

# EVALUATION, CONSERVATION AND UTILIZATION OF RABBIT GENETIC RESOURCES : SITUATION AND PROSPECTS IN THE MEDITERRANEAN REGION AND IN EUROPE\*

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**Abstract** - Intensive rabbit meat production is more and more based on purebred animals from very few breeds and on crossbred animals produced from specialized strains disseminated through pyramidal systems (particularly in Europe). Purebreeding is decreasing. Local populations, used in traditional backyard farming, are currently nearly extinct and were hardly even surveyed. The rabbit is so far missing from the EAAP and FAO animal genetic data banks. A primary phenotypic characterization already exists for standardized european breeds. A cooperation network, including french, spanish, belgian, portuguese, and, more recently, britannic laboratories, is characterizing the genetic polymorphism and measuring genetic distances in wild and domestic populations. A european concerted action allowed the defining of the technical basis for cryoconservation of rabbit embryos and a cryobank is in progress. So, the different parts of a program of characterization, conservation and utilization of rabbit genetic resources exist but have to be better integrated into a global program. Such a program is now possible : on one hand, a research network on rabbit production in the mediterranean area (IAMZ, CIHEAM), founded in 1985 and including 8 countries is working on the identification and characterisation of local populations and breeds (Egypt, Tunisia, Spain,..) ; on another hand, research laboratories and breeders associations from 7 european countries are included in a program « Inventory, characterization, evaluation, conservation and utilization of european rabbit genetic resources » which has just been approved by the European community. These programs will allow to produce the first international inventory and description of rabbit genetic resources, which will be gathered in the EAAP and FAO data banks, and to conserve and exploit the great genetic variability of this species to improve rabbit production, with diversified patterns of production.

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## INTRODUCTION

The rabbit (*Oryctolagus cuniculus*) originates from Spain. Up to Antiquity and even Middle Age, it was bred only in Spain and south of France, and we can consider that its domestication began only at the 18th century (ARNOLD, 1994). Now, the domestic rabbit is widely spread in many countries, and especially in Western Europe and in the Mediterranean countries, where it coexists with its wild form.

World rabbit meat production is estimated around 1 600 000 tonnes (COLIN and LEBAS, 1995). This is a rough estimation, because it includes an estimation of subsistence farming. This is particularly true in countries in which rabbit production is not industrialized, which is the case in most South Mediterranean countries. Rabbit meat is mainly produced in western and southern Europe, namely in Italy, Spain and France, which represent 35 % of world production. Other Mediterranean countries produce around 90 000 tonnes (mainly Egypt, Algeria, Greece, Tunisia and Malta), which represents 6% of world production. Other important producers are China, Ukraine and Russia, which represent around 23%.

## RABBIT POPULATIONS

Depending on the extent of artificial selection, one can distinguish local populations, breeds, defined by a standard and commercial strains, proceeding from a few breeds and strongly selected for production traits.

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## **Northern Mediterranean countries and Europe**

Rabbit breeders are either farmers (mainly for meat, but also for fur and angora wool production) or fancy breeders. The former are predominant in France, Spain and Italy, where rabbit meat consumption is usual. Rabbits reared at present for meat production come from a very limited number of breeds with very similar characteristics, strongly selected, and, increasingly, from crossbreedings among these breeds, mainly New Zealand White and Californian breeds. The latter are particularly active in Germany and Switzerland and organized in France, Italy, Belgium and the United Kingdom, but absent from Spain. Most of national associations are federated into an European Association of Poultry, Pigeon and Rabbit Breeders, including 15 countries. They manage more than 60 breeds, with very different characteristics, such as their size (varying from 1 to 10), their colour, conformation, or the type of fur. They are often more concerned with exterior appearance and esthetics than with economic traits. The national standards of breeds and the catalogues of rabbit exhibitions describe the genetic resources that they manage.

Local populations, used in traditional backyard farming, are currently nearly extinct and were hardly even surveyed.

## **Southern Mediterranean countries**

Rabbit meat production is much less intensive and, apart from some cases, it is mainly based on backyard farming and local populations, possibly crossbred with exotic breeds. Few local breeds or population have been described, in Egypt (YAMANI, 1990), in Tunisia (KENNOU, 1990). More and more, exotic breeds are introduced and local populations are crossbred.

## **WORKS IN PROGRESS**

### **Zootechnic evaluation of breeds and populations**

Most zootechnic evaluations concern a limited number of breeds, mainly strains originating from New Zealand White and Californian breeds (review by ROCHAMBEAU, 1988, 1989).

