ANIMAL GENETIC RESOURCES INFORMATION

BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

BOLETÍN DE INFORMACIÓN SOBRE RECURSOS GENÉTICOS ANIMALES

FAO

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Editorial - Report on Strategic Priorities for Action

The *Report on Strategic Priorities for Action for the Sustainable Use, Development and Conservation of Animal Genetic Resources for Food and Agriculture* is based on 141 country reports submitted to FAO until March 2005. Four major areas were identified for which action is required at national and international levels.

1. *Inventory and characterization.* This is the understanding of the status and characteristics of animal genetic resources to enable their sustainable use, development and conservation. Priorities in this area include breed inventories, comparative performance and monitoring; risk analysis and early warning systems; and phenotypic and molecular breed characterization.
2. *Use and development of animal genetic resources.* Main objective is the sustainable use of animal genetic resources in all production systems, in order to achieve food security and contribute to poverty reduction. Priorities in this area include long term breed development strategies, improving institutional and managerial capacity for conducting sustainable breeding programmes and international cooperation.
3. *Conservation of animal genetic resources.* This area refers to the establishment of national conservation programmes for animal genetic resources of actual and potential value. Priorities include developing national capacity to implement *in-situ* and *ex-situ* conservation measures and promoting regional and global cooperation to conserve animal genetic resources.
4. *Institutional development and capacity building.* This chapter deals with policies and legal framework for the management of animal genetic resources. Priorities include development of human resources, support to National and Regional Focal Points and strengthening research institutions. It also aims at increasing awareness of the roles and values of animal genetic resources in order to promote investments in this sector and facilitate interactions among donor, recipients and international organizations.

The *Report on Strategic Priorities for Action* has been the main subject of regional e-mail consultations covering 10 country groupings. Specific priorities of these sub-regions will be identified in *Regional Reports* to complement the *First Report on the State of the World's Animal Genetic Resources*. These reports will guide the development of a global follow-up mechanism that will raise awareness, provide countries with technical support for project preparation and attract financial resources for concrete actions in the field. They will be considered by the Intergovernmental Technical Working Group on Animal Genetic Resources and the Commission on Genetic Resources for Food and Agriculture in 2006. The final decision will be taken at the First International Technical Conference for Animal Genetic Resources to be held in Switzerland in September 2007.

The Editors

Editorial - Rapport sur les priorités stratégiques

Le *Rapport sur les priorités stratégiques concernant l'utilisation durable, le développement et la conservation des ressources zoogénétiques pour l'alimentation et l'agriculture* est fondé sur 141 rapports nationaux qui ont été soumis à la FAO avant Avril 2005. Quatre domaines principaux pour une action urgente sont recommandées aux niveaux national et international.

1. *Inventaire et caractérisation.* Ce domaine aborde un ensemble de mesures stratégiques prioritaires qui visent à accroître les connaissances sur l'état des ressources zoogénétiques aux niveaux national, régional et international. Les priorités sont : l'inventaire des races nationales, l'analyse comparative de leurs performances, la surveillance des races, en particulier de celles en danger et leur caractérisation phénotypique et moléculaire.

2. *Utilisation et développement.* L'objectif principal est l'utilisation durable des ressources zoogénétiques au sein de tous les systèmes de production existants afin d'assurer la sécurité alimentaire et de contribuer à la réduction de la pauvreté. Les priorités sont le développement des stratégies d'élevage à long terme, le renforcement des capacités institutionnelles et de gestion dans ce domaine et le renforcement de la coopération internationale.

3. *Conservation des ressources zoogénétiques.* Il s'agit de mettre en place des programmes nationaux en faveur de la conservation des ressources zoogénétiques de valeur actuelle et future. Les priorités sont: renforcer les capacités nationales pour exécuter des mesures de conservation *in situ* et *ex situ* et promouvoir la collaboration régionale et mondiale en vue de la conservation des ressources zoogénétiques.

4. *Politiques, institutions et renforcement des capacités.* Ce domaine se penche sur la formulation des politiques et des cadres juridiques en matière de gestion des ressources zoogénétiques. Les priorités sont: le développement des ressources humaines, le renforcement des points focaux nationaux et régionaux ainsi que des institutions de recherche. Par ailleurs, l'attention est accordée à l'intensification de la sensibilisation de la population aux rôles et aux valeurs des ressources zoogénétiques afin de promouvoir les investissements dans ce secteur et accroître les possibilités d'interactions entre bénéficiaires, bailleurs de fonds et organisations internationales.

Le *Rapport sur les priorités stratégiques* est le thème principal des dix conférences régionales électroniques. Des priorités régionales spécifiques seront identifiées dans des rapports régionaux qui s'ajouteront au premier *Rapport sur l'état des ressources zoogénétiques dans le monde*. Ces rapports formeront la base pour le développement global d'un système de suivi dont l'objectif est la sensibilisation, le support technique aux pays pour la préparation de projets et la mobilisation des ressources financières afin de réaliser des actions concrètes sur le terrain. En 2006, les rapports seront révisés par le Groupe de travail technique intergouvernemental sur les ressources zoogénétiques et la Commission pour les ressources génétiques pour l'alimentation et l'agriculture. La décision finale sera prise lors de la Première conférence technique internationale sur les ressources zoogénétiques qui aura lieu en Suisse en septembre 2007.

Les Editeurs

Editorial - Informe sobre las prioridades Estratégicas para la Acción

El *Informe sobre las Prioridades Estratégicas para la Acción, para el Uso Sostenible, Desarrollo y Conservación de los Recursos Zoogenéticos para la Alimentación y la Agricultura* ha sido preparado en base a 141 informes enviados por los países a la FAO hasta marzo de 2005. Se identificaron 4 principales áreas de acción a nivel nacional e internacional.

1. *Inventario y caracterización.* Significa comprender la situación y las características de los recursos zoogenéticos para facilitar su uso sostenible, desarrollo y conservación. Las prioridades en esta área incluyen inventarios, monitoreo de razas y análisis comparativos de su productividad; análisis de riesgo y sistemas de alerta; y caracterización fenotípica y molecular.

2. *Uso y desarrollo de los recursos zoogenéticos.* El principal objetivo es el uso sostenible de los recursos zoogenéticos para la seguridad alimentaria y la reducción de la pobreza. Las prioridades en esta área incluyen estrategias a largo plazo para el desarrollo de las razas y el fortalecimiento de la capacidad institucional y de gestión para llevar a cabo programas de mejoramiento genético, así como la cooperación internacional.

3. *Conservación de los recursos zoogenéticos.* Se refiere al establecimiento de programas nacionales de conservación de los recursos zoogenéticos que posean valor actual o potencial. Las prioridades incluyen el desarrollo de la capacidad de los países para implementar medidas de conservación *in-situ* y *ex-situ* y la cooperación mundial y regional para conservar los recursos zoogenéticos.

4. *Desarrollo institucional y creación de capacidad.* Trata de la formulación de políticas y del marco legal para la gestión de los recursos zoogenéticos. Las prioridades incluyen el desarrollo de recursos humanos, el apoyo a los Puntos Focales Nacionales y Regionales y el fortalecimiento de las instituciones de investigación. Otro objetivo es destacar el papel y el valor de los recursos zoogenéticos promoviéndose las inversiones en este sector y facilitándose las interacciones entre los donantes, destinatarios y organizaciones internacionales.

El *Informe sobre las prioridades Estratégicas para la Acción* es el tema de 10 conferencias subregionales llevadas a cabo por correo electrónico. Se identificarán prioridades específicas en *Informes Regionales* que complementarán el *Primer Informe Mundial sobre los Recursos Zoogenéticos*. Estos informes orientarán la puesta en marcha de mecanismos de seguimiento para fomentar la divulgación, proporcionar soporte técnico a los países en la formulación de proyectos y atraer recursos financieros para concretar la ejecución de estas acciones. Los informes serán examinados por el Grupo de Trabajo Técnico Intergubernamental sobre Recursos Zoogenéticos y la Comisión de Recursos Genéticos para la Alimentación y la Agricultura, en 2006. La decisión final será tomada en la primera Conferencia Internacional sobre Recursos Zoogenéticos que se llevará a cabo en Suiza en Septiembre de 2007.

Los Editores

Portuguese Cachena cattle: a socio-economic, morphological and productive characterization of an endangered breed

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Summary

Today, Portuguese Cachena cattle are limited to a small population in northern Portugal, and while they are well-adapted to the adverse environmental conditions of this mountainous region, they are in a very vulnerable situation.

A socio-economic analysis of the members of the Cachena Breeders' Association showed most to be individual elderly farmers with a worryingly low educational level, mostly with small traditionally managed farms.

The biometric study showed Cachenas to be quite light animals, and small in all three dimensions – indeed, they are the smallest Portuguese breed and one of the smallest in the world. The biometric indices obtained revealed the characteristics of their adaptation to mountain resources.

Financial measures to support Cachena cattle should be considered, oriented through social policies and improvement plans, with a view to developing the current production system, supporting the breeders' association and favouring biological production in order to protect this indigenous breed of limited production potential.

Resumen

La raza bovina Cachena está representada en el momento actual por una pequeña población de animales localizada en el noreste de Portugal y caracterizada por su adaptación a las condiciones ambientales adversas propias de esta región montañosa. Se presenta un estudio sobre esta población bovina de características únicas y que se encuentra en una situación de elevada vulnerabilidad.

El estudio socio-económico de todos los productores inscritos en la Asociación de Criadores de Cachena indicó un predominio de granjas individuales pertenecientes a granjeros de elevada edad y preocupante nivel de instrucción. Las granjas son fundamentalmente familiares, de pequeñas dimensiones y manejo tradicional.

El estudio biométrico reveló un animal de características peculiares, en particular su reducido peso, altura, longitud y anchura, señalando a esta raza como la más pequeña de los bovinos portugueses y entre las más pequeñas del mundo. Los índices obtenidos son un reflejo de sus características de adaptación a los recursos de montaña.

Deberían considerarse medidas financieras de apoyo a la raza Cachena, mediante políticas sociales y planes de mejora que favorecieran el sistema productivo, apoyando el cooperativismo de los criadores y el concepto de producto biológico con el objeto de proteger esta raza autóctona de limitado potencial productivo.

Key words: Portuguese Cachena cattle, Endangered, Characterisation, Production practices, Morphological characteristics.

Introduction

Portuguese Cachena cattle are farmed in a very restricted area, the '*Concelho*' of Arcos de Valdevez, in the Peneda-Gerês National Park (García *et al.,* 1981) in north-eastern Portugal (Figure 1). This region, the first natural area to be protected in Portugal, is very rugged, with mountains between 800 and 1 400 m above sea level and deep valleys with a few plains where heavy rains accumulate to produce soils of medium agricultural quality.

