predecessor of HaGK) was founded
Early 1930s	Major breeding program of old Hungarian poultry breeds started at HRPBF
1939-1945	The majority of breeding stocks were destroyed by World War II
Early 1950s	Hungarian poultry breeds were preserved and propagated again in great quantities thanks to Balint Baldy and colleagues (Biszkup and Beke, 1951; Baldy, 1954)
Early 1960s	Hungarian breeds were replaced by foreign hybrids even in small-scale farms
Early 1970s	Conservation of local chicken breeds became the task of the Hungarian Animal Breeding Authority to maintain Hungarian and Transylvanian breeds as gene reserves
Early 1990s	-Non-governmental organizations took over breed protection programmes according to new regulations in animal breeding -New poultry conservation programmes were initiated based on the existing breeding stocks of the Institute for Small Animal Research (KATKI, predecessor of HaGK) and three other agricultural universities in Mosonmagyarovar, Debrecen and Hodmezovasarhely (Kovacsne Gaal, 2004; Mihok, 2004, Sofalvy, 2005)
In 1998	MGE was appointed as the official breeding organisation for old Hungarian poultry breeds and responsible for registering as well as supervising the whole breeding programme of the existing old Hungarian poultry stocks
In 2008	Official registration to the Hungarian Poultry Information System of all poultry breeding stocks, including those kept under conservation programmes and those kept under the control of the breeding authority
From 2010	-Special EU subsidy system was elaborated and introduced for all officially registered Hungarian farm animal genetic resources, including poultry. -Institutional and individual breeders have been encouraged to take part in the conservation programme for either research or production purposes
From 2012	- New gene rescue programmes to collect and conserve old local poultry breeds and ecotypes of the Carpathian Basin have been initiated by KATKI

In 2013	Change the name of KATKI for HaGK

Major historic events of Hungarian poultry conservations programmes are shown in Table 1. After approximately 40 years of execution, the total number of old Hungarian poultry breeds has been increased up to 14 (Table 2), mainly due to the registration of colour varieties as separate breeds and the gene rescue programmes. New conservation stocks were established by the use of pedigreed offspring of original, institutional and closed populations mentioned above.

Table 2: List of conserved Hungarian poultry breeds registered in conservation programme (Szalay et al., 2016b)

Breeds	Labels
Yellow Hungarian chicken	YHc
White Hungarian chicken	WHc
Speckled Hungarian chicken	SHc
Partridge Coloured Hungarian chicken	PHc
White Transylvanian Naked Neck chicken	WTc
Black Transylvanian Naked Neck chicken	BTc
Speckled Transylvanian Naked Neck chicken	STc
Hungarian Landrace Guinea Fowl	HLgf
Frizzled Hungarian Goose	FHg
Hungarian Goose	HUg
White Hungarian Duck	WHd
Wild Coloured Hungarian Duck	WId
Copper Turkey	COt
Bronze Turkey	BRt

Brief characteristics of old Hungarian poultry breeds *(after Szalay, 2015)*

Chicken breeds

Productivity characteristics of the breeds are shown in Table 3. Old Hungarian chicken breeds belong to the medium size, dual-purpose category. Hens weigh 2.0 to 2.3 kg, while cocks weigh 2.5 to 3.0 kg. The highest value of Hungarian chicken breeds is their fine-fibred, excellent and palatable meat. Pullets at the age of 8 to 10 weeks are ready for marketing. Their annual egg production reaches 140 to 150 pieces per hen per year. White, yellow, speckled and partridge colour are the most common ones. Transylvanian naked neck chickens are characterised by featherless neck, part of the breast and the belly. Also on the top of the head there is only a little plumage. In the gene bank, there are black, white and speckled colour varieties. These breeds are extraordinarily hardy, firm and resistant, and are acknowledged for their good winter laying characteristics.

Turkey breeds

The Copper turkey was used to occur sporadically all over the territory of Hungary. It is known of its hardiness, unpretentiousness, tireless brooding and good food searching ability. It has dark copper coloured front body with whitish wings and tail feathers. Its basic colour may be flickered by white and dun transverse bands. The female is somewhat lighter in colour. Body weight of males is 5.00 to 7.00 kg and that of females is 4.00 to 5.00 kg. The Hungarian bronze turkey can be considered as a naturalized breed. It has the traits of old Hungarian landrace turkeys. Its annual egg production is 50 to 80 pieces per year. Eggs are heavily spotted, and it weighs from 70 to 90 g. Its body conformation and plumage colour are similar to that of the standard bronze turkey, but lighter. Body weight of males is 6.00 to 8.00 kg, and that of females is 5.00 to 6.00 kg.

