

Population size in conservation of local chicken breeds in chosen European countries

Populationsgrößen in Erhaltungszuchtprogrammen für einheimische Hühnerrassen in ausgewählten Ländern Europas

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Introduction

Local breeds are an evidence of great achievements of many generations of breeding. For centuries farmers have been adapting chickens to local conditions, cultural needs and preferences. Unfortunately, over last decades, as a result of the industrialization of agriculture, the old local breeds of Europe mostly suffered a graduate decrease in numbers (GANDINI and VILLA 2003). But, the disappearing unique genetic pools are worth maintaining.

MENDELSON (2003) reported that animal genetic resources can be considered from the economic perspective for at least three reasons: choice of breeds in conservation programs, developing effective genetic improvement programs and interest in benefit sharing. Only a small part of chicken genetic resources was used as a base for the development of commercial strains. Breeders adapted hens to the cage system, introduced a high hygienic standard supplied with a vaccination program, assured free access to a balanced diet (SØRENSEN, 1999) and controlled photoperiod to induce oviposition. Improved strains achieved their biological maximum for a number of performance traits. In parallel they seem to have lost some of their adaptability to floor or free range systems. Troubles arose for nesting behaviour before oviposition, feather pecking against each other and aggressiveness, which can end in cannibalism (SØRENSEN, 1997). Nevertheless, modern chicken breeds were globally distributed displacing indigenous populations.

Knowledge on the merit of traditional breeds is available from local breeders who have developed them over long time horizons (ROOSEN et al. 2005). These breeds are usually preserved in few flocks. Development of breeds and their disappearance is a natural process. However, in the past century the scale of vanishing of locally adapted breeds was dramatic (GEERLINGS et al. 2002). In Italy there are records on extinction of forty traditional breeds (ZANON and SABBIONI, 2001),

Future beneficiaries of conservation programs are likely to be spread throughout the World. Therefore, conservation programs should be considered as an international responsibility. Most countries have approved laws that address breeding and other management aspects of domesticated animals. Rare breeds are promoted through dissemination of information on existing resources together with such incentives like funding, distribution of genetic material and training. The European project AvianDiv, conducted in 1998, showed that traditional unselected breeds are widely heterogeneous populations (HILLEL et al., 1999; TIXIER-BOICHARD et al., 1999). The fullest world-wide inventory of breeds, compiled under the auspices of FAO, is a Domestic Animal Diversity Information System. It is available under reference at <http://www.fao.org/dad-is>.

Conservation activities focus on maximizing the effective number of individuals contributing to the gene pool, as this helps in preventing erosion of animal genetic diversity as a result of inbreeding. Mating of related individuals leads to loss of alleles in a population, especially for the so-called fitness traits like, first of all, reproduction characters. A number of authors reported negative inbreeding effects on these traits (SEWALEM et al., 1999, SZWACZKOWSKI et al., 2000).

Living collections cannot be replaced or insured by cryopreservation (DELANY, 2003). In the case of cells and DNA freezing is technically easy, but it is currently difficult or impossible to recover the material in a living animal. Poultry geneticists are not able to use these resources – only save them for the future. Living collections of breeds give options and opportunities for manifold research and production needs.

The main aim of this paper was to analyse chicken genetic resources and methods of their conservation in Denmark, Hungary, Italy, Poland and Slovakia. Effective population sizes among the conserved breeds were estimated. Moreover, inbreeding rates *per* generation were studied. Genetic uniqueness versus similarity was compared using morphological markers. Characterization of performance was done as well. Changes in population structures were suggested to increase the effectiveness of conservation attempts.

From the historical perspective

Most of the breeds (from five European countries) studied in this paper are indigenous and have been present in the agricultural landscape for centuries. In Denmark archaeologists found graves with chicken bones dating more than

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1,000 years back (placed usually in women's graves). Those birds were similar to contemporary Danish Landrace Fowl. Several Padovana chickens are exhibited in the National Museum of Natural History in Paris, France. (MATASSINO et al., 1995c). Pictures of Sicilian Buttercup from the 16th century can be found in the Vatican and other museums (MATASSINO et al., 1995e). These are, however, just a few examples. Usually, it is possible to go back in the history of breeds only to the year of the first publication of their name. For instance in the 1840 s a Hungarian breeder, Szeremlei, described Transylvanian Naked Necks for the first time (SZALAY, 2002).