Like other indigenous Portuguese breeds, Cachenas decreased sharply in numbers in the closing decades of the 20th century. The National Programme of Application of EU Council Regulation 2078/92/EEC on agricultural methods compatible with the requirements of the protection of the environment and the maintenance of the countryside (Agri-environment Regulation) included Cachena cattle as an endangered breed. Although the application of this program has resulted in a slight increase in the census in recent years (Table 1), the current Cachena population is close to 1 000 adult animals (Associação de Criadores de Raça Cachena, ACRC – The Cachena Breeders Association – 2003) and the breed is still endangered.

Cachenas were previously considered a subtype of Barrosã cattle, their own herd book becoming independent in 1998, while the ACRC, founded in 1993, now has about 85 members.

Measures directed to breed improvement such as artificial insemination or evaluation of reproducers are in their initial stages, the breeding situation being very close to the natural state, that is, with little human intervention.

Socio-economic Characterisation

A survey was made of all the members of the ACRC. Land use is characterized by a very small farm size (3.21 ha on average), with 67.7% between 1 and 5 ha, but the limitations caused by the small farm size are partially offset by access to good pastures such as fallow areas or '*vezeiras'*. Land ownership is characterized by a high number of small plots per owner, over 60% having 15-25 holdings (Figure 1). Given the limited amount of land suitable for cultivation, farmers still keep to the tradition of cultivating as much land as possible, which they need not only for animal production but also for crops for home consumption. Most farms are run by three to six close relatives, 93.5% of whom are over 40 years old and almost illiterate, with no young people taking their place, which implies a low rate of innovation acceptance.

A high importance is placed on indigenous cattle production in the family economy and income not only derives from calf sales, but also from government subsidies. Besides producing meat, many animals are still used for work, as mechanization would be very difficult in such mountainous areas. Other animal species, particularly small ruminants mainly used for home consumption, are also economically important on these farms.

Commercialization has been one of the most significant bottlenecks in this productive system, a process generally effected through middlemen (42.4%) or traditional fairs. Attempts have been made to promote Cachena meat as organic produce (Silva, 1999) and to improve commercialization efficiency and thus bring higher profits to producers.

Tradition is one of the main reasons for the continued breeding of Cachena cattle. A high level of satisfaction with the breed was expressed by most of the producers (94.6%), with 54.6% of farmers planning expansion, probably as a result of subsidies and official support for the breed.

Production Practices

The mean number of adult Cachenas per farm is 7.5±4.1 cows of four to eight years of age and their calves.

Figure 1. A typical Portuguese environment where Cachena cattle are farmed, ('Concelho' of Arcos de Valdevez, in the Peneda-Gerês National Park).

Table 1. Evolution of adult Cachena cattle population registered in the herd book.

	1998		1999		2000		2001		2002	
	M	F	M	F	M	F	M	F	M	F
Animals registered each year	22	321	11	231	10	173	7	214	18	185
Total registered	22	321	33	552	43	725	50	939	68	1 124

Reproduction cycles start at about two years of age with the first calving at 36 months. The calving interval is over 18 months, most occurring between December and May corresponding to mating in the 'vezeiras', when one or more bulls join the herd in periods of adequate feeding resources after hard winters of marked shortage.

In general, in autumn and winter, adult animals graze in unfarmed areas near the village and are gathered in at night. During spring and summer, the use of 'vezeiras' or fallow lands allows for a free grazing.

Feeding is highly dependent on green forage, with hay and straw as the main stored feed, used in periods of food shortage, and particularly coinciding with such physiological situations as calving and milking. Some surplus farm products such as maize, oats or sweet potatoes, among others, are used as supplements.

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Body Weight Parameters

To characterize breed production, the body weight and condition of 64 animals were analysed once every two months, over two years (Tables 2 and 3). Body condition was measured following Lowman *et al.* (1976). Birth weight was remarkably low, averaging 23.7 and 20.3 kg for males and females, respectively. While a maternal effect on birth weight has been reported by different authors regarding cattle, according to present results in the Cachena breed, sex, age of dam and month of birth are not significant (*P*>0.05), which might be partially due to the management conditions and morphologic and productive characteristics of the breed. Weights at weaning (86 kg at 6 months of age) as well as birth-to-weaning daily mean gain (411 g/day) indicate slow growth. However as these values do not reach the minimums specified in Dantas & Leite (2000) and required for the Cachena breed Designation of Origin, there may be difficulties with the commercialisation of certain Cachena animals. Body weight measured at different ages was low in comparison with that of other indigenous

Portuguese breeds (Brito, 2002). Moreover, no significant differences between the sexes were detected which might be partially attributed to the small animal size and the harsh environmental conditions in which the extensive reproduction system has developed with no selection of reproducers. The low body condition scores from the age of 24 months on, between 1.5 and 2.5 (Table 3), demonstrate the scarce nutritional resources available and/or genetic potential of this breed, which negatively influence the productive and reproductive parameters.

An improvement in production efficiency could be obtained by the enrichment of pastures and by favouring a calving time closer to the beginning of spring (to coincide with higher forage production, which would allow a higher milk yield) or the beginning of autumn (when cows' body condition is better and forage is re-growing).

Morphological Characteristics

Cachena cattle (Figure 2 and 3) are leptosomic; mountain animals of high rusticity exhibiting semi-wild behaviour.

Table 2. Body weight parameters in Cachena cattle.

	Sex	N	Mean ± S.E. (kg)	Coefficient of variation (%)
Birth weight	F	11	20.2±1.3	14.0
	M	10	23.7±1.3	9.5
6-month weight	F	20	82.6±3.9	21.2
	M	7	90.1±4.8	14.0
12-month weight	F	14	125.7±4.9	14.7
	M	10	140.2±8.0	18.1
18-month weight	F	16	170.8±5.0	11.7
	M	3	161.7±27.5	27.5
24-month weight	F	21	180.8±5.1	12.8
	M	6	207.1±15.5	18.3
Adult body weight	F	464	288.0±2.2	15.8
	M	79	255.0±5.3	18.6
Daily mean gain till weaning	F	12	0.39±0.03	29.7
	M	10	0.44±0.04	27.2

Contrasts between female and male values did not reach significance (*P*>0.05).

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Table 3. Body condition in Cachena cattle.

Age	Sex	N	Mean±S.E.	Coefficient of variation (%)
24 months	F	21	1.88±0.08	12.3
	M	6	1.92±0.20	25.6
> 24 months	F	464	2.26±0.09	15.3
	M	79	2.19±0.07	19.9

Contrasts between female and male values did not reach significance (*P*>0.05).

Morphologically, they are brachycephalic animals (cranium shorter than it is broad) and brief-lined (length proportionally shorter than it is broad) and brief-lined (length proportionally shorter than height or width).

Cachenas have a long straight-profile head, twice as long as it is wide (measurements based on orbital salient angles). The large horns have a round cross section and are of a screw or corkscrew shape. Other characteristics are a short neck, slightly salient withers and fairly long and drooping chest. The dorsal-lumbar region appears short, thin and horizontal, and well attached to a drooping rump. The abdomen is capacious and a high tail ends in a regular dark switch. Poorly developed and weak legs finish in small, dark, round hooves. The skin is soft but quite thick and the hair is short and fine in summer but long and strong in winter. Hair is light brown tending towards a straw or sherry-like colour. Adult bulls are always darker, while calves have a paler coat.

Figure 2. Cachena cattle.

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Figure 3. Cachena cattle.

Measurements as well as functional indices, obtained in a sample of 53 adult cows registered in the Herd Book and grouped according to age, are shown in Table 4. Results show animals older than two years of very small size (110.5 cm withers height), decidedly short (130.9 cm trunk length), narrow (33.5 cm chest width) and of short perimeters (161.1 cm thoracic perimeter) revealing a markedly tiny animal, in agreement with other authors (Dantas & Leite, 2000), who consider Portuguese Cachenas among the smallest cattle in the world. Estimates for biometric indices such as cephalic (0.65), thoracic (0.57), pelvic (0.44) and corporal indices (0.81) were also lower than those of other Portuguese cattle (Brito, 2002).

With regard to what are considered functional indices, the breed has a low 'chest depth/withers height' index (0.54), relating to a low efficiency for meat production. The 'withers height/trunk length' index (0.84) defines the Cachena breed as small and

weak, limiting its aptitude for work, while the 'shin perimeter/withers height' index (0.16) demonstrates the strength of the legs, relevant to adaptation to pasturing in areas of difficult access. Finally, the 'shin perimeter/thoracic perimeter' index (0.11), which was initially used for the evaluation of milk aptitude, indicates the ratio between metacarpi and thoracic capacity (greater in pasturing animals) and shows that Cachenas are well adapted to extensive mountain systems.

Conclusion

Cachena cattle farming is strongly associated with mountain ecosystems based on populations adapted to adverse environmental conditions. This production system can be included within the context of sustainable agriculture and involves other important considerations such as ecological, cultural and social aspects, allowing for the

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Table 4. Measurements and indices in Cachena cattle females.

Parameters	2 years old (N=10)	> 2 years old (N=43)
Height (cm)		
Withers	106.2±3.7	110.5±6.5
Back	105.4±4.0	108.9±7.0
Rump	107.8±3.4	113.2±6.1
Chest Prof.	55.3±2.8	59.3±5.7
Length (cm)		
Head	31.7±2.0	34.5±4.1
Trunk	117.6±5.9	130.9±10.5
Rump	37.5±2.0	40.0±3.5
Perinea	27.0±5.6	28.1±7.4
Width (cm)		
Head	20.6±1.0	22.3±3.3
Horn Base	17.6±1.8	18.1±2.4
Chest	31.4±4.6	33.5±4.9
Biiliac	37.0±3.1	41.2±3.6
Biisquiatic	17.1±1.8	17.4±3.0
Perimeters (cm)		
Thoracic	146.0±7.4	161.1±11.0
Abdominal	148.0±6.7	165.6±12.8
Shin	16.5±1.1	17.5±2.1
Spiral	142.1±5.7	153.5±12.2
Indices		
Cephalic	0.65±0.04	0.65±0.09
Thoracic	0.57±0.06	0.57±0.08
Pelvic	0.46±0.04	0.44±0.06
Corporal	0.81±0.02	0.81±0.06
IPRP[a]	0.52±0.03	0.54±0.07
ICR[b]	0.90±0.05	0.84±0.07
IERCA[c]	0.16±0.01	0.16±0.02
IDTOR[d]	0.11±0.01	0.11±0.01

a) Index "Chest depth/withers height".
b) Index "Withers height/trunk length".
c) Index "Shin perimeter/withers height".
d) Index "Shin perimeter/thoracic perimeter".

maintenance of a rural population. Besides, the peculiar characteristics of Portuguese Cachena and the small current population make protecting these indigenous cattle interesting from the point of view of biodiversity. Taking into consideration the limited productive efficiency of this breed, financial support policies are necessary, such as subsidies to producers and measures to improve the production system, the commercialization of produce and the association of producers and others, in order to protect this indigenous breed as well as the rural population involved in its production.

