Conservation of local Turkish and Italian chicken breeds: a case study

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Abstract

Increased global use of highly productive breeds of farm animals has been associated with a loss of genetic diversity in most species, especially in local poultry species. Since 2000, in Italy, and most of all in Veneto region, various governmental, non-governmental and private organizations have tried to preserve the genetic diversity of poultry resources. This successful conservation effort has included various activities: improving knowledge on biological functions, conserving typical morphological characteristics, developing a selection of strategies, controlling inbreeding and, valorizing strategies to diffuse breeds in local productive systems. These activities represent a good example for developing countries such as Turkey. With the aim of helping to conserve Turkish poultry resources, this study describes the current status of local chicken breeds in Turkey and Italy, and makes some recommendations for developing countries such as Turkey.

Introduction

The conservation of animal genetic resources (AnGR) is essential to sustaining and improving the quality of life on earth, both in the present and the future. Despite their life-sustaining value, an increasing loss of AnGR is unfortunately being observed for all agriculturally-used species, especially poultry genetic resources, which are considered to be among the most endangered (Zanon and Sabbioni, 2001; Weigend et al., 2004; Bianchi et al., 2011). Over the past 50 years, poultry meat and egg production from individual birds in commercial flocks of broilers and layers has increased enormously, largely owing to genetic selection in the nucleus breeding flocks of poultry breeding companies and the rapid transfer of these gains to the commercial crossbred progeny. On the other hand, current breeding strategies for commercial poultry concentrate on specialised production lines, derived by intense selection from a few breeds and very large populations with a great genetic uniformity of the traits under selection. This has resulted in genetic erosion for the unselected local breeds, which are normally less productive than synthetic hybrids (Notter, 1999; Besebs et al., 2008).

The rural poultry population in most countries accounts for more than 60% of the total national poultry population (Mogesse, 2007). However, inadequate attention has been paid either to the evaluation of these resources or to the setting up of realistic and optimum breeding goals for their improvement. As a result, many such breeds with low productivity are at high risk of extinction under rural production systems (Alemu, 1995; FAO, 2011; Hoffmann, 2011). In addition, there are numerous local chicken breeds that are characterized by medium or low performance and maintained in small populations (Guye, 1997). These local breeds are facing genetic erosion, which may lead to the loss of valuable genetic variability in specific characteristics (Romanov et al., 1996). The Food and Agriculture Organization (FAO) of the United Nations (UN) has called attention to the alarming trend of disappearing large numbers of local livestock breeds, and also estimated that 40 breeds of chicken have become extinct (FAO, 2010a, 2010b). According to FAO (2007, 2011), about 25% of chicken breeds are the subject of conservation programmes; however, information about the nature or efficiency of these programmes is still being debated (Hoffmann, 2009, 2011; Pym, 2010). Correspondingly, based on reports made by countries to the FAO, only 15% of countries (half of them developing countries) have poultry conservation programmes, covering 63% of local breeds and 11% of national populations of transboundary breeds (Singh and Fotsa, 2011). The global databank indicates that 195 poultry species and breeds (of which 77% are chickens, 9% ducks, 9% geese and 3% turkeys) are subject to conservation programmes, but some of these data are out of date (Hoffmann, 2009; Pym, 2010). For 70% of these breeds, the population figures were collected before 2000 so that a new population census is required to update these data (Hoffman, 2009).

Safeguarding poultry biodiversity is a key objective in every developed country, including Italy, which places on it cardinal importance. However, within the last hundred years, the number of endangered local breeds has dramatically increased, leading to an irreversible loss of genetic resources (Zanon and Sabbioni, 2001). The reasons for this negative trend mainly lie in the fact that only a few breeds are selected to maximize yields and that specialized cross-breeds for the various production outputs are created (Bianchi et al., 2011). A consequence of this loss of genetic diversity is that forty traditional poultry breeds which were reared in Italy until recently have now become extinct (Zanon and Sabbioni, 2001). Currently, the conservation of avian genetic resources is part of the institutional activity in many Italian universities and public funds are destined for facing this threat as well.

In developing countries, the effects of genetic loss have been much more severe than in developed countries. Similarly in Turkey, with its increasing urbanisation, the contribution of commercial breeds to overall poultry meat and egg consumption is growing ever more rapidly (FAO, 2004b). This has triggered the
use of commercial hybrids and caused genetic loss in Turkish local poultry species and breeds. Unlike Italy, the conservation strategies for Turkish poultry resources are still debatable and deficient. In this paper, the authors have attempted to analyse cases of conservation programmes for local chicken breeds in Turkey and Italy. Based on an Italian model that has proved to be a successful example of poultry conservation, the paper also aims to contribute to conservation strategies for poultry breeds in Turkey.

Future beneficiaries of conservation programmes are likely to increasingly spread throughout the world. Therefore, conservation programmes should be considered an international responsibility (Spalona et al., 2007). With this approach in mind, the main aim of this paper is to put the case for conservation programmes and strategies, and the status of local chicken breeds in Turkey and Italy.