To avoid crossings with imported strains in Slovakia, Poland and Hungary it was decided to collect pure bred animals in one to four localisations to be bred in closed stocks. Slovakia was the first country belonging to the Council for Mutual Economic Aid (CMEA), which launched the preservation of local chicken breeds. With growing popularity of international lines, hens traditionally managed in back yards and farm yards were recognised as genetic, cultural and historical heritage (BENKOVÁ, 2002). In the 1970 s the Research Institute of Animal Production in Nitra proposed creating a genetic reserve of three local strains: New Hampshire, Rhode Island Red, White Sussex, and in 1994 a fourth one - Oravka. The projects have been realized by the Poultry Breeding Station in Ivanka at Danube (PRIID). In 1982 the first *ex-situ* conservation project was set up there. ROMANOV et al. (1996) reported plans to hold poultry genetic resources in Slovakia in the form of isolated DNA, and they have been realized at the PRIID.

In Poland local breeds have been included in a conservation program since 1972. Conservation projects of the National Research Institute of Animal Production were realized in two different groups – genetic reserve and gene pool (ROMANOV et al., 1996). Currently, all stocks of laying hens which participate in the conservation program are called a 'gene pool'. There is only one closed stock of each breed or strain in Poland except one – Green-Legged Partridge (Zk). Their existence at the Experimental Farm in Chorzelów near Mielec and Agricultural University of Lublin (Zk and Pb) is possible due to governmental subsidies. Studies on local breeds are carried out in the areas of ecology, physiology, molecular genetics, quantitative genetics and quality of poultry products (see e.g. CYWA-BENKO, 2002). As part of the Biodiversity Conservation Program in the Kurpie region farmers have been given purebred hens. In recent years, a growing interest, especially in Green-legged hen with the Partridge plumage colour (Green-Legged Partridge), has been noted among hobbyists.

In Hungary, already in the 1950 s individual breeders started to collect specimen of old breeds to save the last animals of traditional livestock. They took up the idea again in 2000, when original individuals of Partridge coloured Hungarian chicken were collected in the Hungarian countryside. It is considered to be a traditional Hungarian chicken breed which, however, disappeared as a stock in the 1950 s, mostly due to the recessive character of this colour relatively to all others. When the national program to save traditional breeds started in the 1970 s, there was no such stock to conserve. After four years of slight selection for colour the breed was officially registered again as a gene bank stock in 2004.

The main location of the 7 indigenous breeds included in the Hungarian conservation programme is the poultry gene bank of the Institute for Small Animal Research in Gödöllő. The breeding program is supervised by the Association of Hungarian Small Animal Breeders for Gene Conservation. Regarding subsidy system, the major role is to be taken over by the National Agri-Environment Protection Program. Conservation is secure in elite stocks of the gene

banks, however, offspring can rarely be sold for breeding purposes, which is the task of the future.

In Italy, the conservation of avian genetic resources is part of the institutional activity at many universities and also public funds are finalized to this aim. A working group was constituted by the Italian Branch of WPSA with the aim to study biodiversity in avian species. The effectiveness of conservation programs is related to the possibility of cooperation between research structures and local administrations that are interested in studying "their" local breeds, so to promote their re-introduction in the productive system. The strategy of conservation proposes creation of reproduction stocks. It should be followed by intensive multiplication and selection within stocks. Purebred individuals are distributed in the area, preferably on traditional regions of prevalence. There is a technical education of breeders through courses, seminars, etc. They are necessary if breeders who deal with conservation do not have adequate knowledge on morphological and functional assessment of animals. Otherwise, their mistakes in reproduction could defeat conservation efforts. The supervision of conservation stocks has been taken over by controlling units (ZANON and SABBIONI, 2001).