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A comparison of the productive, reproductive and body condition score traits of the Simmental, Brown Swiss and Tyrol Grey breeds in smallholder herds in Kosovo

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Summary

After the war in Kosovo, the Food and Agriculture Organization and the World Bank implemented an Emergency Farm Restocking Project, by allocating Simmental, Brown Swiss and Tyrol Grey heifers, 4-7 months pregnant, to farmers at the rate of one per farm. Data was monitored over a period of 14-16 months and the results showed that Brown Swiss had the highest milk production, while Tyrol Grey did worst. However, Tyrol Grey had the shortest service period and also changed the body condition score postpartum less than the other two breeds, making it best fitted of the three, to the extensive environment in Kosovo. Breeds were compared by growth rate, but this comparison was deemed highly inadequate as breeds with a high growth rate normally reach maturity at a high weight, and so need intensive feeding. Considering the extensive production environment in Kosovo, our results suggest that dairy cattle production should be based on a smaller breed, well adapted to the diet offered

Résumé

Après la guerre du Kosovo, la FAO (Food and Agriculture Organisation) et la Banque Mondiale ont mis en place un programme d'urgence pour le réapprovisionnement des fermes. Il s'est agi de fournir pour chacune des fermes du programme une génisse gravide de 4 à 7 mois appartenant à une des trois races suivantes : Simmental, Brown Swiss ou Tyrol Grey. Diverses données de production ont ensuite été collectées sur une période de 14 à 16 mois. Les résultats des analyses ont montré que la Brown Swiss présentait la meilleure production laitière et la Tyrol Grey la plus mauvaise. Cependant, cette dernière a la durée de service la plus courte et son score de composition corporelle est moins variable que les deux autres races, ce qui la rend plus adaptée aux conditions d'exploitation extensives du Kosovo. Les races ont également été comparées pour leur taux de croissance, mais la prise en compte de ce paramètre est jugée particulièrement inappropriée dans la mesure où les individus de race à fort taux de croissance arrivent à maturité à un poids élevé et donc nécessitent des conditions intensives d'alimentation. Ainsi, en considérant les conditions de production extensive du Kosovo, nos résultats indiquent qu'il est préférable pour l'élevage bovin laitier de s'appuyer sur des races de petit format, plus adaptées au régime alimentaire offert.

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Introduction

As a consequence of Kosovo war, during 1998-99 farmers lost approximately 200 000 cattle, or half the national cattle population (Kodderitzsch and Veillerette, 1999). After the war the Food and Agriculture Organization (FAO) and the World Bank (WB) implemented a joint cattle Emergency Farm-Restocking project (EFRP) in Kosovo aiming at improving nutrition and food security in households affected by the conflict. During this restocking process three dual-purpose cattle breeds [Simmental (S), Figure 1 and 2; Brown Swiss (BS), Figure 3 and 4; and Tyrol Grey (TG), Figure 5 and 6] were imported and randomly allocated to small-scale farmers. Before receiving the new breeds, these farms have had on average 2.4 cows per farm, making up 95% of the cattle population in Kosovo. The introduction of these breeds (S, BS and TG) raised discussion among local and international experts concerning their suitability to the local small scale farming system.

One way to identify the most appropriate cattle breed for Kosovo would be to rely on a profit approach, measuring all traits affecting profit. Alternatively, one could select the breed that is best fitted to the local environment as measured by some indicator traits, e.g. the interval from calving to first insemination, or body condition scoring. The latter approach was chosen here.

Hence, the objective of this study was to compare production, fertility traits and body condition scoring of the three imported breeds under the small scale farming system in Kosovo, to possibly identify the most appropriate cattle breed for Kosovo conditions.

Materials and Methods

Description of project

The project was carried out from October 2000 to June 2003, in three phases of importation, in the years 2000, 2001 and 2002 (Table 1). In the first phase S and BS were imported, while only S and TG were imported later. Over the three phases, far more S heifers (3463) than BS (678) and TG (259) were imported.

Both S and BS were sourced from Germany and Austria, while TG was sourced from Austria (two international companies provided the animals).

At importation, heifers were 4-7 months pregnant, with bulls of the same breed. Farmers in the 228 villages that suffered the greatest losses to their livestock during the war were given for free, one heifer per farm. The average number of cows donated per village was about 20. For the first phase of importation calving was mainly from December until the end of May, with about 60% in January and February. In phase three, calving was from August to December, with more than 50% in October and November.

All heifers were re-mated to a bull of the same breed, the majority by artificial insemination, but also by natural mating to imported bulls (Table 1).

Management practice

The climate in Kosovo is typically semi-continental, with annual averages for rainfall and temperature of 631 mm and 11°C respectively, during the last 20 years (Kosovo Hydrometeorology Institute, 2001). Normally, cattle are kept indoors from second part of November until the end of April (winter period). During this period all feeding takes place indoors, and consists mostly of hay. Farms are small and fragmented, each being on average 1.5 ha in size.

Data recording

The FAO and Non-Governmental Organisations (NGO) staff and local veterinarians monitored the cows for

Figure 1. A Simmental cow.

Table 1. *Number of imported heifers and bulls of Simmental (S), Brown Swiss (BS) and Tyrol Grey (TG) in three phases of importation.*

Import phase	Simmental		Brown Swiss		Tyrol Grey	
	Heifers	Bulls	Heifers	Bulls	Heifers	Bulls
2000	1 749	32	678	13	-	-
2001	1 182	25	-	-	199	10
2002	532	10	-	-	60	2
Total	3 463	67	678	13	259	12

different events over a period of 14-16 months. The data collected consisted of ear tag number, breed, phase of importation, village of donation, birth date, calving date, data for milk production, sex of calf, birth weight of calf, calf growth rate, fertility, body condition scoring, and socio-economic variables. Due to lack of recording practice in some farms, incomplete records and obvious outliers were excluded from the analyses.

Milk production

The farmers carried out recording of milk production twice a day each month, in the morning and in the evening. From these observations, average monthly milk production was derived, from which average daily milk yield over the first 305 days of lactation (AMY305, Table 2) was calculated.

Calf sex, birth weight and growth rate Calf body weights at birth (BWC, Table 2), at 3 (weaning) and at 10 months of age were used to calculate growth rate from birth to 3 (GRC3) and 10 (GRC10) months of age, respectively (Table 2). Actually, calf live weight records were predicted using heart girth circumference and non-elastic calibrated tape, by the national livestock specialist. For accuracy of recording, predictions were compared with actual weights of 20 individuals from each breed at birth, 3 and 10 months of age. Predictions

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Table 2. Number of records (N), mean ($\overline{X}$) and standard deviation (SD) for each trait[1] and breed.

Traits	Simmental			Brown Swiss			Tyrol Grey		
	N	$\overline{X}$	SD	N	$\overline{X}$	SD	N	$\overline{X}$	SD
AMY305	1 900	11.96	2.68	444	12.69	2.84	172	10.82	1.89
BWC	328	39.45	2.68	73	38.15	2.34	73	32.59	2.01
GRC3	281	0.86	0.16	62	0.74	0.10	68	0.65	0.08
GRC10	254	0.96	0.16	59	0.76	0.09	66	0.72	0.07
SP	3 179	102.33	47.35	582	119.37	50.23	242	97.02	40.23
NRR	3 261	0.46	0.52	623	0.33	0.53	244	0.52	0.57
BCSC	791	3.28	0.34	200	3.21	0.33	118	3.24	0.29
BCSS	791	2.52	0.34	200	2.35	0.34	118	2.62	0.30

[1]AMY305 = Average milk yield over first 305 days of first lactation (kg/day).
BWC = Birth weight of calf (kg).
GRC3 = Growth rate of calf over first 3 months of age (kg/day).
GRC10 = Growth rate of calf over first 10 months of age (kg/day).
SP = Service period (days).
NRR = Non-return rate at first insemination (%/100).
BCSC = Body condition score, within one week after calving (1-5).
BCSS = Body condition score, within one week after service (1-5).

Figure 2. Simmental cow.

were found to be accurate, deviating on average by 5.2%, 3.5% and 1.6%, respectively.

Fertility

For each cow, the farmer and veterinarians recorded dates up until third mating and whether this was by artificial insemination or by natural mating. From these, the interval from calving to first insemination defined the service period (SP; Table 2), while non-return rate at first insemination was coded 1 if a cow did not return to service after the first insemination and 0 otherwise (NNR; Table 2). Cows were serviced more often with artificial insemination (56%) than with natural mating (44%).

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Figure 3. Brown Swiss cow.

Body condition scoring

Body condition was scored at the loin, pelvis and tail head within one week after calving (BCSC; Table 2) and within one week after service (BCSS; Table 2), by the project national livestock specialist and national veterinary specialist. A scale from 1 (very thin) to 5 (very fat) was used for evaluation (Edmonson *et al.,* 1989).

Socio-economic variables

Several socio-economic indicators were recorded;

Figure 4. Brown Swiss cow.

1. Household headed by a female - yes (1), or otherwise (2);
2. Size of land - <1 Ha (1), 1 ha ≤ -<2.5 ha (2), and ≥ 2.5 ha (3);
3. Size of the family -<7 (1), 7 – 11 (2), and >12 (3);
4. Existence of members within the family older than 65 years of age - yes (1), or otherwise (2);
5. Existence of members within the family younger than 12 years of age - yes (1), or otherwise (2);
6. The family had cow before the donated one - yes (1), or otherwise (2); and
7. Sex of beneficiary - female (1), or male (2).

The data was obtained from village representatives and local agricultural authorities and recorded by project staff (national data base specialist and national livestock specialist).

Information on feeding

Information on feeding was available for 166 randomly selected farms. Farms were blocked into two groups (rations) 1 and 2, made up of farms using forage and concentrate, or only forage, respectively. This allowed for estimation of a breed x ration interaction effect on different traits.

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Statistical analyses

All analyses were carried using the SAS-package and the PROC GLM procedure (SAS Institute Inc., 1999). Generally, univariate fixed effect models were used to estimate breed effect. The final model was chosen by backward elimination of non-significant ($P \geq 0.05$) variables, one at time. All effects were considered as classification variables. Effects were tested and their respective levels of significance are shown in Table 3. The same approach was used when estimating for a breed x ration effect (Table 4). However, due to few records for weight traits being available (Table 2), they were not analysed. Furthermore, socio-economic variables were hardly significant in the completed material (Table 3), so they were omitted from these analyses, in which importation phase and village were considered as major effects.

Results

Overall mean and standard deviations for the various traits and breeds are presented in Table 2, while the levels of significance of breed differences are shown in Table 3. In table 5, least-squares mean with corresponding standard error and levels of significance in tests of differences in least-squares means between breeds are given. Generally, least squares mean results were in accordance with those from simple means.

For milk production, breed differences were significant ($P<0.0013$; Table 3), and so were all least-squares mean differences ($P<0.0270$; Table 5), the highest average daily milk yield was for BS, exceeding the milk yield of S and TG with 0.59 kg and 2.72 kg milk per day, respectively (Table 5). The month of calving had a clearly significant effect on milk yield ($P<0.0001$; Table 3), with the highest yield obtained during the winter period (results not shown). Furthermore, cows from households headed by a man produced a slight but highly significant increase (0.42 kg) in milk yield per day compared with cows from female-headed households ($P<0.0051$; Table 3).