Table 3: Productivity characteristics of Yellow Hungarian chicken (YHc), White Hungarian chicken (WHc), Speckled Hungarian chicken (SHc), Partridge Coloured Hungarian chicken (PHc), White Transylvanian Naked Neck chicken (WTc), Black Transylvanian Naked Neck chicken (BTc), Speckled Transylvanian Naked Neck chicken (STc)

Characteristics	WHc	YHc	SHc	PHc	WTc, BTc, STc
Body weight of 1st year hens (kg)	1.7-2.0	1.8-2.2	1.9-2.3	2.0-2.5	1.7-2.2
Body weight of 1st year cocks (kg)	2.0-2.2	2.3-2.6	2.7-3.0	2.8-3.2	2.2-2.4
Body weight of cocks at 12 week of age (kg)	1.0-1.2	1.2-1.4	1.1-1.3	1.2-1.5	1.0-1.1
Egg production (pcs/laying period)	min. 103	min. 100	min. 78	min. 98	min. 70
Egg weight (g)	48-50	50-55	55	55	48-50

Goose breeds

The Hungarian goose occurs in white, grey coloured or spotted plumage. The white variant was used to be the most common. It is a medium-sized breed. The body weight of the gander is 6 to 8 kg, and that of the female is 5 to 6 kg. The Hungarian goose was used to be an unpretentious, fast growing, well feathering, hardy and tirelessly grazing breed. It produced a soft meat of excellent quality and its big livers were appreciated in foreign markets. Annual egg production of the original Hungarian goose is around 15 pieces per year. Hungarian frizzle feathered goose has all the good traits that exist in Hungarian goose. It differs from the Hungarian goose merely in the structure of feathers. Its thigh and tail feathers are long, soft and frizzling in a ribbon-like way.

Duck breeds

The Hungarian duck can be considered as a landrace breed. It occurs mostly in white colour variant. The spotted and brown variants are less common. It belongs to the small-sized category.

It is a highly resistant breed with good food searching ability. Hungarian duck meat is highly palatable, juicy and fine fibred. In the gene bank, white and wild colour variants are maintained as two separate breeds. Body weight of the male is 2.50 to 3.20 kg, and that of the female is 2.30 to 3.00 kg.

Hungarian landrace guinea fowl

In Hungary, the bluish-grey colour variety is the most commonly seen. The plumage of the bluish-grey guinea fowl is evenly spotted with white dots. Wing and tail feathers are brown, bordered with a whitish mottle. Neck and breast are violet-grey without dots. The chicks at hatching are brownish with longitudinal darker bands on the back. Grey, brown, or white varieties also occur to a smaller extent. The White guinea fowl is spangled with silvery white dots. Its day-old chicks are greyish with lighter bands and down feathers. Body weight of the male is from 1.30 to 1.60 kg, while that of the female is from 1.20 to 1.40 kg. It starts laying eggs at the end of April and produces 50 to 80 eggs per year. Its eggs are small with thick shell and an average weight of 50 g. Due to the thickness of the shell, guinea fowl eggs can be stored for a longer period of time in comparison to eggs of the other poultry species. It is a very hardy, quarrelling, fierce kind of poultry and very good at exterminating insects. There are local guinea fowl ecotypes still existing and conserved in different regions of the country (Szalay et al, 2015; Szalay et al, 2016a).

Effective population size, inbreeding rate, number of registered breeding stocks

The population data of entirely controlled stocks of the highest breeding level (either officially registered or existing and temporarily unregistered) were considered for evaluation. Yearly, the *n* of each traditional Hungarian poultry breed, the number of breeding males and females was monitored. The N_e is the number of individuals from a population that are randomly selected and randomly mated and would be expected to have the same rate of inbreeding (Waples, 2002). Since breeding birds were kept in various locations of Hungary, the assumptions of random mating and no selection are unrealistic. However, estimated N_e was to only provide the presumption of upper limit. ΔF within a population is inversely proportional to N_e. The estimation of N_e and ΔF was based on the formula given by Wright (1931). N_e and ΔF and *n* are given in Tables 4. There was no PHc, HLgf, WHd, WId breeding stock registered before 2004 and no HUg before 2005. The *n* of breeds other than HUg, in which *n* remained unchanged (n = 2), increased year by year, reaching the peak in 2012 (YHc and SHc with n = 10; COt and BRt with n = 9; HLgf with n = 8, PHc, BTc, STc, FHg and WId with n = 7; WHd with n = 5) or in 2013 (WTc with n = 8). From 2013, a slight decrease in the n of most breeds can be seen. Changes are partly due to a new 5 year subsidy system financed by the European Union for *in vivo* gene conservation of the registered breeds and stocks between 2010 and 2014. The N_e of WTc, BTc, STc, WHd and COt always stayed below 1000 individuals. Huge enhancement of N_e can be seen in PHc (from 242 in 2009 to 1640 in 2013), in HLgf (from 633 in 2009 to 2581 in 2012) and in HUg (from 163 in 2010 to 1262 in 2012). It has been noted that the higher *n*, the greater N_e is. In case of ΔF, the lowest of 0.019% and highest of 0.794% were recorded in 2012 (HLgf) and 2009 (WHd), respectively. YHc and SHc had ΔF lower than 0.108% during the entire investigating period. Populations with N_e smaller than 100 birds had ΔF higher than 0.500% (COt in 2000, 2002 and 2004; WHd in 2009). In the last 2 years of analysis, 2014 and

2015, only HUg and WHd had ΔF higher than 0.200%. Noticeably, there was a gradual decline in the ΔF of PHc, HLgf, COt and BRt.