In Denmark genetics of poultry, including old breeds, is the prerogative of the Department of Animal Science and Husbandry at the Royal Veterinary and Agricultural University and the Danish Institute of Agricultural Sciences. Still, there is carried out neither conservation program, nor breeding scheme for the only indigenous chicken breed, the Danske Landhøns. Responsibility for its preservation has been taken by hobbyists. The main organization of breeders is the Special Club for Danish Landrace Fowl, which is affiliated to The Danish Association for Poultry Breeding (GENETIC RESOURCES COMMITTEE 2002). They receive no subsidies. Dissolution of individual stocks, exaggerated inbreeding and lack of assessment of existing resources are the most challenging problems in conservation efforts. In 1879 the Poultry Breeder Organization recommended farmers not to cross the Old Danish Landrace with other breeds. Every year there were exhibitions of farm animals in Denmark (for example in Roskilde in June) at which also Danish Fowl is presented. It is favoured for its appearance, rareness and long tradition of keeping. Still, official restrictions force some fanciers to give up breeding and there are few young people interested in keeping Danish Fowl. The population size may become too small to enable the breed to survive.

Populations studied

Local breeds were identified based on DAD-IS and data from institutions specialized in chicken genetic resources in all the five countries. For 37 breeds precise numbers of breeding animals were found. Effective population sizes and inbreeding rates per generation for all studied breeds were estimated.

The effective population size (N_e) corresponds to the size of an idealized population in which individuals evenly contribute to the gene pool. As assumptions of random mating and no selection are questionable, the effective size of chicken populations estimated in this paper is only a rough approximation of the upper limit. It was calculated according to the formula given by WRIGHT (1931):

$$N_e = \frac{4N_f N_m}{N_f + N_m}$$

where: N_f is the number of dams, N_m is the number of sires.

Inbred populations are in fact smaller than non-inbred populations of the same size, since fewer genes are availa-

ble for selection (QUINTON, 2003). The increment of hypothetical inbreeding (ΔF) is inversely proportional to the number of individuals that evenly contribute to the gene pool:

$$\Delta F = \frac{1}{2N_e}$$

The studied breeds have found attention within each country as its own genetic reservoir, which should be preserved. There is a trend to exploit unique and exceptional qualities of old breeds. Therefore, a description of production performance in this paper focused on their adaptation to local environments. The last part presents the morphological

features of chickens, such as plumage, colour of skin, shanks and feet, types of comb, colour of egg shells and the effect of dwarfing genes on depressed growth in some breeds.

Effective population size

Estimated effective population sizes are given in Table 1. The total number of breeding animals was the highest for Italian strain of Leghorn – 2,800 individuals, and the lowest for genetic reserve of Rhode Island Red strain, kept in Slovakia – 170 individuals. The N_e/N ratios varied widely from 0.33 to 0.84. Even though the total population size of Bionda Piemontese and Padovana was lower than the one of Hungarian Yellow and Hungarian Speckled, effective popu-

Table 1. Effective population sizes, sex ratio (N_m/N_f) and N_e/N ratio in analyzed breeds.

Effektive Populationsgröße, Geschlechtsverhältnis (N_m/N_f) und Verhältnis der effektiven Populationsgröße zu tatsächlichen für die untersuchten Rassen