For birth weight of calves and their growth rates until 3 or 10 months of age, breed differences as well as least-squares mean of breed differences were significant

Figure 5. Tyrol Grey cow.

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Table 3. Level of significance¹ for effects modeled² to affect various traits³ in analyses of a breed effect.

Traits	Breed	Importation phase x village	Calving month	Age - 1st insemination in 1st lactation	Sex of calf	Method of insemination	HHF	SL	SF	FM>65	FM<12	FCBD	SB
AMY305	<0.0013	<0.0001	<0.0001	-	-	-	<0.0051	NS	NS	NS	NS	NS	NS
BWC	<0.0001	NS	NS	-	<0.0001	-	NS	NS	NS	NS	NS	NS	NS
GRC3	<0.0001	NS	NS	-	<0.0001	-	NS	NS	NS	NS	NS	NS	NS
GRC10	<0.0001	NS	NS	-	<0.0001	-	NS	NS	NS	NS	NS	NS	NS
SP	<0.0001	<0.0001	<0.0001	-	-	-	<0.0366	NS	NS	NS	NS	NS	NS
NRR	<0.0048	<0.0001	NS	NS	-	<0.0001	<0.0191	NS	NS	NS	NS	NS	NS
BCSC	NS	<0.0056	NS	-	-	-	NS	NS	NS	NS	NS	NS	NS
BCSS	<0.0059	<0.0129	NS	-	-	-	NS	NS	NS	NS	NS	NS	NS

[1]NS = Not significant, i.e. level of significance ≥ 0.05.
[2]Breed = (Simmental (1), Brown Swiss (2), or Tyrol Grey (3)).
Importation phase x village = (1,2 or 3) x (1, . . . , 228)).
Calving month = (1, . . . , 12).
Age-1st insemination in 1st lactation = (months 22, . . . , 45).
Sex of calf = (female (1), or male (2)).
Method of insemination = (artificial (1), or natural (2)).
HHF = (household headed by a female (yes (1), or otherwise (2)).
SL = (Size of land (<1 Ha (1), 1 Ha ≤ - < 2.5 Ha (2), and ≥ 2.5 Ha (3)).
SF = (size of the family (<7 (1), 7 – 11 (2), and ≥ 12 (3)).
FM>65 = (members within the family older than 65 years of age (yes (1), or otherwise (2)).
FM<12 = (members within the family younger than 12 years of age (yes (1), or otherwise (2)).
FCBD = (family had cows before donated one (yes (1), or otherwise (2)). and
SB = (sex of beneficiary (female (1), or male (2)).
[3]AMY305 = Average milk yield over first 305 days of first lactation (kg/day).
BWC = Birth weight of calf (kg).
GRC3 = Growth rate of calf over first 3 months of age (kg/day).
GRC10 = Growth rate of calf over first 10 months of age (kg/day).
SP = Service period (days).
NRR = Non-return rate at first insemination (%/100).
BCSC = Body condition score within, one week after calving (1-5).
BCSS = Body condition score, within one week after service (1-5)

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Table 4. *Level of significance[1] for effects modeled[2] to affect various traits[3] in analyses of a breed x ration effects.*

Traits	Breed x ration	Importation phase	Village	Calving month	Age - 1st insemination in 1st lactation	Method of insemination
AMY305	<0.0750	<0.0298	<0.8570	NS	-	-
SP	<0.0011	<0.7863	<0.3386	NS	-	-
NRR	<0.5992	<0.5611	<0.3974	NS	NS	NS
BCSC	<0.1329	<0.2183	<0.2741	NS	-	-
BCSS	<0.0017	<0.2497	<0.2245	NS	-	-

[1]NS = Not significant, i.e. level of significance ≥ 0.05.
[2]Breed x ration = (Simmental (1), Brown Swiss (2), or Tyrol Grey (3) x forage and concentrate (1), or only forage (2)).
  Importation phase = (1,2, or 3). Village = (1, . . . , 64). Calving month = (1, . . . , 12).
  Age-1st insemination in 1st lactation = (months 22, . . . , 45).
  Method of insemination = (artificial (1), or natural (2)).
[3]AMY305 = Average milk yield over first 305 days of first lactation (kg/day).
  SP = Service period (days).
  NRR = Non-return rate at first insemination (%/100).
  BCSC = Body condition score, within one week after calving (1-5).
  BCSS = Body condition score, within one week after service (1-5).

Figure 6. Tyrol Grey cow.

(P<0.0001 and P<0.0026, Table 3 and Table 5, respectively). S calves had the highest birth weight, 1.28 kg and 6.85 kg higher than BS and TG, respectively (Table 5). S grew faster than BS and TG, 130 g/day and 220 g/day at 3 months of age, and 180 g/day and 240 g/day at 10 months of age, respectively (Table 5). Birth weight and growth rate traits were significantly (P<0.0001; Table 3) affected by the sex of the calf.

For the service period breed differences were again significant (P<0.0001, Table 3), as were the least- squares mean differences

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Table 5. Estimates of least-squares mean (LSM), their standard error (SE) and level of significance on the test of differences in least-squares mean between Simmental (S), Brown Swiss (BS), and Tyrol Grey (TG), for various traits[1].

Traits	Simmental		Brown Swiss		Tyrol Grey		S vs. BS	S vs. TG	BS vs. TG
	LSM	SE	LSM	SE	LSM	SE			
AMY305	11.76	0.26	12.35	0.29	9.63	0.92	<0.0037	<0.0270	<0.0058
BWC	39.24	0.17	37.96	0.31	32.39	0.31	<0.0002	<0.0001	<0.0001
GRC3	0.87	0.01	0.74	0.02	0.65	0.02	<0.0001	<0.0001	<0.0004
GRC10	0.96	0.01	0.78	0.02	0.72	0.02	<0.0001	<0.0001	<0.0026
SP	125.29	4.13	113.79	4.67	97.07	9.88	<0.0001	<0.0035	<0.2282
NRR	0.53	0.02	0.44	0.03	0.40	0.11	<0.0023	<0.2355	<0.7374
BCSC	3.28	0.02	3.21	0.04	3.14	0.17	<0.0611	<0.4552	<0.7415
BCSS	2.54	0.03	2.40	0.05	2.54	0.19	<0.0014	<1.0000	<0.4937

[1]AMY305 = Average milk yield over first 305 days of first lactation (kg/day).
 BWC = Birth weight of calf (kg).
 GRC3 = Growth rate of calf over first 3 months of age (kg/day).
 GRC10 = Growth rate of calf over first 10 months of age (kg/day).
 SP = Service period (days).
 NRR = Non-return rate at first insemination (%/100).
 BCSC = Body condition score within, one week after calving (1-5).
 BCSS = Body condition score, within one week after service (1-5).

between, respectively, S and BS and S and TG.(*P*<0. 0035; Table 5).

The service period was the longest for S (125 days), followed by BS (114 days) and TG (97 days). The service period was affected by calving month (*P*<0.0001, Table 3) with calving during spring resulting in the shortest period (results not shown). The service period was significantly (*P*<0.0366; Table 3) longer (4 days) for cows from female-headed households than for cows from households headed by a man.

For non-return rates, the overall test of the breed effect was significant (*P*<0.0048; Table 3) with a clear (*P*<0.0023; Table 5) least-squares mean difference between S and BS. S had the highest success rate on conceiving at first insemination (53%), followed by BS (44%) and TG (40%). Non-return rate was significantly affected by the method of insemination (*P*<0.0001; Table 3), with about 57% success rate for natural service compared with 34% in artificial insemination. Whether the household was headed by a man or a woman also significantly affected non-return rate (*P*<0.0191, Table 3), with female headed households being (0.09 %, results not shown) better than those headed by a man.

At calving breed differences in body condition score were not significant (*P*<0.1701).

However, significant breed differences were found for body condition scores within one week after service (*P*<0.0059; Table 3) as indicated by the least-squares mean differences between S and BS (*P*<0.0014 Table 5). Actually, BS reduced its body condition score more than S, while TG cows showed the smallest reduction (Table 5).

For the length of service period and body condition score at service, the overall test of a breed x ration effect was significant (*P*<0.0011 and *P*<0.0017, respectively; Table 4). When looking at the differences in least-squares mean between rations within breed, body condition scoring within one week after service was significantly reduced for both S and BS, on the ration without concentrate (*P*<0.0012 and *P*<0.0444, respectively; Table 6). Notably, the S non-return rate was higher when feeding extensively (*P*<0.0012; Table 6).

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Table 6. Estimates of least-squares mean (LSM), their standard error (SE) and level of significance of differences in least-squares mean between rations, within Simmental, Brown Swiss and Tyrol Grey, for various traits[1].

Traits	Simmental		Brown Swiss		Tyrol Grey	
	LSM	SE	LSM	SE	LSM	SE
Forage and concentrate						
AMY305	13.25	0.58	15.31	1.31	9.46	1.29
SP	72.44	8.46	93.15	23.42	109.92	21.56
NRR	0.58	0.09	0.61	0.23	0.46	0.21
BCSC	3.36	0.06	2.94	0.14	3.34	0.14
BCSS	2.65	0.07	2.38	0.16	2.71	0.16
Forage only						
AMY305	12.29	0.46	13.74	1.33	9.24	1.13
SP	113.18	10.88	131.80	22.97	140.00	22.29
NRR	0.64	0.11	0.50	0.23	0.18	0.22
BCSC	3.33	0.07	3.19	0.15	3.24	0.14
BCSS	2.35	0.08	2.00	0.17	2.62	0.16
Level of significance for differences between rations						
AMY305	<0.1349		<0.3050		<0.8407	
SP	<0.6068		<0.6711		<0.2063	
NRR	<0.0012		<0.1404		<0.1833	
BCSC	<0.7868		<0.1441		<0.5232	
BCSS	<0.0012		<0.0444		<0.5592	

[1]MY305 = Average milk yield over first 305 days of first lactation (kg/day).
SP = Service period (days).
NRR = Non-return rate at first insemination (%/100).
BCSC = Body condition score, within one week after calving (1-5).
BCSS = Body condition score, within one week after service (1-5).

Discussion

BS is known as a high yielding cow of medium size, while both S and TG are dual-purpose breeds, with TG being a small breed with low milk production. Compared to the countries from which the breeds were imported, milk production was definitely lower in Kosovo, approximately 35 % for S and BS and 20 % for TG (Cattle breeding in Austria, 2002; Rinder production, 2002; Tiroler Grauvieh, 1999). In this rather extensive production environment, milk in kg/per day was highest for BS, followed by S and TG. When comparing breeds on the basis of service period or change in body condition scoring, we are, to a large extent, comparing them on indicators of energy balance (e.g. Van der Lende, 1998, for service period). This gives an indication of how well the breeds fit the local environment. In this respect, TG did best, followed by BS for service period, and S for body condition scoring. TG was closest to achieving a 12 month calving interval, as recommended by Schultz-Rajalla and Frazer (2003) and Schmidt (1989).