Conclusions and discussion

According to Lynch et al. (1995), the N_e of rare breeds should exceed 500 animals, otherwise the accumulation of deleterious mutations may cause extinction. FAO (2013) recommended a minimum N_e of 50 to guarantee a short or medium term survival and over 50 individuals for a long term survival of a population. This study showed that 11 Hungarian poultry breeds recently had N_e higher than 500 and 6 breeds (WHc, WTc, BTc, HUg, WHd and WId) had N_e lower than 500. No breed studied had N_e below 50. This result is much better than that of Belgian chickens reported by Lariviere et al. in 2011, in which only 3 breeds were reported to have the N_e of more than 500 individuals. If compared to some other European local poultry breeds such as the Polish (ΔF up to 0.20%), Slovakian (ΔF up to 0.71%), Belgian (ΔF up to 0.94%) and Spanish breeds (ΔF up to 0.70%) or commercial breeds (ΔF up to 0.60%), (Ameli et al. 1991, Campo et al., 2000, Spalona et al., 2007, Lariviere et al., 2011) the ΔF of Hungarian breeds can be considered fairly low. If such ΔF can be maintained for the long term, then Hungarian local poultry breeds will have less risks of becoming extinct (Simon and Buchenauer, 1993). The population data of old Hungarian poultry breeds between 2000 and 2015 confirm the effectiveness of Hungarian poultry conservation strategy. It also reflects the significance of *n* in conservation programmes (Szalay et al, 2016b). In case of very low *n* (e.g. HUg), if a main breeding stock drops out from the programme for any reason, it would lead to a marked fall in N_e. More importantly, since most of the conservation programmes are subsidised by international bodies (the EU in the case of the Hungarian conservation programme) for a strict period of time with limited additional local support, getting close to the end of a funding period (e.g. 2013), reduction of *n* and N_e is undoubtedly inevitable. Additionally, the various size of breeding stocks due to stock holder capacity should be taken into consideration. In a small breeding stock, the ΔF formula used offers very limited future predictions.

Table 4: Effective population size, inbreeding rate, number of registered Hungarian poultry breeding stocks

		2000	2003	2006	2009	2012	2015
YHc	*n*	3	3	3	4	10	9
	N_e	736	1078	634	1259	1407	1396
	ΔF	0.068	0.046	0.079	0.040	0.036	0.036
WHc	*n*	2	2	2	3	7	4
	N_e	309	282	168	237	426	386
	ΔF	0.162	0.177	0.297	0.211	0.117	0.130
SHc	*n*	3	3	3	4	10	8
	N_e	862	942	645	463	954	936
	ΔF	0.058	0.053	0.078	0.108	0.052	0.053
PHc	*n*	0	0	2	2	7	6
	N_e			189	242	1202	1419
	ΔF			0.265	0.207	0.042	0.035
WTc	*n*	2	2	2	3	7	4
	N_e	280	286	175	225	401	389
	ΔF	0.178	0.175	0.286	0.223	0.125	0.129
BTc	*n*	2	2	2	3	7	4

	N_e	263	318	161	238	400	386
	ΔF	0.190	0.157	0.311	0.210	0.125	0.130
STc	*n*	3	3	3	4	7	5
	N_e	317	404	315	306	549	531
	ΔF	0.158	0.124	0.159	0.163	0.091	0.094
HLgf	*n*			2	3	8	6
	N_e			244	633	2581	1110
	ΔF			0.205	0.079	0.019	0.045
FHg	*n*	3	3	3	4	7	5
	N_e	355	523	495	277	1231	1170
	ΔF	0.141	0.096	0.101	0.180	0.041	0.043
HUg	*n*			2	2	2	2
	N_e			324	166	605	245
	ΔF			0.154	0.302	0.083	0.204
WHd	*n*			1	1	5	3
	N_e			122	63	556	241
	ΔF			0.409	0.794	0.090	0.208
WId	*n*			3	3	7	4
	N_e			248	358	1044	321
	ΔF			0.202	0.140	0.048	0.156
COt	*n*	1	2	2	3	9	6
	N_e	92.3	139	143	158	849	625
	ΔF	0.542	0.359	0.350	0.317	0.059	0.080
BRt	*n*	2	2	2	3	9	6
	N_e	357	321	290	162	952	657
	ΔF	0.140	0.156	0.173	0.310	0.053	0.076

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