Genetic group	country	N_e	N_e/N	N_m/N_f
Leghorn Leg [s]	IT	2285	0.82	0.40
http://www.agraria.org/polli/biondapiemontese.htm [b]	IT	1142	0.82	0.40
http://www.agraria.org/polli/padovana.htm [s]	IT	900	0.75	0.33
http://www.agraria.org/polli/polverara.htm [b]	IT	900	0.75	0.33
http://www.agraria.org/polli/valdarnese.htm [b]	IT	900	0.75	0.33
http://www.agraria.org/polli/robustamaculata.htm [b]	IT	872	0.79	0.38
http://www.agraria.org/polli/romagnola.htm [b]	IT	840	0.84	0.43
Siciliana [s]	IT	750	0.75	0.33
Hungarian Yellow [b]	HU	706	0.34	0.10
Hungarian Speckled [b]	HU	692	0.44	0.14
Ancona [s]	IT	640	0.64	0.25
http://www.agraria.org/polli/modenese.htm [b]	IT	622	0.69	0.29
http://www.agraria.org/polli/biancadisaluzzo.htm [b]	IT	571	0.82	0.40
http://www.agraria.org/polli/robustalionata.htm [b]	IT	571	0.82	0.40
Danish Landrace Fowl [b]	DK	521	0.45	0.15
Leghorn G99 [s]	PL	452	0.59	0.22
http://www.agraria.org/polli/ermellinatarovigo.htm [b]	IT	320	0.64	0.25
Green-Legged Partridge Z11 [s]	PL	268	0.37	0.12
Leghorn H22 [s]	PL	268	0.38	0.12
Rhode Island Red R11 [s]	PL	268	0.38	0.12
Yellow-Legged Partridge Z33 [b]	PL	252	0.35	0.11
Sussex S66 [s]	PL	250	0.37	0.12
Partridge colour Hungarian chicken [b]	HU	227	0.61	0.23
Transylvanian Naked Neck Speckled [v]	HU	193	0.38	0.12
http://www.agraria.org/polli/collonudo.htm [b]	IT	184	0.71	0.30
Green-Legged Partridge Zk [s]	PL	181	0.33	0.10
Polbar Pb [b]	PL	181	0.33	0.10
http://www.agraria.org/polli/pepoi.htm [b]	IT	181	0.33	0.10
Hungarian White [b]	HU	180	0.35	0.11
Transylvanian Naked Neck White [v]	HU	180	0.35	0.11
Transylvanian Naked Neck Black [v]	HU	179	0.36	0.11
Mericanel Brianza [b]	IT	171	0.49	0.17
Valdarno [b]	IT	150	0.75	0.33
New Hampshire [s]	SK	107	0.38	0.12
http://www.agraria.org/polli/millefioridilonigo.htm [b]	IT	100	0.56	0.20
Sussex [s]	SK	72	0.33	0.10
Rhode Island Red [s]	SK	70	0.42	0.13

Note on symbols: N_e - effective population size, N_e/N - ratio of breeding animals, effectively contributing genes to population, N_m - number of males, N_f - number of females.

b - breed, *s* - strain, *v* - variety

lation sizes of these Italian breeds were higher. It is a consequence of a strategy in Italy to increase the number of males, ideally to be as close as possible to the number of females for minimizing the family bond between parents. It is the first priority of conservation and determines maximization of the effective population size (ZANON and SABBIONI, 2001).

There is a potential in populations, which have a lower proportion of males, to increase their effective population size without changing the census population size. In Jungle Fowl the basic social unit consists of a dominant male with a harem of 4-12 females and their sub-adult progeny. So, the male: female ratio is between 0.08-0.25. In most populations studied here this ratio is lower than 0.25 and could be increased. There may be proposed even an increase in the number of cocks in genetic reserve stocks which have a low share of males, together with decreasing size of stocks. Let us imagine the following situation. In a group of 600 females and 60 males N_e equals 218. The sex ratio is 0.1. A similar value of N_e could be found in a group of 65 cocks and 325 hens (sex ratio 0.2). Decreasing the size of flocks in this way changes neither the effective population size nor the inbreeding coefficient.

Hypothetical inbreeding level within populations studied

Estimates of the inbreeding increment per generation are shown in Table 2. Leghorn (ancestral Italian strain) and Bionda Piemontese have the lowest hypothetical inbred increase of all analysed breeds. Inbreeding coefficient equal to 0.02% means that 0.02 percent of heterozygosity is lost in one generation. It is expected that 9.98% of genetic variability remains within the population. Minimization of the inbreeding rate is in Italy the second priority (after increasing effective population size) in conservation. On the contrary, genetic reserves of Slovakian breeds are semi inbred. The hypothetical inbred increase is the highest for them: 0.71 percent in the Rhode Island Red strain and 0.68 percent in the Sussex strain.