With respect to the breed x ration interaction effect, data was rather limited. The results indicated, again, that S and BS were more sensitive to the extensive production environment than TG, especially regarding changes in body condition score, which was significantly reduced in these two breeds when fed only forage.

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There is evidence in the literature (Van der Lende, 1998) that the quality of follicles ovulating early may be poorer than those ovulating later, thus explaining the highest non-return rate for S, followed by BS and TG. It may be the reason why the larger breeds need more time to come to first ovulation after parturition as a result of energy balance. When showing oestrous they have a higher ability to conceive (Butler and Smith, 1989). The result also agrees with results shown by Averdunk *et al.* (1995), reporting that cows coming early to heat have the lowest conception rate.

Another physiological explanation for the differences in non-return rates is that return to oestrous is heavily influenced by early embryonic mortality (Van der Lende, 1998). Non-return rate and service period are rather different traits; this is also shown in the results (Andersen- Ranberg *et al.,* 2004), manifesting a genetic correlation of close to zero between these two traits in first lactation of the Norwegian Red breed.

To date in Kosovo, specialized beef cattle production is almost non-existent. Hence, dual-purpose cattle breeds (S and TG) may have preference over more specialised milk breeds (BS). A significantly higher growth rate was found in S compared with TG. However, breeds with higher growth rates normally reach maturity later and also require more intensive feeding than those reaching maturity earlier (Geay and Robelin, 1979).

Many farmers are used to dealing with local cattle and their crossbreeds of a smaller type, with limited milk production, and small feed requirements compared with the large imported breeds. Thus the quality and quantity of the feed offered were probably not sufficient to meet the requirements of the imported breeds, especially for S and BS. Hence, under current extensive environmental conditions in Kosovo, results suggest that dairy cattle production should be based on a smaller breed, well adapted to the diet offered.

Conclusion

Our results support the finding that under the extensive production environment in Kosovo, dairy cattle production should be based on a small breed with limited milk production potential, which is more adapted to the extensive environmental production conditions. More relevant information about the best cattle type for small-scale farming in Kosovo would have been obtained if local cattle and their crossbreeds had been included in the study.

Acknowledgements

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La raza ovina Xisqueta en España: Caracterización estructural de las explotaciones

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Resumen

La Xisqueta es una raza ovina de orientación cárnica que se localiza mayoritariamente en tres comarcas del N-O de Catalunya (España). Se caracteriza por poseer una coloración centrífuga particular y por ser una raza rústica, perfectamente adaptada a las condiciones trashumantes y pirenaicas. El censo aproximado de xisquetas en pureza lo situamos entre 12 000 y 15 000 hembras reproductoras, habiendo sufrido una importante reducción en las últimas décadas.

La caracterización estructural de las explotaciones de Xisqueta se ha realizado mediante una encuesta, y los resultados se han analizado estadísticamente con el fin de obtener información sobre la distribución poblacional, los sistemas de manejo productivo y reproductivo, la sanidad y otras cuestiones adicionales sobre el entorno social de los ganaderos.

Utilizando como base la información y resultados generados en el presente estudio, se pretende iniciar un programa de conservación de la raza, el cual deberá englobar las marcadas diferencias existentes entre las comarcas de la región. Además, deberá considerarse la elevada media de edad de los ganaderos (52 años como promedio) y el bajo relevo generacional de las explotaciones (<30%), factores que agravan la continuidad del sector ovino en dichas comarcas.

Summary

The Xisqueta is a sheep breed utilised for meat production, found mainly in three areas of north western Catalonia, Spain. This breed is characterized by a particular pattern of coloration on the points and its rusticity, being perfectly adapted to migrate seasonally in the search of fresh pastures. The Xisqueta population ranges between approximately 12 000 and 15 000 breeding females, having suffered a significant reduction in the last decades.

The Xisqueta breeding system has been studied by means of a questionnaire, and the results have been statistically analysed with the objective of obtaining information about the distribution, flock health and productive and reproductive management systems of the breed. Additional questions posed referred to the farmer's lifestyle.

A next step would be to undertake a conservation programme of the Xisqueta breed, taking into account the results obtained in the recent survey. This programme should consider the marked differences observed in the three analysed regions. Moreover, farmers were found to be middle aged or older (52 years as an average), a feature that makes the continuity (<30%) of the ovine sector in these areas difficult.

Key words: *Sheep, Distribution, Production system, Conservation, Health.*

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Introducción

La Xisqueta es una raza autóctona de Cataluña, España, aunque también existen algunos efectivos en Aragón (Sánchez-Belda y Sánchez-Trujillano, 1986). Se localiza mayoritariamente en las comarcas del Pallars Jussà, el Pallars Sobirà y la Alta Ribagorça, en zonas de Pirineos y pre-pirineos (Figura 1).

La Xisqueta es de aptitud cárnica y como rasgo morfológico característico presenta una coloración blanca con pigmentación centrífuga en forma de manchas negras, excepcionalmente pardas o rojizas, en la punta de las orejas, alrededor de los ojos, labios y partes distales de las extremidades. Respecto a los caracteres regionales, tiene la cabeza pequeña y subconvexa; el cuello corto, muy fuerte y sin papada; el tronco ancho y robusto; y los miembros y aplomos cortos e intensamente musculados (Sánchez-Belda y Sánchez-Trujillano, 1986; Jordana y Jordana, 1995; Asociación Catalana de Criadores de Ovino de Raza Xisqueta – comunicación personal-). Las figuras de los animales de la raza van de la 2 a la 6.

La Xisqueta es una raza rústica, perfectamente adaptada a las condiciones ambientales adversas y muy activa. Proviene del Tronco Ibérico, que se encuentra repartido entre los diferentes sistemas montañosos de España, distribución que se atribuye a su capacidad para subsistir en regiones con recursos vegetales escasos y condiciones ambientales extremas. Actualmente la raza padece una importante regresión, principalmente debida a la disminución del número de ganaderos que habitan estas zonas montañosas, y porque en las zonas no montañosas no puede competir con otras variedades ovinas más productivas. Por otro lado, la situación se ve agravada debido a que en las últimas décadas se ha producido una progresiva despoblación y una marcada regresión de la ganadería, en pro del sector terciario en las zonas de alta montaña.

Debido a la escasa información existente sobre el sector ganadero de oveja Xisqueta, se elaboró una encuesta que pudiese proporcionar una información amplia y global sobre dicho sector y, de este modo, poder iniciar un programa de conservación de la raza.

Material y Métodos

El estudio se ha realizado en una típica región montañosa del N-O de Cataluña, que se estructura en tres comarcas: el Pallars Jussà (PJ), el Pallars Sobirà (PS) y la Alta Ribagorça (AR). La población humana de la zona se ha visto reducida en un 70% en las últimas décadas y el censo ovino de la región ha disminuido en un 25% en los últimos años. El clima de las tres comarcas se

Figura 1. Localización geográfica de la raza ovina Xisqueta.

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Figura 2. Detalle de la cabeza de una hembra de raza Xisqueta.

caracteriza por las bajas temperaturas, durante la mayor parte del año, y por la elevada pluviometría, con frecuencia en forma de nieve, que varía entre 500-1 200 mm/año según la altitud (Gran Enciclopedia Catalana, 1994). Las diferencias en la pluviometría y en la orografía condicionan la utilización de los sistemas productivos propios de cada comarca, razón por la cual, al analizar los datos, se ha considerado la subdivisión comarcal.

Para realizar la encuesta se seleccionaron todas aquellas explotaciones de la región que tenían más del 5% del rebaño formado por ovejas xisquetas en pureza, cumpliendo estas condiciones 108 explotaciones (52 en PJ, 35 en PS y 21 en AR) de un total de 252. Todos los propietarios de estas explotaciones fueron entrevistados por el mismo técnico, con el objetivo de conocer la situación del manejo que se estaba realizando sobre la raza. La encuesta se estructuró en cinco apartados, referentes a la distribución poblacional, manejo productivo y

reproductivo, sanidad y cuestiones adicionales para caracterizar el entorno social de los ganaderos.

Una vez finalizadas las entrevistas, las encuestas se agruparon según la comarca a la que pertenecían los ganaderos. Las variables de los cuatro primeros bloques se diferenciaron en dos grupos, según si eran de tipo continuo o porcentual, y se procedió a su análisis mediante el paquete estadístico SAS (Statistical Analysis System, 1996). Las variables del último bloque se analizaron a través de estadística descriptiva también con el paquete estadístico SAS.

Resultados y Discusión

Distribución poblacional

Según los datos proporcionados por los ganaderos, a través de las encuestas, el censo de xisquetas fue bastante elevado debido a que en muchos casos consideraron a los animales cruzados como pertenecientes a la

raza. No obstante, la Asociación Catalana de Criadores de Ovino de Raza Xisqueta (ACOXI), organización que vela por la pureza y selección de la raza en Cataluña y promueve su expansión, tiene admitidos en su registro únicamente 8 693 animales, después de la correspondiente valoración morfológica. Así pues, y habiéndose visitado la totalidad de las explotaciones analizadas, con el fin de determinar el porcentaje de animales en pureza y teniendo en cuenta los datos anteriores de ACOXI que no incluyen la totalidad de las ganaderías de la raza, podemos extrapolar y afirmar que el censo aproximado de xisquetas en pureza estaría comprendido entre 12 000 y 15 000 cabezas.

Siguiendo los resultados de las encuestas, el porcentaje de xisquetas por comarca se sitúa en el 67,6% en la Alta Ribagorça, en el 49,5% en el Pallars Sobirà y en el 37,8% en el Pallars Jussà. La variación porcentual entre comarcas estuvo en función de las mismas, aumentando dicho porcentaje en condiciones más extremas. El porcentaje de xisquetas por rebaño fue del 80,6% en la Alta Ribagorça, del 76,2% en el Pallars Sobirà y del 58,8% en el Pallars Jussà.

De los 108 rebaños estudiados, 51 (47,2%) estaban formados tan sólo por ovejas y 57 (52,8%) por cabras y ovejas. En los rebaños que tenían cabras, éstas representaban una minoría, con una media de 14 cabras y 1 macho cabrío por rebaño. El tamaño medio de los rebaños fue de 598 ovejas y 11 moruecos en el Pallars Jussà,

480 ovejas y 11 moruecos en el Pallars Sobirà y 838 ovejas y 15 moruecos en la Alta Ribagorça, existiendo una clara relación positiva entre la comarca, el nivel de acondicionamiento de las explotaciones y el número de efectivos que presentan las mismas (Tabla 1).