**Conservation of local chicken breeds**

**Turkish scenario**

Recently, 46 breeds of farm animal genetic resources have been included into some conservation schemes supported by the General Directorate of Agricultural Research and Policy of Turkey (GDAR) (Turkish Regulation, 2004). Although a comprehensive programme for the conservation of farm animal genetic resources in Turkey is being running, unfortunately poultry species are only represented by two local chicken breeds Denizli and Gerze (Tables 1 and 2) in this scheme (Turkish Regulation, 2004; Ertugrul et al., 2010; Ministry of Food, Agriculture and Livestock, 2011b). This case demonstrates the alarming results of genetic attrition in the poultry resources of Anatolia, a region which has a great potential for biodiversity given its peculiar climate, geographical and cultural characteristics. Despite the current situation in poultry genetic resources of Turkey, the conservation of local poultry breeds began in 1930 with the establishment of the Ankara Poultry Research Institute Directorate. The Institute had various missions, including: collecting and evaluating data for poultry research, transferring the results to the field and public basis, planning a strategic research for implementation at national and regional levels, ensuring the development and spreading into the market of the high-yield poultry genotypes needed by the poultry sector, maintaining and developing the genetic resources of the domestic material and hybrids in poultry, and developing and using biotechnological methods for improving breeds. Although these activities appeared as a hopeful trend, the activities of the Institute have gradually decreased with the effects of industrialisation, the import of commercial hybrids from developed countries and the wide use of commercial breeds in meat and egg production. The Institute was recently reactivated by GDAR, in 2011, and one of its most important activities has been the production of national chicken hybrids (Atabey, Atak and Atak-S), using pure lines (Ministry of Food, Agriculture and Livestock, 2011a). On the other hand, local Turkish chicken breeds – Denizli and Gerze – were placed in a conservation programme by GDAR at the Lalahan Central Livestock Research Institute in 1997 (FAO, 2004a). Despite all these recent developments, activities related to the conservation of poultry resources are still inadequate in the context of the biodiversity potential of Turkey.

In brief, local poultry genetic resources were not adequately evaluated until 1930 in Turkey, even though some of the genotypes had become extinct or were facing extinction risk. At this point, one may ask why these breeds are not conserved adequately in Turkey. There may be several answers to this question, but there is one response that is common to most developing countries: with increasing urbanisation, the contribution of commercial breeds to overall poultry meat and egg consumption is growing ever more rapidly in many countries including Turkey (Weigend et al., 2004; Besbes et al., 2008). In addition to the results of this rapid development in commercial poultry breeding, the indigenous chicken population of Turkey suffered loss with the introduction of improved stock from developed countries in 1960. Another major problem for the conservation of local poultry breeds is lack of information about their population numbers, distribution and risk status in Turkey. The risk status of local poultry is therefore predicted on the basis of current data such as census information, research outputs and expert evaluation, but this is still insufficient. Moreover, some of the breeds have been lost without characterisation and recording. According to the decisions of the Government of Turkey, poultry species in large populations were destroyed as potential carriers of avian influenza, without any biological testing in some regions, especially in the eastern part of Turkey where they

**Table 1. Conserved local chicken breeds in Italy and Turkey (Zanon and Sabbbioni, 2001; Turkish Regulation, 2004).**

| Chicken breeds          | Region of origin |
|-------------------------|------------------|
| Italia                  | Lombardia        |
| Mericanel della Brianza | Marche           |
| Ancona                  | Piemonte         |
| Bianca di Saluzzo or Di Ca'vour | Piemonte |
| Bionda Piemontese       | Sicilia          |
| Siciliana               | Toscana          |
| Magellesse              | Toscana          |
| Valdadmesse Bianca      | Veneto           |
| Padovana                | Veneto           |
| Pépoli                  | Veneto           |
| Ermellinata di Rovigo   | Veneto           |
| Polverara               | Veneto           |
| Robusta Lionata         | Veneto           |
| Robusta Macalata        | Veneto           |
| Turkey                  | Denizli          |
| Denizli                 | Sinop            |
| Gerze                  |                  |

**Table 2. Traits of local chicken breeds in Turkey and Italian Veneto region (Turkish Regulation, 2004; Veneto Agricoltura, 2004).**

| Chicken breeds          | SM, months | AFBW, kg | AMBW, kg | EW, g  | EC   |
|-------------------------|------------|----------|----------|--------|------|
| Veneto                  |            |          |          |        |      |
| Robusta Macalata        | 5-7        | 2.8-3.3  | 4.0-4.5  | 55-60  | Rose |
| Robusta Lionata         | 5-7        | 2.8-3.3  | 4.0-4.5  | 55-60  | Rose |
| Ermellinata di Rovigo   | 5-7        | 2.2-2.6  | 3.0-3.5  | 55-60  | Rose |
| Pépoli                  | 5-6        | 1.0-1.1  | 1.3-1.5  | 40-45  | Rose |
| Padovana                | 5-7        | 1.5-2.0  | 1.8-2.3  | 50-60  | White|
| Polverara               | 5-7        | 1.5-2.0  | 1.8-2.3  | 50-60  | White|
| Turkey                  |            |          |          |        |      |
| Denizli                 | 6-8.5      | 2.0      | 1.5      | 50-52  | White|
| Gerze                  | 6-8.5      | 1.85     | 1.4      | 45-50  | White|