As effects of bottlenecks and subdivision of populations were omitted in calculations, in analysed populations indi-

viduals may carry more identical genes than expected. Especially, for the Danish Fowl the mean inbreeding level of 0.1% is probably underestimated. It is the most dispersed of all populations studied here. Also, in the 1950 s there was a temporary period when a population was reduced to only 20-30 individuals. Currently there are around 100 flocks with 5-7 hens and one cock on average and relatives are often mated. Still, inbreeding level was never precisely measured for any of breeds analysed in this paper.

As for other breeds, estimation of inbreeding level made by AMELI et al. (1991) on commercial lines of White Leghorn showed inbreeding increase of approximately 0.60% per generation. This estimates based on number of sires and dams mated and the variances and covariances of progeny family size agreed very well with those from pedigree analysis.

Based only on numbers of breeding males and females it can be estimated, that 99.29 - 99.98% of genetic variability of local chickens is transmitted to the next generation. If N_e was very large most of the genetic variability would be maintained by consecutive generations. On the contrary, if the effective population size was very small, heterozygosity would be removed and inbreeding rate would become significant. Adaptive and evolutionary ability, important in *in-situ* and *ex-situ* conservation, could be lost.

Some performance traits

Egg production dominates in utilization of traditional breeds in all countries, except Italy. The best performance among the breeds studied is at the level of 70% in comparison to industrial lines. Italian strain of Leghorn and such breeds as Ancona, Padovana and Valdarno have records of 220 eggs per year. In contrast to them native Hungarian and Transylvanian breeds have a very short breeding season, which lasts from January to July. They lay 64-90 eggs per year on average (SZALAY, 2002). Still, Transylvanian Naked Necks are regarded as good layers in a winter season. This used to be reported for Slovakian breed Oravka, too (BENKOVÁ, 2002).

Table 2. Level of hypothetical inbreeding (ΔF %) in populations studied
Theoretischer Inzuchtgrad (ΔF %) in den untersuchten Populationen

Genetic group	ΔF %	Genetic group	ΔF %
Leghorn Leg	0.02	Rhode Island Red R11	0.19
Bionda Piemontese	0.04	Yellow-Legged Partridge Z33	0.20
Padovana	0.06	Sussex S66	0.20
Polverara	0.06	Partridge colour Hungarian chicken	0.22
Valdarnese	0.06	Transylvanian Naked Neck Speckled	0.26
Robusta maculata	0.06	Collo nudo Italiano	0.27
Romagnola	0.06	Green-Legged Partridge Zk	0.28
Siciliana	0.07	Polbar Pb	0.28
Hungarian Yellow	0.07	Pepoi	0.28
Hungarian Speckled	0.07	Hungarian White	0.28
Ancona	0.08	Transylvanian Naked Neck White	0.28
Modenese	0.08	Transylvanian Naked Neck Black	0.28
Bianca di Saluzzo	0.09	Mericanel Brianza	0.29
Robusta lionata	0.09	Valdarno	0.33
Danish Landrace Fowl	0.10	New Hampshire NH	0.47
Leghorn G99	0.11	Millefiori di Lonigo	0.50
Ermellinata Rovigo	0.16	Sussex SU	0.69
Green-Legged Partidge Z11	0.19	Rhode Island Red RIR	0.71
Leghorn H22	0.19		

Chickens kept in households were provided with minimal care influencing their performance.

In local flocks there are individuals with records deviating significantly from the mean. For example Oravka hens lay 190 eggs per year on average, but there were reported individuals, which laid 280 eggs per year (BENKOVÁ, 2002). CYWA-BENKO (2002) found a positive correlation between weight of adults and average number of eggs in Green-Legged Partridge.

Traditional breeds tolerate poor feeding. For Hungarian breeds there is reported good seeking habit (SZALAY, 2002). Green-Legged Partridges are able to gather feed far away from their fowl-house (ROMANOV et al., 1996) and have good scavenging ability (CYWA-BENKO, 2002). Other breeds for which good performance in poor environmental conditions has been reported are Yellow-Legged Partridge, Polbar and Rhode Island Red R11 (CYWA-BENKO, 2002). Only local breeds in traditional management still have a strong brooding instinct, and eggs do not have to be incubated. It is neither a necessary, nor desirable trait for hens in cages. For instance Green-Legged Partridges are known for brooding. Fertility rates reported for them range between 89-97% and hatchability of laid eggs is high as well – 83% (CYWA-BENKO, 2002).