Manejo productivo

La práctica más utilizada en las tres comarcas fue el sistema semi-extensivo, dónde, según las necesidades y estado fisiológico de la oveja, se aporta una alimentación suplementaria. El pastoreo es conducido y se realiza en las zonas próximas a la explotación. En verano, la trashumancia hacia los pastos de alta montaña se practica en casi todos los rebaños de la Alta Ribagorça (95,2%) y del Pallars Sobirà (97,1%), mientras que en el Pallars Jussà esta práctica se reduce al 65,4% de las explotaciones. El resto del año, únicamente la mitad de las explotaciones de la Alta Ribagorça (47,6%) realizan trashumancia hacia regiones con una climatología más benigna y unos pastos más abundantes, situadas en el Valle del Ebro (provincias de Lérida y Huesca)

El período de lactancia de los corderos depende del criterio de los ganaderos y puede ser continuo, parcial o alternativamente uno u otro según la época

Tabla 1. Tamaño medio de los rebaños de las explotaciones estudiadas y error estándar asociado. Entre paréntesis, número de explotaciones con efectivos (>5%) de raza Xisqueta por comarca.

	Alta Ribagorça (n=21)	Pallars Sobirà (n=35)	Pallars Jussà (n=52)
Hembras totales	838,0±87,8[b]	479,7±68,0[c]	598,1±55,8[a]
Machos totales	15,3±1,8[a]	10,9±1,4[b]	10,8±1,1[b]
Hembras Xisqueta	675,3±84,9[a]	346,7±65,8[b]	359,5±54,5[b]
Machos Xisqueta	13,1±1,8[a]	8,5±1,5[b]	5,7±1,2[b]

[a, b, c] Letras diferentes en la misma línea indican diferencias estadísticamente significativas entre comarcas ($P<0.05$).

Figura 3. Oveja de raza Xisqueta amamantando a su cordero.

de cría. La alimentación de los corderos consiste fundamentalmente en pienso y paja, aunque a veces también se les suministra algo de trigo y cebada. La media de los pesos y edades de los corderos al destete y a la venta fueron muy similares entre comarcas. El peso al destete se situó alrededor de los 16 kg y el peso a la venta en torno a los 24,5 kg, mientras que la edad al destete fue de unos 52 días y la edad a la venta de unos 84 días (Tabla 2).

Manejo reproductivo

En las explotaciones estudiadas la sincronización de celos era la única alternativa a la monta continua. Concretamente, la sincronización de celos se realizaba en el 80,4% de las explotaciones del Pallars Jussà, en el 80,0% de las de la Alta Ribagorça y en el 55,9% de las del Pallars Sobirà, presentando esta comarca diferencias

Tabla 2. Media de los pesos (kg) y edades (días) al destete y a la venta, y sus errores estándar asociados.

	Alta Ribagorça	Pallars Sobirà	Pallars Jussà
Peso al destete	15,28 ± 0,58	16,40 ± 0,53	16,00 ± 0,41
Edad al destete	49,57 ± 3,04	57,23 ± 3,15	51,51 ± 2,11
Peso a la venta	23,57 ± 0,38 [b]	24,39 ± 0,31 [ab]	24,52 ± 0,24 [a]
Edad a la venta	81,26 ± 2,39	86,84 ± 1,90	83,86 ± 1,53

[a, b, c] Letras diferentes en la misma línea indican diferencias estadísticamente significativas entre comarcas (*P*<0.05).

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significativas respecto a las dos primeras, ya que algunos ganaderos eran muy reacios a cambiar de sistema y otros no querían aumentar la prolificidad de su explotación porque el inadecuado acondicionamiento de la misma no lo permitía.

Se observó una relación directa entre el sistema reproductivo y el número de partos realizados por oveja y año, donde se obtenían tres partos bianuales por oveja en el 75,0% de las explotaciones del Pallars Jussà, en el 88,1% de las de la Alta Ribagorça y en el 68,8% de las del Pallars Sobirà. El resto de ovejas de cada rebaño realizaba un parto anual. El porcentaje de ovejas que parían dos corderos era bajo, situándose entre el 15-25% de las ovejas paridas por explotación. El porcentaje de reposición estaba en torno al 15,5% de los efectivos de cada rebaño.

Sanidad

La vacunación para evitar la basquilla o enterotoxemia y la desparasitación eran las medidas que prioritariamente tomaban los ganaderos para sanear sus rebaños, realizándose en el 100% de las explotaciones de la Alta Ribagorça, mientras que en el Pallars Jussà los valores eran del 84,6% y 88,5%, respectivamente, y en el Pallars Sobirà se practicaban en el 74,3% y el 82,9% de las explotaciones. El número de explotaciones que realizan la vacunación para evitar la agalaxia contagiosa y los abortos (*Chlamydia* sp.) fue mucho menor (Tabla 3).

El 2,7% de las hembras de cada rebaño padecían mamitis y el 3,5% abortaba. Las bajas de efectivos adultos variaban según la comarca, siendo del 5,4% anual en el Pallars Jussà, del 6,0% en la Alta Ribagorça y del 7,4% en el Pallars Sobirà.

Cuestiones adicionales

La edad media de los ganaderos era de 52 años. Casi todos habían tenido siempre ovejas de raza Xisqueta en su rebaño y creían

Figura 4. Cordero de raza Xisqueta.

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Figura 5. Rebaño de xisquetas acalorando en una colina cercada con pastor eléctrico, en la comarca del Pallars Sobirà.

Tabla 3. Número y porcentaje de explotaciones en cada comarca que toman medidas sanitarias.

	Alta Ribagorça	Pallars Sobirà	Pallars Jussà
Vacunación contra basquilla	21 (100,0%)[a]	26 (74,3%)[b]	44 (84,6%)[a]
Desparasitación	21 (100,0%)[a]	29 (82,9%)[b]	46 (88,5%)[a]
Vacunación contra Agalaxia Contagiosa	7 (33,3%)[a]	5 (14,3%)[ab]	4 (7,7%)[b]
Vacunación contra abortos por *Chlamydia sp.*	4 (19,0%)	3 (8,6%)	6 (11,5%)

[a, b, c]Letras diferentes en la misma línea indican diferencias estadísticamente significativas entre comarcas ($P<0.05$).

que era la raza idónea para la región, ya fuera por su rusticidad o porque era la raza autóctona (Tabla 4). Más del 80,0% de los ganaderos encuestados por comarca recibían ayuda familiar para realizar las tareas diarias del manejo de su explotación. Pese a estos datos, la mayoría de las explotaciones parece ser que no tendrán continuidad dentro del núcleo familiar (>70%). Casi la mitad de los encuestados tenían otros negocios aparte de la explotación ovina, ya fueran explotaciones bovinas, carnicerías o casas de turismo rural. El 60% de los ganaderos de la comarca creían que una de

las salidas del sector sería orientar la producción hacia productos de calidad como pudieran ser corderos con denominación de origen de raza Xisqueta. También creían que podría ser interesante la comercialización conjunta y la creación de un cebadero comunitario, que permitiera certificar que la carne de los corderos de esta raza es un producto de calidad. Por otro lado, los ganaderos consideraban que si no se incentivaba a la gente joven para que se dedicase a trabajar en explotaciones con Xisqueta, la raza se extinguiría en pocos años.

Tabla 4. Porcentaje de ganaderos encuestados en cada comarca que han contestado afirmativamente a las cuestiones adicionales.

	Alta Ribagorça	Pallars Sobirà	Pallars Jussà
Ha tenido siempre Xisqueta	95,2	100,0	90,4
Es la raza idónea	90,5	77,1	78,8
Recibe ayuda familiar	81,0	80,0	82,7
No tiene continuidad generacional	81,0	82,9	73,1
Tiene otros negocios	42,9	45,7	40,4
Programa de mejora del sector	61,9	62,9	61,5

Dada la estrecha relación que ha existido durante siglos entre la raza ovina Xisqueta y la población de las comunidades rurales de las comarcas del Pallars Jussà, el Pallars Sobirà y la Alta Ribagorça, se hace notoria la necesidad de iniciar acciones enfocadas al mantenimiento del desarrollo rural sostenible de esta región. Con el fin de potenciar el crecimiento económico de estas zonas rurales se debería conservar la raza ovina autóctona y, por otro lado, incrementar la productividad de las explotaciones de ovino de esta zona. Además, el mantenimiento de la ganadería extensiva, vinculada en estas comarcas a la raza Xisqueta, es la única garantía de conservación y mantenimiento del paisaje tradicional y de los ecosistemas ligados a la montaña. La aproximación realizada a las explotaciones de Xisqueta mediante el presente estudio servirá para iniciar un programa de gestión de las explotaciones, constituyendo la primera fase del proyecto de conservación de la raza.

Figura 6. Detalle del día del esquileo de un rebaño de xisquetas.

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Agradecimientos

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Pastoral community selection and the genetic structure of a local goat breed in Patagonia

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Summary

The effect of human intervention on the structure of locally adapted breeds in America is analyzed using the case of a rural community in Patagonia (Argentina) and its goats. The Neuquen Criollo Goat is analyzed focusing on the artificial selection practiced by the local rural community and its effects on the current type's distribution. Goatherd preferences in the selection of replacements were studied by means of a survey (n= 242). The distribution of 634 females of various types was recorded and compared with selection criteria through multivariate techniques. Producers showed clear grounds for the selection of their animals, size, conformation, hair type and coat color being the criteria most frequently cited. Most producers (84%) used at least two criteria to choose their replacements. Differences of criteria and phenotypes between areas were significant, as was the correlation between Chi-squared distances matrix on both data sets (r=0.78), showing the influence of human intervention on the breed's shape. Directional selection, practiced by rural communities in marginal areas, was the main factor of microevolution in this Criollo goat population, and probably in other Criollo populations in America.

Resumen

Se analiza el efecto de la intervención del hombre sobre la estructura genética de una raza adaptada localmente, tomando como ejemplo una comunidad campesina de la Patagonia (Argentina) y sus cabras. El caso de la Cabra-Criolla-Neuquina se analiza considerando la selección artificial practicada por los campesinos y sus efectos sobre la distribución actual de ecotipos. Las preferencias de los productores fueron estudiadas mediante una encuesta (n: 242) y se registró la distribución de ecotipos de 634 hembras, comparándose ambos grupos de datos a través de técnicas multivariadas. La mayoría de los Crianceros (84%) emplean al menos dos criterios para elegir sus reemplazos. Los más frecuentes fueron: tamaño, conformación, tipo de pelo y color de capa. Se observaron diferencias significativas entre criterios de selección, así como en los fenotipos encontrados según el área de distribución. La correlación entre las matrices de disimilaridad (distancias Chi-cuadrado) fue asimismo significativa (r: 0,78) demostrando la influencia de la intervención del hombre en la modelación de esta raza. La selección dirigida, practicada por una sociedad campesina en una región marginal sería el principal factor microevolutivo en esta raza caprina Criolla y probablemente en otras poblaciones Criollas en America.

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Key words: Directional selection, Pastoral community, Genetic structure, Breed formation.