SM, sexual maturity age; AFBW, adult female body weight; AMBW, adult male body weight; EW, egg weight; EC, egg colour.
Conservation of local chicken breeds

are accepted as the gene stock of Turkish poultry resources. After these dramatic events, two local chicken breeds, Denizli and Gerze, are currently part of a GDAR conservation programme in closed flocks. This kind of conservation is however debatable, as it may cause increased homozygosity and genetic loss from the breeds, and is also potentially risky for epidemic diseases. In this perspective, a more effective conservation programme that includes different activities, such as improving knowledge of biological functions, conserving typical morphological characteristics, developing selection strategies, controlling inbreeding and, finally, agreeing valorization strategies to diffuse the breed in local production systems should be implemented (Zanon and Sabbioni, 2001; Cassandro et al., 2004; Weigend et al., 2004; De Marchi et al., 2005a; Nitsch, 2006; Sanetti, 2009). As a starting point for stopping the deterioration in poultry genetic resources and local chicken breeds of Turkey, a genetic conservation project has been designed by the authors of this review with the support of the Scientific and Technological Research Council of Turkey (TUBITAK). In this project, the method of conservation and valorisation (Co.Va.) of local poultry breeds in Veneto, i.e. one of the most successful examples of a poultry genetic conservation programme in Italy, has been followed (Cassandro et al., 2004; De Marchi et al., 2005a, 2005b; Sanetti, 2009; Sanetti et al., 2010).

Italian scenario

Italy had a wide diversity of animal breeds and populations, consolidated over the centuries thanks to a wide environmental variety. However, animal biodiversity has been threatened in the past few decades and remains in constant decline because of changes occurring in modern animal production systems. Rural areas have decreased, modern animal production systems are highly intensified and standardised, and highly productive breeds have become globally distributed and preferred to local breeds. This situation is greatly enhanced in the poultry sector, where only selected strains are reared for meat and egg production (Cerolini et al., 2010). With the introduction of commercial species, many local chicken breeds in Italy became extinct, as did in other countries of the world. Despite all these limitations, today 13 local chicken breeds still exist and are protected as part of various conservation programmes in various Italian regions (Table 1).

In Veneto, like in other Italian regions, several poultry breeds that were used for centuries have been abandoned for the last four decades due to rapid changes in intensive production systems. Unselected local breeds, which are normally less productive than cosmopolitan breeds and synthetic hybrids, became very marginalised, and only a few were able to survive. In order to mitigate this situation, in 2000 the regional government of Veneto, in collaboration with the University of Padova, implemented an in situ poultry conservation programme, the Co.Va. The Co.Va. programme involves four different poultry species (chicken, duck, helmeted guinea fowl and turkey) and four conservation nuclei located in different areas of the region. Six local chicken breeds (Robusta Maculata, Robusta Lionata, Ermellinata di Rivogio, Pépoi, Padovana and Polverara) are conserved as part of the project in different areas of Veneto region, amounting to half of the total number of local Italian breeds (Tables 1 and 2) (Cassandro et al., 2004; De Marchi et al., 2005a, 2005b; Sanetti, 2009). In 2004, four years after the beginning of the programme, the minimum population size per breed within each flock was greater than 50 for most breeds; this threshold is important as many studies demonstrated that a minimum population size of 50 limits the rate of inbreeding per generation to a value of 1%.

In conservation stations and farms, breeds are reared in free-range hen houses following the Co.Va. programme. Although there are houses are sometimes structured differently, the standards are largely the same for all poultry breeds and species, and breeding activities and conservation scheme have been developed simultaneously and equally in all flocks. Each breed within each conservation flock consists of 34 females and 20 males; males are divided into two distinct groups based on genetic relationships estimated using information from molecular markers; females of each breed are grouped together. Male groups are rotated between female groups from February to June. The reproduction period ends when 180 chicks per breed are attained. At hatching, chicks are individually tagged with wing tags. In October, new males and females are selected for use in the next season according to group of origin, breed phenotypic standards, and productive and reproductive performance. The conservation programme is based on a biannual change of all animals in order to extend the generation interval, increase effective population size and reduce genetic drift. Every year, for each breed within the flock, 50% of males (10 males per year) and females (17 females) are replaced. In December, birds are weighed and a blood sample is collected from all the males for DNA analysis. Until 2005, genotyping of the individual animals for the marker-assisted conservation scheme was carried out using the amplified fragment length polymorphism (AFLP) technique (De Marchi et al., 2006). After 2005, microsatellites were applied in the Veneto conservation scheme because they are well dispersed in the genome and highly polymorphic (Twito et al., 2007; Sanetti, 2009). About 30 microsatellites are currently routinely used for genotyping chicken breeds in the conservation scheme. While using this technique can help to preserve allelic diversity and existing genetic variation, they are also useful for genetic traceability purposes. Tracing the breed of origin of animal products represents an opportunity for the promotion of local genetic resources, with benefits for the local economy, breed valorisation and sustainable conservation of biodiversity.

Problems in conserving Turkish and Italian chicken breeds: a criticism

Although FAO defines animal genetic resources eligible for conservation as including animal populations that have economic potential, scientific use and cultural interest (Henson, 1992), the conservation of local breeds is a complex problem for countries (Hiemstra et al., 2010; Martin-Collado et al., 2012). This problem exists due to the complex background of conservation, which in turn is related to interactions among national government agencies, rural development agencies, non-government organisations, private organisations, co-operative groups of farmers, and economical, technical, genetic, social, cultural and political issues (Hiemstra et al., 2010; Alderson, 2011; Hiemstra, 2011; Hoffmann, 2011; Singh and Fotsa, 2011).