In local breeds of chickens maturity age varies from 4.5 to 6 months. Females usually lay the first egg at the age of 5.5 months. Males reach maturity in principle 2 weeks later. Only for Hungarian cocks it is 2 weeks earlier than for hens and quite early – at the age of 4.5 months (SHERF, 2000). Italian hens which belong to light Mediterranean stock mature the latest of all studied breeds. They also have the highest records in egg production.

A great advantage of local breeds is their resistance to many diseases. It may be also one of the breeding goals for conservation. Therefore, obligatory vaccination program against Newcastle Disease and bird flu for Danske Landhøns is regarded as a threat for this breed. Resistance against common diseases is an adaptation to production systems and allows for medicine-free food intake. This characteristic was reported apart from Danske Landhøns (PERMIN et al., 2001) for instance in Green-Legged Partridge, Yellow-Legged Partridge, Polbar and Rhode Island Red R11 (CYWA-BENKO, 2002). Breeds mentioned here may be used in studies on the genetic basis for resistance and susceptibility to diseases.

Rare breeds are suitable for ecological production, as their products are regarded to be of better quality. Studies on Green-Legged Partridge showed that this breed has low cholesterol level in the egg yolk (CYWA-BENKO, 2002). Promotion of branded products from ecological farms increases interest in household production of old breeds.

Exterior characters

The exterior of chickens as described below represents huge variability. Native breeds from all the studied countries are well adapted to local environmental conditions, which are often quite harsh. Danish Fowl is appropriate for temperate climates, possibly because of the small single comb and dense feather covering, whereas Naked Necks in Hungary are resistant to heat stress due to limited feather covering (SZALAY, 2002).

Most breeds under consideration possess a single comb. Two types of combs are observed in Leghorn (Leg) population in Italy. About 90 percent of birds have a single comb and 10 percent possess a rose type comb (MATASSINO et al. 1995b). The rose comb is frost-hardy. For example, Slovakian native breed Oravka which shows resistance to low temperatures possesses a rose comb (BENKOVÁ, 2002, ROMANOV et al., 1996). Among Italian breeds Padovana and

Polverara-Schiatta have duplex or V-shaped comb. A very unique type of comb is represented in the population of Sicilian Buttercup and gives the name to the breed. It is cup-shaped.

The colour of skin, shanks and feet varies in the studied breeds, as well. Yellow or white skin and yellow or white shanks are most common. Depending on the amount of produced pigments green, blue and black colours are also possible. Only in Polish indigenous breeds, Yellow-Legged Partridge and Green-Legged Partridge, a blue-dark skin is observed. In hobby and fancy breeding an exceptional colour of shanks and feet is an advantage. Siciliana, Polverara-Schiatta, and Green-Legged Partridge have green shanks, Danish Fowl, Padovana, Romagnola and Valdarno blue, Transylvanian Naked Neck Black black (SHERF, 2000), all Leghorn strains yellow ones.

Apart from the original wild-type plumage, a whole palette of feathering colour was found in studied breeds. In Italy, for example a lot of different colour varieties of ancestral Italian Leghorn are bred (white, black red, silver duckwing, barred, blue, black and buff).

In certain colour variants sexual dimorphism can be observed. Green-Legged hens are partridge coloured, whereas, cocks are ginger-brown with dark golden head and hackle, golden-orange saddle, black chest with green sheen, black-grey flight feathers, black sickles and abdomen (CYWA-BENKO, 2002). Some strains possess patterns within the feather, such as barred, mottled, laced or pencilled.

The different colour of down of female and male chicks may be very useful in breeding. Sexing of most chickens is difficult. There are some genes in some lines which would produce colour differences that indicate the sex of the chick. One example of breed which may be auto-sexed is Polbar. This trait was a key characteristic, while establishing the breed in 1946 (ROMANOV et al., 1996). One-day-old females have longer black "eyebrows" than males. Auto-sexing is possible also in Green-Legged Partridge Z11 (CYWA-BENKO, 2002).