Introduction

Although a close relationship between people living in pastoral communities and their domestic animals is recognized, there is still a dominant paradigm that livestock in developing countries has been shaped only by the environment without human intervention (Köhler-Rollefson, 2000). Particularly in America, the general model, related to the evolution of Criollo populations, indicates that after the introduction of domestic animals in the early days of colonization some five hundred years ago, the animals have occupied different environments along the continent, with natural selection driving the process of adaptation (Russell *et al*., 2000). Other microevolution factors, such as migration, genetic drift or artificial selection, were reflected to a lesser extent in the scarce studies on these groups. Criollo populations appeared to provide optimal material for improvement, because of their rusticity and their phenotypic, and assumed genetic, variability. These populations have not been properly characterized and generally have been considered as heterogeneous groups without any identity and definition.

Directional selection is a generally accepted process, as evidenced by the formation process of standard breeds in developed countries (Herrera and Rodero, 2000) but is neglected in the case of traditional populations bred by rural communities (Lauvergne *et al*., 1987) thus ignoring the symbiosis and co-evolution between people and their animals, as postulated by Negi (1998) and Blench (2000).

In America, goat populations are generally locally adapted breeds found in marginal areas. The first goats brought to this continent, from the 16th to 18th century, were most probably of Andalusian and Canarian origin (Rodero *et al*., 1992; Capote *et al*., 2004). Later a diversity of breeds were introduced, whose dispersion and cross breeding were uncontrolled (Mueller, 1993). This accepted process probably had different results not only because different breeds were introduced at different times but also because of the diverse environmental conditions and people involved in the process.

In the present study the Neuquen Criollo goat of north Patagonia, is taken as a case study to analyze the effect of human activities on its phenotypic and genetic structure. This breed has been recently defined based on phenotypic and genetic characteristics (Table 1). Its holders identify one breed, Criollo Goat, and two types, Criollo Pelada and Criollo Chilluda (Figure 2a and 2b). Type differentiation can be explained according to a geographical pattern (Lanari *et al*., 2003). Nevertheless, these differences may not be the consequence of adaptational advantages or simply of geographical isolation as other factors could produce the observed divergence. Therefore the aim of this study was to discern how human intervention, cultural practices and other factors affected the formation of this local breed.

Materials and Methods

A survey was carried out in the north of Neuquén Province, Argentina (Figure 1). The region is home to some 1 500 "*Crianceros*" and 340 000 Neuquen Criollo goats (INDEC 2002). According to previous studies (Lanari *et al*., 2003), the region was divided into four areas: Pehuenches (P), Barrancas (B), Añelo (A) and Minas-Ñorquín (W). "*Crianceros*" can be described as goat herds which belong to rural communities of indigenous and local origin who practice an extensive subsistence farming system with transhumance. Goats have an important role in the life of the community and most associated practices have their roots in the Mapuche and Tehuelche culture (Figure 3).

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Table 1. *Phenotypic and genetic characteristics of Neuquén Criollo goat.*

Phenotypic trait		Genotype locus	Allele	Frequency
Fleece	Fleece with inner layer of Cashmere fiber	Hemoglobin	A	0.571
			B	0.373
Hair type	Short and Long hair types		D	0.056
Cranial profile	Straight	Malic Enzyme	A	0.156
Coat color	Mixed		B	0.574
Ear tonicity	Horizontal or slightly drooping ears		C	0.270
Ear length	Medium length	Alkaline Phosphatase	0	0.834
			F	0.166
Wattles	Mostly absent	Albumin	A	0.323
			B	0.535
			V	0.143
Horn shape	Aegrarus and mixed	X Protein	0	0.090
			1	0.288
			2	0.622
Body weight	Females: 39 kg	Nucleoside	H	0.450
	Males: 63 kg	Phosphorylase	L	0.550
Withers height	Females: 64 cm			
	Males: 72 cm			
Shin circumference	Females: 8.6 cm			
	Males: 11 cm			
Body length	Females: 72 cm			
	Males: 84 cm			

From: Lanari, 2004.
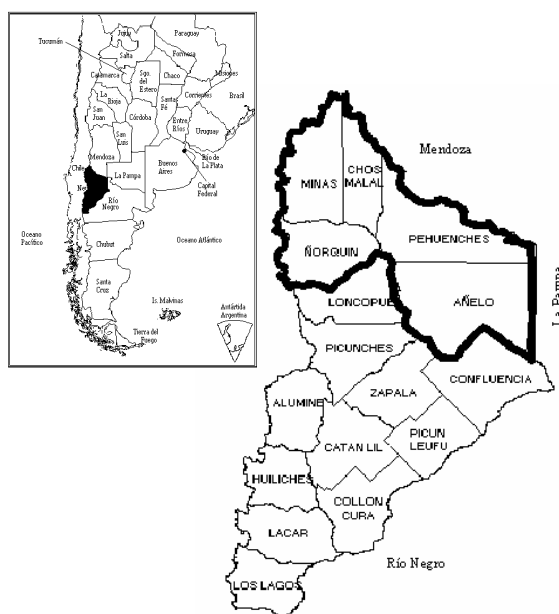
A total of 242 "*Crianceros*" were interviewed during November and December 2002. They were asked about their preferences in relation to the selection of bucks, the replacement of females and types of births in their flocks. Questions were designed to identify the importance that was given to morphological and productive traits.

Data on morphological traits such as hair type (HT) and coat color (CC) from 634 adult female goats was taken from a previous survey (Lanari *et al.*, 2000). Liveweight corrected for Body Condition Score (CLW) was taken as size indicator. The correction on Body Condition Score allows us to ignore the effect of fattening level. Two types of hair were considered: long hair (L) and short hair (S), both types having a down layer of

Figure 1. Neuquen Criollo Goat distribution area.

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Figure 2a. Types of Neuquén Criollo goat: Criollo Pelada .

Figure 2b. Types of Neuquén Criollo goat: Criollo Chilluda.

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cashmere fibers. Detailed descriptions of the region and hair types were presented in Lanari *et al*. (2003).

Descriptive analyses and Chi-square test were carried out to compare answers, as well as phenotypes in the different areas. Both sets of records were analyzed by multivariate techniques. Correspondence analysis was performed taking all variables, the answers and phenotypic traits as attributes of each area. In this procedure, Area was considered the principal classificatory variable and was included as a supplementary variable in the analysis (SAS, 1989). Then Chi-squared distances between areas were calculated based on the frequencies of each category and were separated for the inquiry and for phenotypic traits. Two additive trees (neighbour-joining) were obtained and the distance matrix compared. The SAS/STAT package was applied for the statistical analyses (Figure 5).

Table 2. Selection criteria used for the selection of "Crianceros", according to areas.

	Area			
	A	B	P	W
Buck preference- 1st choice	n=25	n=27	n=97	n=45
Size	0.48	0.15	0.42	0.56
Age	0	0.52	0.13	0.04
Hair type	0.52	0.26	0.41	0.29
Coat colour	0	0.04	0	0.07
Horns	0	0	0.04	0.02
Conformation	0	0.04	0	0.02
Buck preference- 2nd choice	n=25	n=24	n=71	n=35
Size	0.40	0.04	0.27	0.14
Age	0.16	0.08	0.24	0.37
Hair type	0.36	0.08	0.23	0.29
Coat colour	0.08	0.04	0.03	0.06
Horns	0	0.04	0.13	0.09
Conformation	0	0.71	0.11	0.06
Female goat preference- 1st choice	n=25	n=23	n=77	n=51
Size	0.08	0.52	0.69	0.76
Hair type	0.80	0	0.09	0.07
Coat colour	0	0.04	0	0
Horns	0	0.09	0.03	0.13
Conformation	0.08	0.22	0	0.02
Mothering ability	0.04	0.13	0.19	0.02
Female goat preference- 2nd. choice	n=25	n=20	n=60	n=36
Size	0.04	0.05	0.18	0.14
Hair type	0.16	0.25	0.25	0.39
Coat colour	0.16	0.35	0.03	0.14
Horns	0	0	0.10	0.06
Conformation	0.60	0.20	0.07	0.19
Mothering ability	0.04	0.15	0.37	0.08

Ref: A: Añelo, B; Barrancas, P: Pehuenches, W: Minas-Ñorquin.
n: number of effective answers to corresponding question.
Numbers in the cells indicate frequencies of answers.

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Table 3. Preferences of Neuquen Criollo breeders by area.

	Area			
	A	B	P	W
Buck preference	n=15	n=73	n=97	n=46
Big	0.07	0.08	0.40	0.50
Big & Compact	0.40	0.69	0.44	0.17
Angular	0	0	0	0.02
Small	0	0	0.01	0
Compact	0.53	0.23	0.16	0.31
Female goat preference	n=25	n=72	n=97	n=46
Big	0.08	0.06	0.54	0.61
Big & Compact	0.12	0.75	0.38	0.24
Angular	0	0	0	0.02
Small	0	0	0	0
Compact	0.80	0.19	0.08	0.13
Buck hair length preference	n=15	n=74	n=97	n=46
Short	0	0.81	0.14	0.22
Long	0.87	0.19	0.79	0.61
Indifferent	0.13	0	0.06	0.17
Females hair length preference	n=25	n=74	n=97	n=46
Short	0	0.80	0.11	0.20
Long	1.00	0.19	0.78	0.59
Indifferent	0	0.01	0.10	0.21
Buck coat colour preference	n=15	n=74	n=97	n=46
White	0.87	0.13	0.85	0.70
Coloured	0	0.84	0.05	0.17
Indifferent	0.13	0.03	0.10	0.13
Female goat coat colour preference	n=25	n=74	n=97	n=46
White	0.16	0.14	0.72	0.65
Coloured	0	0.82	0.03	0.02
Indifferent	0.84	0.04	0.25	0.33
Type of birth	n=25	n=74	n=97	n=46
Single	0.04	0.88	0.78	0.57
Multiple	0.96	0.12	0.22	0.43

Ref.: A: Añelo, B; Barrancas, P: Pehuenches, W: Minas-Ñorquin.
n: number of effective answers to corresponding question.
Numbers in the cells indicate frequencies of answers.

Results

Goatherds expressed clear criteria for selecting replacements. Most of them mentioned two criteria (84%) and a negligible proportion showed indifference. There was an agreement on considering size or conformation in males and females. In males, hair type and age were other important options while in females, size, hair type and conformation were the most frequent criteria cited (Table 2).

In response to the question about preferences in hair type and coat color, 'Crianceros' answered differently according to area (Table 3). These differences among areas were significant ($P<0.01$).

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Figure 3. "Crianceros" and their goats in North Neuquén (Patagonia, Argentina).

Table 4. Morphological traits frequency and liveweight by area.