In order to spread conservation programmes for local poultry species in different countries, there needs to be an understanding of the productive and functional attributes of animals, breed populations, breed structure, quality of breed products, farming features, collaboration among farmers, production systems, technical-cultural and environmental aspects, marketing systems, aspects of the current marketing of breed products under farmers’ control such as branding, distribution channels developed by breeders, policies and legislation concerning local breeds (Hoffmann, 2009; Hiemstra et al., 2010; FAO, 2010a; Singh and Fotsa, 2011; Martin-Collado et al., 2012). The Co.Va. project is a good example relevant to this. In the late 1990s, in Veneto and other Italian regions, the regional-national government started to consider the problem of reducing the loss of biodi-
European Union (EU) regulation encouraged the support of biodiversity conservation, with specific subsidies for farmers who continued to use traditional and local varieties of vegetables and animal breeds. These EU regulations provided a framework for national actions and subsidies supporting the conservation of rare breeds (Woelders et al., 2006). Like other EU members, Italy supports the conservation and sustainable use of rare breeds. This is achieved by providing farmers with subsidies for rearing animals from rare breeds. Regional subsidies for biodiversity conservation [introduced by the EU Common Agricultural Policy (CAP) Rural Development Programme in the last ten years] has led farmers to participate (Bonesan, 2011). The Veneto Rural Development Programme – the regional plan for agricultural intervention – has included specific measures for biodiversity. The regional strategy, as defined by the programme, is derived from the contextualisation of EU and national objectives, with specific reference made to the local needs, strengths and weaknesses identified in the regional context analysis.

In addition to these actions, special organisations have been set up in some countries to supervise conservation of animal genetic resources (Singh and Fotsa, 2011). These organisations play a very important role in breed conservation and development, monitoring, stimulation of sustainable use, in situ conservation, and promotion of public awareness. Some organisations and societies involve citizens and ask for donations to fund conservation efforts for specific rare breeds (Woelders et al., 2006). In Veneto, the Veneto Agricultural Agency aims to encourage breeders at the national level to offer help in formulating strategies for the global management of common property resources, especially for the protection of threatened breeds of livestock and poultry. This organisation is also promoting and carrying out interventions in modernising farms and agro-forestry soil conservation, as well as making the most effective use of agricultural land and developing aquaculture and fisheries, in particular by using research, experimental trials and generating market support.

In the complex structure of conservation activities, breeders and breed societies are the most important players in the conservation of local poultry breeds. In particular, breed societies are important for the promotion and management of local breeds. FAO (2007) states that, if no society exists for a target breed, then it is worth establishing one. In addition to having responsibilities similar to those of farmers or associations of livestock keepers, breed societies take a special interest in animal recording, genetic improvement, and breed population monitoring. They also take measures to protect the breed if it is threatened with extinction or genetic erosion. In Veneto, small groups of poultry breeders formed an association called Pro Avibus Nostri (Padova, Italy). This society tries to save breeds by promoting strong linkages with, and finding new markets for, its traditional products. These products are easily accepted by consumers for their better quality, taste and flavour compared to commercial products. The price of traditional products derived from local breeds is normally higher than conventional ones, and this disparity helps farmers to achieve a good income in breeding local breeds unsolicited for commercial use. In Veneto, the conservation of avian genetic resources is part of the institutional activity of many universities, especially the University of Padova, and public funds are also allocated to this aim (De Marchi et al., 2005a, 2005b; Zanetti, 2009).

The effectiveness of conservation programmes depends on the possibility of co-operation among the actors involved in local breeds conservation, such as national governments, research and educational institutions (e.g. universities), non-governmental organisations (NGOs) and breeders’ associations, farmers and pastoralists, part-time farmers and hobbyists, and breeding companies (Delany and Pisenti, 1998; Blackburn, 2004; Nidup and Dorji, 2005; FAO, 2007; Hoffmann, 2009; Ertugrul et al., 2011). In Veneto, this effectiveness is strong due to integration between the University of Padova, Veneto Agricultural Agency (Legnaro) and Pro-Avibus Nostri (Padova). Despite this well-organised conservation scheme, problems exist. For instance, finding pure breeds, funding activities and determining markets for products from these breeds put pressure on the conservation scheme. The strategy to solve these problems must be based on the traceability of animal products and determination of peculiarities of fat composition, and quality of meat and eggs (Zanetti et al., 2009, 2011a, 2011b; De Marchi et al., 2011, 2012).

Unlike Italy, Turkey has many defects in its local poultry conservation programme, including a lack of animal records, very inadequate information about the remaining population size of local breeds, inadequate financial support from national government agencies, and network defects between government agencies, universities and breeders. Today, one of the main problems for Turkey is to determine the numbers and risk status of local poultry species and breeds. Unfortunately, there is no information about the population size of the local poultry resources except for the two chicken breeds Denizli and Gerze, which are part of a conservation programme implemented by national government agencies in closed flocks. In addition to these insufficiencies, most of the research carried out by universities and research institutes relates to commercial breeds and, as a consequence, information on breed characteristics is very limited.

It is known that conservation of local breeds is a high-cost practice and must be supported by national government agencies. In Turkey, a national programme for conserving poultry genetic resources started in 1930, establishing breeding programmes and support for farmers rearing local poultry breeds (FAO, 2004a; Ministry of Food, Agriculture and Livestock, 2011b). However, it was later stopped because of the limited financial resources available to support local poultry genetic resources. The government and research organisations have now established two gene banks for local breeds of sheep, goat, buffalo and horse, and, until 2002, conservation of these local breeds – except for poultry – have been subsidised by the government and other organisations (Turkish Regulation, 2004; Ertugrul et al., 2010; Ministry of Food, Agriculture and Livestock, 2011b). It is clear that there is a lack of appropriate conservation of poultry breeding in Turkey owing to inadequate policies, together with a lack of co-ordination and financial and technical support. This notwithstanding, most of the unregistered local poultry breeds in Turkey are currently reared, and also conserved indirectly by farmers in small flocks for special interests and as a hobby. Another main problem in the Turkish poultry conservation programme is the lack of co-operation among breeders, research institutes, universities and government agencies. Recently, a few universities and research institutes have carried out research into indigenous chicken breeds, but unfortunately the results of these studies cannot be transferred efficiently into the field because of the lack of a network among universities, institutes, breeders and government agencies. As a result of these accumulated problems, Turkey now urgently needs a well-designed conservation programme for local poultry resources. Some recommendations can be offered to Turkey for implementing an effective poultry conservation programme, based on the example of Veneto.
Establishment of a national poultry resource conservation structure