In Hungary there is a prevalence of breeds laying eggs with tinted shells (SZALAY, 2002) and in Slovakia brown. Among Polish breeds, Rhode Island Red (R11) has brown egg shells and Yellow-Legged Partridge brown with red speckles. All other analysed breeds in Poland have light colour of egg shells – white or cream white (CYWA-BENKO, 2002). In Italy consumers prefer eggs with brown shells and not white, laid by most local breeds. Therefore native breeds are usually kept there only for fancy (MATASSINO et al., 1995a-e). It is true also for Livorno (ancestral Leghorn strain) which made an international career as an exceptional layer. In general, the light breeds laying whiteshelled eggs have white earlobes and the heavy ones laying brownshelled eggs have red earlobes.

Dwarfing genes have a depressing effect on growth rate after hatch. The biggest effect comes from the sex-linked recessive *dw* gene. Adult birds of the same origin weigh 30 percent (females) and 40 percent (males) less in comparison with normal-sized ones. Eggs are also smaller by 10 percent. Other features, such as healthiness and hatchability are not affected (SOMES, 1990).

Dwarfism is an attractive trait for fancy keepers. In a part of Livorno (Leg) population exist the sex-linked bantam dwarfism. Some farmers appear to distinguish this group as a different breed (MATASSINO et al. 1995b). A similar situation occurs in Ancona and Padovana. On the other hand there are populations, such as Siciliana and Valdarno, in which no dwarfs are observed. Nevertheless, most bantam breeds are not carriers of the dwarf gene *dw*, but are selected based on the natural variation in size (HUTT, 1965).

Of special interest for some hobby breeders is "Luttenhøne", short-legged variety of the Danish Landrace Fowl. It is a carrier of the Creeper gene that is lethal in its homozygote form (SØRENSEN et al. 2004).

A lack of awareness of the difference between conserving phenotypes and genotypes can be sometimes observed. Fanciers in Denmark continue crossings of Danish Fowl with imported strains. When the Special Club for Landrace was in operation, some breeders developed Landrace Fowl in new colours by cross-breeding and often with fewer genes from the original Landrace Fowl than all the other breeds. In the long run it will gradually dilute the original genetic pool of the total population. The brown offspring from the mixed population will be admitted into the genuine brown Danish Landrace Fowl.

Local breeds of hens, developed through natural and artificial selection are differentiated and possess unique features. Populations of the same breed in different countries – sharing the same name and originating from a common gene pool may still represent two various genetic resource populations, if they were developed in two different directions.

Final comments

1. Four of the five analysed countries (except Denmark) preserve traditional strains of chickens *in-situ* within national and international projects. The most common method used is closed populations with 1-4 localizations in Poland, Hungary and Slovakia. In Italy local flocks of hens belong often to fanciers, so part of the conservation strategy is collaboration between scientific institutions and hobbyists.
2. Effective population sizes in studied breeds vary between 33%-82% of census population sizes. With an increasing number of males in some stocks, effective population size could come closer to its census value.
3. Monitoring the inbreeding rate is considered to be one of the most important tasks in safeguarding variability of local populations. For local chicken breeds it was evaluated between 0.02-0.71 percent.
4. The local breeds studied are diversified morphologically. Characterization and evaluation of the degree of uniqueness of a breed is a vital part of conservation plans.
5. Information exchange between countries about better use of local breeds and common programs help to safeguard local stocks and set priorities in conservation undertakings, taking into account the presence of close relatives of a breed in other countries.
6. Indigenous chicken breeds can be conserved for a long time, if commercial use of breeds – based on the high quality meat and egg production capacity – is elaborated. In this respect, finding a way to using the breeds in organic or ecological farming and/or in national quality production will be crucial.

Summary

Local chicken breeds are a vital reservoir of gene resources. Because of small population sizes they can survive only if there is someone who takes responsibility for their preservation. This study analyzed conservation populations of 41 locally adapted chicken breeds and strains in Poland (8 breeds and strains), Denmark (1 breed), Hungary (8 breeds and varieties), Italy (20 breeds and strains) and Slovakia (4 breeds and strains). Sources of information

were mainly materials shared by institutions dealing with this topic in their home countries. The stress was put to comparison of diverse morphological and reproductive traits in hens. Effective population sizes and hypothetical inbreeding increments were investigated within genetic groups.