Many other breeds exist and were described, as explained earlier, but in few cases their zootechnic performances were evaluated in comparison with other breeds or in crossbreeding. It was the case for some french breeds (Argenté de Champagne, Gris du Bourbonnais, Fauve de Bourgogne, see ROCHAMBEAU, 1988), three egyptian breeds : Giza White, Baladi and Gabali (AFIFI and KHALIL, 1992 ; KHALIL *et al.*, 1995), two spanish breeds : common and giant spanish (LOPEZ *et al.*, 1992 ; ZARAGOZA *et al.*, 1992), one italian breed : Carmagnola Grey (PAGANO TOSCANO *et al.*, 1992). Fewer local populations were evaluated as in Tunisia (BEN HAMOUDA and KENNOU, 1990).

### **Genetic evaluation**

Analysis of genetic polymorphisms and measurement of inter and intra population genetic distances may be of great interest for evaluation of rabbit genetic resources. A co-operation network of french, spanish, belgian, portuguese and, more recently, britannic laboratories is working together on the characterization of the genetic polymorphism of several wild and domestic populations from Portugal, Spain and France (MONNEROT *et al.*, 1994, 1996). They are using a great set of intrinsic traits to evaluate the genetic diversity between breeds and between geographical populations within each breed, to establish phylogenetic trees and to measure genetic distances. All of them have proved to be useful criteria for this purpose. The main ones are :

- Mitochondrial DNA characterization, which allows to assign animals to a precise maternal lineage (CASANE *et al.*, 1994 ; HARDY *et al.*, 1995).
- Analysis of protein polymorphism (in rabbit, up to 25 variable loci have already been used) (ZARAGOZA *et al.*, 1987 ; FERRAND, 1995).
- Determination of allelic diversity for some genes (VAN DER LOO *et al.*, 1991) and, recently, at microsatellite loci, in relation with D. BELL and G. HEWITT group.

### **Conservation**

In rabbit, there is no systematic collection of genetic resources, as exists in most domestic animal species. In some cases, their preservation is currently performed *in situ* by either professional or fancy breeders, but

without any consistent program such as that of the "Conservatoire National des Animaux de Basse-Cour" which worked in France between 1978 and 1985 (ARNOLD and ROCHAMBEAU, 1983).

Collection of frozen semen and embryos has to be considered as a complement to *in situ* preservation. A european concerted action ("germplasm banking"), in which the rabbit was used as a model animal, allowed the defining of the technical basis for cryoconservation of rabbit embryos. Up to now, embryos or semen from 22 different genetic groups have been stored (JOLY *et al.*, 1996).

## PROSPECTS

This list of works in progress shows that the different partners of a program of evaluation and conservation of rabbit genetic resources exist and have already got results. However, their programs have developed more or less independently from each other and they need to be integrated. To carry out a characterization, evaluation, conservation and utilization program of genetic resources, successive steps have to be followed :

- inventory of populations and description of primary characteristics
- zootechnic and genetic evaluation
- conservation and utilization.

We will comment more in details some of these steps.

### Inventory of populations and primary characterization

The rabbit is not, up to now, included in the EAAP Hannover Animal Genetic data bank neither in the FAO global animal genetic data bank. So, the first task is to produce the first inventory of european and mediterranean rabbit genetic resources. This inventory could gather and complete information already registered for most of the northern mediterranean breeds and which essentially describe the exterior appearance and the history of the breed in most cases. It will allow to include data already registered in south mediterranean breeds and populations. The rabbit data bank can be based on the same model as the data bank for other mammalian species, but needs to be adapted. Detailed proposals for the organization of rabbit data bank have already been made by LUKEFAHR (1988) and by KHALIL (1993).

### Genetic and zootechnic evaluation

We have to take into account two major features of rabbit breeds :

- Most rabbit breeds are present in various countries. Because of selection choices and genetic drift, we can suppose that, within a breed, some of these populations are widely different and others no. For example, the New Zealand White breed is selected by fancy breeders on external criteria and by commercial breeders on zootechnical traits, namely litter size or growth rate.

- Some breeds, considered now as pure breeds, were in fact derived by crossbreeding of pure breeds which still exist. Populations, considered as original populations, are in fact the result of crossbreeding of local populations with exotic breeds or strains, and have little interest *per se*.

Analysis of genetic polymorphisms described earlier is one of the tools which will help to clarify these two points, if analyzed populations are carefully sampled, and to state the genetic diversity of rabbit germplasm.

As mentioned earlier, some comparisons of breeds or populations have already been carried out. However, they were done using different criteria and it is difficult to compare results. A zootechnic evaluation needs to be done with well defined criteria, as those proposed by LEBAS (1992) to control feeding, BOLET *et al.* (1992) to measure reproductive abilities, BLASCO *et al.* (1993) to study meat and carcass, BOSCH *et al.* (1992) to construct and analyze crossbreeding experiments.