It is apparent that Turkey lacks a sound poultry policy, long-term poultry research plans, co-ordination among the relevant government organisations, universities and poultry producers, and organised poultry marketing systems for local poultry resource products. Therefore, there is a national poultry resource conservation structure in Turkey needs to be established. This structure could monitor the constraints to local poultry production, formulate research needs, develop plans and execute them in an organised way in order to ensure the overall development of local poultry farming in Turkey. Within this structure, national decision-makers would need to identify those breeds which genetic improvement programmes would be the most beneficial for. Such conservation programmes could include breeds classified as being at risk (FAO, 2007).

So far there is no national programme for conservation of poultry genetic resources, nor are there clear standards systematically carried out for identification and documentation in Turkey.

The conservation and development of local chicken breeds need to be given political and institutional support for researching experiments into products processing and added value, as well as for creating the right marketing environment (Ajmone Marsan, 2010; Hiemstra et al., 2010; FAO, 2010a; Bondesan, 2011; Martin-Collado et al., 2012). A strategy or policy enhancing the visibility of local poultry through could help to ensure national plans for the agricultural sector including budget allocations for local poultry, and thus leading to improved local poultry production in the country (FAO, 2009; Singh and Fotsa, 2011).

Improved flock management/husbandry of local chicken breeds

Firstly, changes need to be made to local chicken breeding systems within conservation programmes in Turkey. Today, two chicken breeds of Turkey at risk of extinction are kept in closed flocks as part of a conservation project run by government-linked research institutes (Ministry of Food, Agriculture and Livestock, 2011b). This type of conservation is known to be very risky for transmission of epidemic disease, and whole flocks can be lost. To avoid this dangerous situation, conservation flocks should be divided into small flocks in different regions, and centres should be established for the diagnosis of local poultry diseases, as in Veneto Co.Va. Moreover, when reproducing breeds and species at risk of extinction, it is preferable to use free-range systems, which can improve welfare and allow animals to behave more naturally in their environment.

Use of biotechnological tools

Another important problem for Turkey is the determination of local poultry species and chicken breeds. Unfortunately, information about their genetic and phenotypic characteristics is very limited. At present, two chicken breeds are kept by institutes as part of in situ conservation programmes, but no genetic path is monitored. There is an urgent need to document the genetic diversity of local poultry resources and design strategies for their sustainable conservation. Putting an effective conservation plan for local poultry resources into practice, whether in situ or ex situ, will require the effective use of molecular genetic techniques (Hillel et al., 2003; FAO, 2004a; Weigend et al., 2004). The conservation effectiveness of the Co.Va. project is being improved by using advanced molecular genetic techniques, such as microsatellite markers and mitochondrial DNA (mtDNA) (Cassandro et al., 2004; De Marchi et al., 2006; Zanetti, 2009; Zanetti et al., 2010). Similarly, genetic characterisation of local breeds and species through the use of molecular markers associated to powerful statistical approaches is urgently needed in Turkey.

Niche markets and improved support to rural economy for local poultry resources

Local poultry species are kept for as a means of sustaining or improving livelihood in rural areas. Many studies carried out on local poultry found chickens to play a pivotal role in the economy of rural areas of countries (Cassandro et al., 2004; FAO, 2006, 2009; Singh and Fotsa, 2011). Similarly, in Turkey, most farmers in rural regions already keep small chicken flocks in their backyards to provide meat and eggs for their families. Still, local poultry breeds in Turkey are in danger of disappearing, pushed out by modern production techniques and out-competed by exotic breeds. Additionally, government policies and subsidies often support large-scale production rather than smallholder systems utilising local poultry genetic resources in Turkey. Financial resources are limited and always will be. Finding niche markets for local poultry products is therefore a possible way of ensuring the survival of these breeds, enabling those who keep them to earn more (FAO, 2010a). On one hand, niche markets may be vital for the survival of many local breeds which cannot compete with higher-producing exotic breeds in mass markets. On the other hand, many local breeds may be ideally suited to niche markets, as they have unique characteristics (meat or eggs with special tastes) (Table 2). Many of these traits are undesirable in the mass market, but ideal for specific market sectors, if marketed in the right way (FAO, 2010). Several experiences developed in Italy over the last twenty years demonstrate that a strong linkage between endangered breeds and their traditional products represent a good marketing strategy for increasing profit from the breeding of less productive animals, since these products can be sold in a niche market at a higher price compared to non-traditional products (Bonides, 2011). The Veneto region example provides a persistence model to a niche market. De Marchi et al. (2005a, 2005b) state that local poultry breeds provide an interesting alternative to commercial strains, providing typical products with particular qualities that are of great interest in regional local markets. In fact, Veneto poultry breeds showed meat quality characteristics (dark colour and good flavour) that distinguished them from more common commercial birds. Genetic traceability could be a very important way to valorise local poultry breeds, as has been shown in other species by identifying different breed populations (Dalvit et al., 2007, 2008a, 2008b). Additionally, by implementing the conservation plan, the demand for products from Veneto poultry breeds has increased because of their being perceived as nutritious and healthy natural products from birds that are reared in a clean and natural environment with no industrial residues (Westgren, 1999; Fanatico and Born, 2001).