Various countries implement different methods of conservation of their genetic resources. A huge activity of hobbyists in cooperation with research institutions was found in Italy, in contrary to a lack of conservation projects in Denmark. In Poland, Hungary and Slovakia genetic reserve stocks were analyzed *in-situ*. Genetic variety of studied breeds was found in diversified and unique morphological traits. Adaptation to local environment which is reflected in performance of birds was expressed in low to moderate production, high fertility and hatchability rates, as well as resistance to many diseases and poor management. In conserved stocks with small sex ratios increasing number of males will allow to reducing population sizes of some breeds without any effects or changes in effective population size or in inbreeding rate. The latter was assessed as not high (about 0.02-0.71 percent per generation). Results are an incentive to significant improvement in the accessibility of genetic resources through research and development. They are also shown as confirmation of validity of international efforts to conserve locally adapted breeds.

Key words

Biodiversity, chicken, conservation, inbreeding

Zusammenfassung

Populationsgrößen in Erhaltungszuchtprogrammen für einheimische Hühnerrassen in ausgewählten Ländern Europas

Einheimische Hühnerrassen sind eine wichtige Genreserve für die Hühnerzucht. Auf Grund der geringen Populationsgrößen können diese Rassen nur in speziellen Konservierungsprogrammen erhalten werden. In der vorliegenden Studie wurden 41 einheimische Hühnerrassen und – schläge aus Konservierungsprogrammen in Polen (8 Rassen und Schläge), Dänemark (1 Rasse), Ungarn (8 Rassen und Schläge), Italien (20 Rassen und Schläge) und in der Slowakei (4 Rassen und Schläge) untersucht. Die verwendeten Informationen stammten in erster Linie aus den Einrichtungen, die die Erhaltungszucht in den jeweiligen Ländern durchführen. Der Vergleich wurde anhand verschiedener morphologischer und reproduktiver Merkmale der Hennen vorgenommen. Ferner wurden die effektive Populationsgröße und die theoretische Zunahme der Inzucht innerhalb der genetischen Gruppen bestimmt.

In den verschiedenen Ländern werden unterschiedliche Programme zur Erhaltung der genetischen Ressourcen eingesetzt. Während in Italien eine enge Kooperation zwischen den Rassegeflügelzüchtern und Forschungseinrichtungen besteht, existiert in Dänemark kein spezifisches Erhaltungszuchtprogramm. In Polen, Ungarn und in der Slowakei wurden die Genreserven *in-situ* untersucht. Für diversifizierte und einmalige morphologische Merkmale wurde bei den untersuchten Rassen eine deutliche genetische Variabilität beobachtet. Die Anpassung an die lokalen Umweltbedingungen zeigte sich vor allem im Leistungsvermögen der Hühner. Die Legeleistung war gering bis mäßig, die Fruchtbarkeit und die Schlupfraten waren hoch, wie auch eine Resistenz gegen viele Krankheiten und

schlechtes Haltungsmanagement beobachtet wurde. Ferner zeigte sich, dass bei einigen Rassen, die als Erhaltungszuchtherden mit einem engen Geschlechterverhältnis gehalten werden, durch eine Erhöhung der Anzahl der Hähne die Populationsgröße reduziert werden kann, ohne Auswirkungen auf die effektive Populationsgröße oder die Inzuchtrate. Generell wurde die Inzuchtrate als gering angesehen (0,02 bis 0,71% je Generation). Die vorliegenden Ergebnisse können als ein Anreiz zur Verbesserung der Verwendung der genetischen Ressourcen durch Forschung und Entwicklung angesehen werden. Sie sind ferner eine Bestätigung für die Wichtigkeit internationaler Aktivitäten zur Erhaltung von einheimischen Hühnerrassen.

Stichworte

Huhn, Biodiversität, Konservierung, Inzucht

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