As far as Mediterranean countries are concerned, breeds and populations have to be compared, not only in standardized conditions, but also in other production systems, less intensive and adapted to other climatic and economic conditions (FINZI, 1992). Particular attention has to be paid to response to hot climatic conditions (MARAI *et al.*, 1992).

### Conservation and utilization : environmental and economic conditions

The establishment of a cryobank of gametes or embryos is necessary to maintain genetic diversity and conserve threatened populations. Different criteria of choice have been described by JOLY *et al.* (1994) : Strains with a high zootechnic value, old endangered breeds which have a sociological value, animals with rare allotypes or

mutations,... But conservation is not a purpose *per se*, it is a tool for present or future utilization of genetic resources.

A better knowledge of the abilities of breeds rarely used today because of their low level of production in standard conditions of production, could lead to the development of new activities. Owing to the great variability in body size, diversification of carcass weight is one approach. For example, potential customers, up to now put off by a whole carcass, could be interested in portions of "heavy" animal's carcasses. In the same way, lighter but sufficiently mature animals could lead to the development of new consumption, in small size families.

The patterns of production could also be diversified, and, with more adapted breeds, lead to more extensive way of rearing for a part of the production. The production of an animal reared in more rustic housing, with poorer food and less intensive rhythms of reproduction, but reaching the same weight as those produced in standard conditions when killed older, could be one aim of this diversification.

On another hand, a more complete knowledge of the different breeds, particularly from the immunological point of view, would allow to develop the production of rabbits for labs, producing more homogeneous or more sensitive groups of animals better suited to users needs.

## CONCLUSION

Rabbit meat production is characterized by a great diversity : from local populations to highly selected crossbred strains, from backyard farming to intensive industry, from feeding with forages and by-products to exclusive use of concentrate,... Available breeds are still numerous, but their number is rapidly decreasing. It is urgent to initiate a characterization and conservation program (HAMMOND and LEITCH, 1995).

As far as Mediterranean and European countries are concerned, two networks deal with rabbit genetic resources :

- A cooperative research group " Research network on rabbit production under mediterranean conditions " has been created in 1987 by the Mediterranean Agronomic Institute (Zaragoza, Spain). (ROUVIER, 1994). In the international conference of Cairo, on September 1994, this network decided to focus its work on the gathering of informations and exchange of interesting genetic material which will benefit from the co-operative researches.

- Most european groups and breeders associations quoted in this paper are involved in a project entitled "Inventory, characterization, evaluation, conservation and utilization of european rabbit genetic resources" which was approved by the European Community in 1996.

With their own specificities, these networks will be the main actors of the inventory and conservation of rabbit genetic resources in the next years.

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## Evaluation, conservation et utilisation des ressources génétiques chez le Lapin : situation et perspectives dans la zone méditerranéenne et en Europe - La production intensive de viande de lapin est de plus en plus fréquemment réalisée avec un nombre restreint de races ou des animaux croisés, obtenus à partir de quelques souches spécialisées et diffusées dans un système pyramidal (notamment en France, Italie et Espagne).

L'élevage en race pure diminue ; les populations locales, traditionnellement utilisées pour la production fermière, sont en voie de disparition, sans même avoir été vraiment étudiées. Jusqu'à présent, le lapin ne figure pas dans les banques de données de la FEZ et de la FAO sur les ressources génétiques animales. Une description phénotypique primaire a été réalisée pour les races européennes standardisées. Un réseau de recherche comprenant des laboratoires français, espagnols, belges, portugais et, plus récemment, anglais, étudie le polymorphisme génétique de plusieurs populations de lapins sauvages ou domestiques. Une action concertée européenne a permis de définir les bases techniques de la conservation par congélation des embryons de lapin, et une cryobanque est en cours de réalisation. Ainsi, les différents éléments d'un programme de caractérisation, de conservation et d'utilisation des ressources génétiques cynicoles existent mais demandent à être mieux coordonnés dans un programme global, ce qui est maintenant possible : d'une part, un réseau de recherche sur la production de lapin dans la zone méditerranéenne (IAMZ, CIHEAM) a été créé en 1987 ; il comprend 8 pays qui ont commencé à identifier et caractériser des races et populations locales (Egypte, Tunisie, Espagne,...) ; d'autre part, des laboratoires et des organisations d'éleveurs de 7 pays européens sont rassemblés dans un programme (« Inventaire, caractérisation, évaluation, conservation et utilisation des ressources génétiques cynicoles en Europe ») qui vient d'être accepté par la Communauté Européenne. Ces programmes permettront de réaliser le premier inventaire international des ressources génétiques cynicoles, ainsi que leur description et des actions de conservation. Ces données seront intégrées dans les banques de données de la FEZ et de la FAO. Cet outil permettra d'exploiter la grande variabilité génétique de cette espèce afin d'améliorer la production cynicole, dans des systèmes de production variés.

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