Conclusions

Conservation of poultry breeds plays an important role in safeguarding farm animal biodiversity. It represents an important tool for preserving and supporting the rural economy in some marginal agricultural areas and could also have a relevant role in developing new high quality products for niche markets. Quite patently, local poultry breeds cannot compete with highly productive commercial breeds because of their low meat and egg production. Still, they are maintained for their cultural value: their survival depend on future changes.
in rural societies. This raises the global issue of how development will be managed in countries where village chickens are still numerous (Besbes et al., 2008). Moreover, developing countries such as Turkey may consider that they should not depend on a few international companies for their supply of poultry meat and eggs. Therefore, Turkey needs a well-planned sustainable conservation programme which requires political, economic and technical support from international, national and local organisations. In this context, biotechnological tools will benefit the management of genetic resources. This review has aimed to contribute to future plans for conservation of local poultry resources in Turkey in collaboration with the Veneto Co.Va. scheme in Italy.

References

Ajmone-Marsan, P., 2010. A global view of live-stock biodiversity and conservation-GLOBALIV. Anim. Genet. 41:1-5.

Alderson, G.L.H., 2011. Sustainable conservation of ANGR through cooperative networks. pp 5-11 in Proc. 8th Global Conf. RBI on Conserv. Animal Gen. Res., Tekirda, Turkey.

Alemu, Y., 1995. Poultry production in Ethiopia. World Poultry Sci. J. 51:197-200.

Besbes, B., Tixier-Boichard, M., Hoffmann, I., Jain, G.L., 2008. Future trends for poultry genetic resources. Proc. Int. Conf. Poultry Twenty first Cent.: avian influenza and beyond, Bangkok, Thailand. Available from ftp://ftp.fao.org/docrep/fao/011/i0323e/i0323e00.htm

Bianchi, M., Ciccobelli, S., Landi, V., Cassandro, M., De Marchi, M., Targhetta, C., De Marchi, M., Battagin, M., Dalvit, C., Pervolaris, M., 2007. Assessment of genetic variability in two ancient chicken breeds of Padova area. Ital. J. Anim. Sci. 4(Suppl.3):151-153.

De Marchi, M., Dalvit, C., Targhetta, C., 2006. Assessing genetic diversity in ancient Veneto chicken breeds using AFLP markers. Anim. Genet. 37:101-105.

De Marchi, M., Penasa, M., Battagin, M., Zanetti, E., Pulici, C., Cassandro, M., 2011. Feasibility of the direct application of near-infrared reflectance spectroscopy on intact chicken breasts to predict meat color and physical traits. Poultry Sci. 90:1594-1599.

De Marchi, M., Riovanto, R., Penasa, M., Cassandro, M., 2012. At-line prediction of fatty acid profile in chicken breast using near infrared reflectance spectroscopy. Meat Sci. 90:653-657.

De Marchi, M., Soysal, M., Orhan, E., Meuwissen, T., Cassandro, M., 2008a. Genetic characterization of the Burlina cattle breed using microsatellites markers. J. Anim. Breed. Genet. 125:137-144.

De Marchi, M., De Marchi, M., Targhetta, C., Baruchello, M., Notter, D.R., 2005a. Conservation of poultry genetic resource in the Veneto region of Italy. Anim. Genet. Resour. 37:63-74.

De Marchi, M., Dalvit, C., Targhetta, C., Cassandro, M., 2005b. Assessing genetic variability in two ancient chicken breeds of Padova area. Ital. J. Anim. Sci. 4(Suppl.:3):151-153.

Dalvit, C., De Marchi, M., Targhetta, C., Gervaso, M., Cassandro, M., 2008b. Genetic traceability of meat using microsatellite markers. Food Res. Int. 41:301-307.

Dalvit, C., De Marchi, M., Targhetta, C., Baruchello, M., Notter, D.R., 2005a. Conservation of poultry genetic resource in the Veneto region of Italy. Anim. Genet. Resour. 37:63-74.

Dalvit, C., De Marchi, M., Targhetta, C., Gervaso, M., Cassandro, M., 2008b. Genetic traceability of meat using microsatellite markers. Food Res. Int. 41:301-307.

Dalvit, C., De Marchi, M., Targhetta, C., Baruchello, M., Notter, D.R., 2005a. Conservation of poultry genetic resource in the Veneto region of Italy. Anim. Genet. Resour. 37:63-74.

Dalvit, C., De Marchi, M., Targhetta, C., Gervaso, M., Cassandro, M., 2008b. Genetic traceability of meat using microsatellite markers. Food Res. Int. 41:301-307.

Dalvit, C., De Marchi, M., Targhetta, C., Baruchello, M., Notter, D.R., 2005a. Conservation of poultry genetic resource in the Veneto region of Italy. Anim. Genet. Resour. 37:63-74.

De Marchi, M., Dalvit, C., Targhetta, C., Cassandro, M., 2005b. Assessing genetic variability in two ancient chicken breeds of Padova area. Ital. J. Anim. Sci. 4(4-suppl):151-153.

De Marchi, M., Dalvit, C., Targhetta, C., Cassandro, M., 2006. Assessing genetic diversity in ancient Veneto chicken breeds using AFLP markers. Anim. Genet. 37:101-105.

De Marchi, M., Penasa, M., Battagin, M., Zanetti, E., Pulici, C., Cassandro, M., 2011. Feasibility of the direct application of near-infrared reflectance spectroscopy on intact chicken breasts to predict meat color and physical traits. Poultry Sci. 90:1594-1599.

De Marchi, M., Riovanto, R., Penasa, M., Cassandro, M., 2012. At-line prediction of fatty acid profile in chicken breast using near infrared reflectance spectroscopy. Meat Sci. 90:653-657.

Delany, M.E., Pisenti, J.M., 1998. Conservation of poultry genetic resources: consideration of the past, present and future. Poult. Avian Biol. Rev. 9:25-42.

Ertugrul, M., Delal, G., Elmaci, C., Akın, O.A., Pehlivan, E., Soysal, M., Arat, S., 2010. Çiftlik hayvanları genetik kaynaklarının korunması ve sürdürülebilir kullanımı. pp 179-198 in Proc. 7th Nat. Congr. Technical Agricultural Engineering, Ankara, Turkey.

Fanatoci, A.C., Born, H.M., 2001. Label rouge: pasture-raised poultry in France. ATTRA Publ., Fayetteville, AR, USA.

FAO, 2004a. Secondary guidelines: measurement of domestic animal diversity (MoDAD): new recommended microsatellite markers. FAO ed., Roma, Italy. Available from: http://dad.fao.org/ 

FAO, 2004b. Turkey country report on farm animal genetic resources. FAO ed., Roma, Italy. Available from: ftp://ftp.fao.org/docrep/fao/010/a1250e/annexes/CountryReports/Turkey.pdf

FAO, 2006. Poultry sector country review: the structure and importance of the commercial and village based poultry systems in Egypt. FAO ed., Roma, Italy. Available from: www.fao.org/docrep/001/ai355e/ai355e00.pdf

FAO, 2007. The state of the world’s animal genetic resources for food and agriculture, Rome, Italy. FAO ed., Roma, Italy. Available from: www.fao.org/docrep/001/a1250e/a1250e00.htm

FAO, 2009. Poultry policies, legislation and strategies in Uganda. FAO ed., Roma, Italy. Available from: http://www.fao.org/docrep/013/a691e/a691e00.pdf

FAO, 2010a. Adding value to livestock diversity. Marketing to promote local breeds and improve livelihoods. Available from: http://www.fao.org/docrep/012/i1103e/i1103e00.htm

FAO, 2010b. Breeding strategies for sustainable management of animal genetic resources. FAO animal production and health guidelines no. 3. FAO ed., Roma, Italy. Available from: http://www.fao.org/docrep/012/i1103e/i1103e00.htm

FAO, 2011. Developing the institutional framework for the management of animal genetic resources. FAO animal production and health guidelines no. 6. FAO ed., Roma, Italy. Available from: http://www.fao.org/docrep/014/ba0054e/ba0054e00.pdf

Gueye, E.F., 1997. Diseases in village chickens: control through ethno-veterinary medicine. ILIEA Newsletter 13:20-21.

Henson, E., 1992. In situ conservation of livestock and poultry. FAO animal production and health paper, No. 99. FAO ed., Roma, Italy. Available from: www3.zetatek.com/docs/Animal_Production/Livestoc k/FAO_Animal_Production_and_Health_Paper_1992.pdf

Hiemstra, S.J., 2011. Cryopreservation strategies for farm animal genetic resources in Europe. pp 29-35 in Proc. 8th Global Conf.

Tekirda, Turkey.

Bled, Slovenia.

Cerolini, S., Madeddu, M., Zaniboni, L., Cassinelli, C., Mangiagalli, M.G., Marelli, S.P., 2010. Breeding performance in the Italian chicken breed Mericanel della Brianza. Ital. J. Anim. Sci. 9:e72.

Déli, C., De Marchi, M., Cassandro, M., 2007. Genetic traceability of livestock products: a review. Meat Sci. 77:437-449.

Henson, E., 1992. In situ conservation of livestock and poultry. FAO animal production and health paper, No. 99. FAO ed., Roma, Italy. Available from: www3.zetatek.com/docs/Animal_Production/Livestock/FAO_Animal_Production_and_Health_Paper_1992.pdf

Hiemstra, S.J., 2011. Cryopreservation strategies for farm animal genetic resources in Europe. pp 29-35 in Proc. 8th Global Conf.

[page 318] [Ital J Anim Sci vol.12:e49, 2013]
RBI on Conserv. Animal Gen. Res., Tekirda, Turkey.

Hiemstra, S.J., de Haas, Y., Mäki-Tanila, A., Gandini, G., 2010. Local cattle breeds in Europe. Development of policies and strategies for self-sustaining breeds. Wageningen Academic Pubb., Wageningen, The Netherlands.

Hillel, J., Groenen, M.A., Tixier-Boichard, M., Korol, A.B., David, L., Kirzher, V.M., Burke, T., Barre-Dirie, A., Crooijmans, R.P., Elo, K., Feldman, M.W., Freidlin, P.J., Mäki-Tanila, A., Oortwijn, M., Thomson, P., Vignal, A., Wimmers, K., Weigend, S., 2003. Biodiversity of 52 chicken populations assessed by microsatellite typing of DNA pools. Genet. Sel. Evol. 35:533-557.

Hoffmann, I., 2009. The global plan of action for animal genetic resources and the conservation of poultry genetic resources. World Poultry Sci. J. 65:286-297.

Hoffmann, I., 2011. The global plan of action for animal genetic resources, pp 1-4 in Proc. 8th Global Conf. RBI on Conserv. Animal Gen. Res., Tekirda, Turkey.

Martin-Collado, D., Diaz, C., Mäki-Tanila, A., Colinet, F., Duclos, D., Hiemstra, S.J., EURECA Consortium, Gandini, G., 2012. The use of SWOT analysis to explore and prioritize conservation and development strategies for local cattle breeds. Animal 20:1-10.

Ministry of Food, Agriculture and Livestock, 2011a. Directorate of poultry research station. Ankara, Turkey. Available from: http://tac.gov.tr/www/ EN/icerik. xASP? ID=54

Ministry of Food, Agriculture and Livestock, 2011b. Domestic animal genetic resources in Turkey. General Directorate of Agricultural Research and Policy, Ministry of Food, Agriculture and Livestock ed., Ankara, Turkey.

Mogesse, H.H., 2007. Phenotypic and genetic characterization of indigenous chicken populations in northwestern Ethiopia. Degree Diss., University of the Free State, Bloemfontein, South Africa.

Nidup, K., Dorji, P., 2005. A review of poultry development in Bhutan. Family Poultry 15:8-15.

Nitsch, H., 2006. Case study on genetic resources in food and agriculture. Federal Agricultural Research Centre ed., Braunschweig, Germany. Available from: http://www.ieep.eu/assets/602/WPS5_Case_ study_GenRes_Sep_06_final_pdf.pdf

Notter, D., 1999. The importance of genetic diversity in livestock populations of the future. J. Anim. Sci. 77:61-69.

Pym, R., 2010. Poultry genetics and breeding in developing countries: genetic diversity and conservation of genetic resources. FAO Publ., Roma, Italy. Available from: http://www.fao.org/docrep/013/al728e/al728 e00.pdf

Romanov, M.N., Wezyk, S., Cywa-Benko, K., Sakahatsky, N.I., 1996. Poultry genetic resources in the countries of Eastern Europe: history and current state. Poult. Avian Biol. Rev. 7:1-29.

Singh, D.P., Fotsa, J.C., 2011. Opportunities of poultry breeding programmes for family production in developing countries: the bird for the poor. FAO Publ., Roma, Italy.

Spalona, A., Raanig, H., Cywa-Benko, K., Zanon, A., Sabbioni, A., Szalay, I., Benková, J., Baumgartner, J., Szwarckopf, T., 2007. Population size in conservation of local chicken breeds in chosen European countries. Arch. Gefügelkd. 71:49-55.

Turkish Regulation, 2004. Yürütmeye ve idare bölümlü. In: Official Journal of the Republic of Turkey no. 25668, 12/12/2004. Available from: www.resmigazete.gov.tr/ eskiler/2004/12/20041212.htm#4

Twito, T., Weigend, S., Blum, S., Granavitza, Z., Feldman, M.W., Perl-Treves, R., Lavi, U., Hillel, J., 2007. Biodiversity of 20 chicken breeds assessed by SNPs located in gene regions. Cytogenet Genome Res. 117:319-326.

Veneto Agricoltura, 2004. Progetto Co.Va. Interventi per la conservazione e la valorizzazione di razze avicole locali venete. Veneto Agricoltura - Settore Ricerca e Sperimentazione Agraria ed Ittica ed., Legnaro (PD), Italy. Available from: http://www.venetoagricoltura.org/upload/Files/sperimentazione/scheda%20avicoli.pdf

Weigend, S., Romanov, M.N., Rath, D., 2004. Methodologies to identify evaluate and conserve poultry genetic resources. Available from: http://infofed.it/filemanager/upload/research/as1340428969ht.pdf

Westgren, R.E., 1999. Delivering food safety, food quality, and sustainable production practices: the label rouge poultry system in France. Am. J. Agr. Econ. 81:1107-1111.

Woelders, H., Zuidberg, C.A., Hiemstra, S.J., 2006. Animal genetic resources conservation in The Netherlands and Europe. Poultry Sci. 85:216-222.

Zanetti, E., 2009. Genetic, phenotypic and proteomic characterisation of local chicken breeds. Degree Diss., Università di Padova, Italy.

Zanetti, E., Dalvit, C., Molette, C., Remignon, H., Cassandro, M., 2009. A proteomic approach to study local chicken breeds’ characterisation. Ital. J. Anim. Sci. 8 (Suppl.2):174-176.

Zanetti, E., De Marchi, M., Abbadi, M., Cassandro, M., 2011a. Variation of genetic diversity over time in local Italian chicken breeds undergoing in-situ conservation. Poultry Sci. 90:2195-2201.

Zanetti, E., De Marchi, M., Dalvit, C., Cassandro, M., 2010. Genetic characterisation of local Italian breeds of chickens undergoing in-situ conservation. Poultry Sci. 89:420-427.

Zanetti, E., Molette, C., Chambon, C., Pinguet, J., Rémignon, H., Cassandro, M., 2011b. Using 2-DE for the differentiation of local chicken breeds. Proteomics 11:2631-2639.

Zanon, A., Sabbioni, A., 2001. Identificazione e valorizzazione di razze avicole locali venete. Annali della Facoltà di Medicina Veterinaria di Parma 21:117-134.