	Area			
	A	B	P	W
Phenotype	(n= 196)	(n= 154)	(n= 122)	(n= 157)
Long hair	0.89	0.29	0.73	0.48
Short hair	0.11	0.71	0.27	0.52
White	0.85	0.24	0.85	0.71
Colored	0.15	0.76	0.15	0.29
Horn presence	0.86	0.99	0.94	0.97
Horn absence	0.14	0.01	0.16	0.03
Corrected liveweight * (kg ± stderr)	39.0 ± 0.41	40.6 ± 0.43	40.9 ±0.79	38.7 ±0.40
CV of CLW* (%)	14.8 %	13.2 %	21.2 %	13.0 %

Ref.: A: Añelo, B; Barrancas, P: Pehuenches, W: Minas-Ñorquin.
n: number of animals.
Numbers in the cells indicate frequencies of answers.
*CLW: Liveweight corrected after Body Condition Score of 2.5. CV: Coefficient of Variation

The answers to birth-type preferences were clearly different. Only "*Crianceros*" from area A preferred twins, in W preferences were balanced and the others preferred single births.

Phenotype distribution, particularly HT and CC, indicated a clear distinction by area (Table 4).

Liveweights showed no significant difference from area to area. Variation (CV) was greater in area P, over 20 %, and about 13% in the rest.

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Table 5. Coordinates from correspondence analysis

Traits	Producer's preferences		Phenotypes distribution	
	DIM1	DIM2	DIM1	DIM2
White coat	0.277	-0.87	-0.640	0.453
Colored coat	-1.41	0.508	1.05	0.739
Long hair	0.568	-0.396	-0.69	0.488
Short hair	-1.21	0.397	0.96	-0.679
Areas (supplementary variables)				
Añelo (A)	1.210	0.844	-0.68	0.154
Barrancas (B)	-1.19	0.377	0.876	0.150
Pehuenches (P)	0.362	-0.482	-0.406	-0.158
Minas –Ñorquín (W)	0.468	0.023	0.154	-0.281

Ref: DIM1: first dimension or abscises; DIM2: second dimension, or ordinates.

Legend.: A: Añelo, B: Barrancas, P: Pehuenches, W: Minas-Ñorquín. HT1: long hair, HT2: short hair, CC1: white coat, CC2: colored coat.

a)   b)
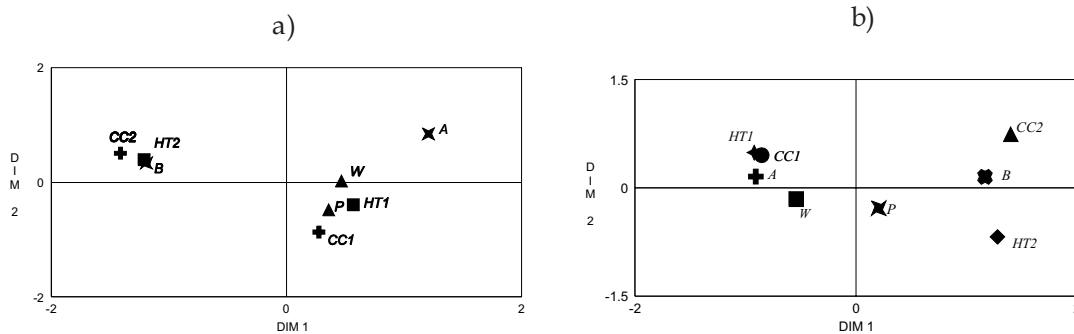
Figure 4. Graphical representation of correspondence analysis of preference of "Crianceros" (a) and phenotypes distribution (b)

Correspondence analysis allows for examining the association between different attributes. In this analysis two dimensions (DIM1 and DIM2) were taken into account. Similar values in both dimensions indicate an association among traits and Areas (Table 5).

The graphical representation of Table 5 shows the relationship between area (supplementary variable), morphological attributes and the selection criteria of the "*Crianceros*" (Figure 4a, b). Both graphs show a clear association between colored CC, short HT and B area.

Additive trees (neighbour-joining) represent Chi-squared distances between areas based on "*Crianceros*" selection criteria

and on observed phenotypes (Figure 5a, b). Both dissimilarity matrixes show a significant correlation (r) of 0.78.

Discussion

In the present study, it is demonstrated that the pastoral community of Neuquen (Patagonia, Argentina) practices directional selection on their goats, which may explain an important part of their currently observed phenotypic differences (Table 3 and 4). According to Palermo (1988) directional selection was also practiced by the ancient

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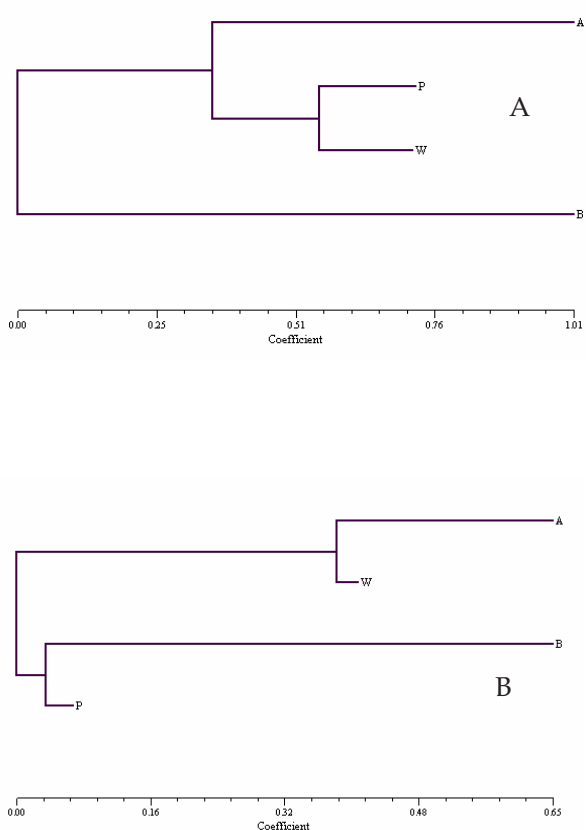
Figure 5. Additive tree representing Chi-square distances among areas; A) based on "Crianceros" preferences and B) based on phenotype.

tribes in the same region of North Patagonia, who introduced the European domestic animals to their culture.

Respondents have demonstrated the use of clear criteria to choose their replacements. The selections seem to be based on hair type and coat color, which is demonstrated by the significant correlation between selection criteria and observed phenotypes (r= 0.78). Major genes determine both traits (Lauvergne, *et al*., 1987). Less distinction is shown by the selection on size. Corrected Liveweight (CLW) by area presented a high Coefficient of Variation, particularly in area P, where CLW showed a great dispersion that suggested a strong environmental effect at work on this trait (Table 4).

Birth type is contradictorily evaluated. People from A, and to a lesser extent from W, look for twins but B and P "*Crianceros*" prefer singles. Field data of kids born in this region have shown high prolificacy particularly in B and P areas (Lanari, 2004). People want the opposite of what they have, preferring a lower level of prolificacy probably due to the husbandry difficulties associated with raising multiple births. High prolificacy would be an undesirable attribute under harsh environmental conditions (Bradford and Berger, 1988). In spite of the fact that these goats are able to rear twins even in this situation, their kids do not reach slaughter weight within a desirable timeframe. On the other hand, some "*Crianceros*" probably unconsciously select for twins, because they remain in the flock while singles are sold for slaughter.

Hair and coat color preferences have possibly been influenced by production and environmental factors. Mainly in areas W, A and less so in P, people sheared their goats in the past (Campbell and Alvarez, 1978), but this tradition was not so strong in area B. In spite of the fact that a white colored fleece is related to this shearing tradition, nowadays Neuquen Criollo goats are not shorn because their fibers do not fulfill market requirements. Acharya *et al*. (1995) suggest that white and longhair goats are more adapted to heat and high radiation. This fact seems to be an additional advantage of longhaired white goats, present in areas A and P which have an arid, continental climate. On the other hand typical Criollo hair, with an inner layer, provides important thermal protection. That is why "*Crianceros*" cull animals that show poor adaptation to cold weather; such is the case of the Anglo-Nubian goats.

The preference for colored coats in area B in the north was based on two practical points. First, colored goats are easier to find under the snow and second, color helps with the identification of kid and mother in the pen. Area B presents harder winter conditions, the snow is more persistent and twins more common (Lanari, 2004).

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Artificial selection oriented to production traits and economic goals has been considered important for the creation of standard breeds in the last 200 years. The most important difference between conventional and pastoralists' selection is the relationship between the animals and the environment and the period of time involved to achieve breeding goals. Conventional selection considers individual efficiency of domestic animals in first place while the environment (husbandry, feed and health management) is modified to achieve the maximal expression of individual potential and economic success in the short term. Community selection takes the animal as a component within the environment. It means that the animals must essentially have the ability to survive and produce in a given, generally marginal, situation. As noted by Köhler-Rollefson (2000) "such populations are raised under conditions close to those obtained in the wild; therefore the breeds kept by them are most likely to retain those traits that are of greatest interest from the genetic resource angle". In this case the productive as well as the economic vision exist as a long term goal, and imply the sustainability of the whole system.

The present study emphasizes the importance of the pastoral community that bred and therefore shaped this population. In the Neuquen Criollo goat, the harsh environment has played an important role in avoiding the introduction of exotic breeds and has acted over the centuries as a force of natural selection. Isolation from nearby populations as a result of political and sanitary barriers could have accentuated the process. Other local breeds in America such as Chiapas-sheep (Pérezgrovas and Castro, 2000) and Navaho-Churro sheep (Sponenberg, 2000) are examples as well of similar developmental processes. Köhler-Rollefson (1997) proposed selection practiced by pastoral communities as a part of the breed formation process. In America this process probably took place and has been preserved only in isolated areas, where the environment includes extreme climatic

conditions, either tropical or cold, and where local pastoral societies exist. In those cases the original introduced livestock in America became local breeds with a defined cultural identity.

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Survey and characterization of Attappady black goats of Kerala, India

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Summary

Attappady Black goats are found exclusively in Attappady, an isolated hilly region of Kerala, India. A survey on these goats was carried out in the breeding tract for the purposes of breed characterization. The total population of Attappady Blacks in the area was estimated to be 9351, which represented only 40% of the total goat population in the area. These goats are reared mainly by the tribes of Attappady and maintained on an extensive grazing system. The animals are black in colour with bronze coloured eyes. Ears are medium in length (13.5 cm) drooping over the lateral side of the face. Horns are present in both males and females and they are curved laterally upwards and backwards. Tassels are present in some animals. Their tail is of a bunchy type and curved. The average body length, height at withers, height at rump, chest girth and paunch girth of these goats in the adult stage were found to be 67±0.8, 80±0.8, 76±0.8, 71±1.3, 75±1.3 cm , in males and 63±0.4, 69±0.4, 71±0.3, 69±0.4, 75±0.3 cm in females, respectively. Adult males above 18 months of age weigh on average 35±1.1 kg and females weigh 31±0.4 kg. Attappady Blacks are reared for meat purposes.

Resumen

La raza caprina Attappady Black se encuentra exclusivamente en Attappady, una zona montañosa aislada de la region de Kerala en la India. Se realizó una encuesta sobre esta raza en su zona de origen con el fin de caracterizar la raza. Se estimó la población total de Attappady Blacks en el area en 9 351 animales, lo que representa el 40% de la población caprina en la zona. Esta raza viene criada principalmente por las tribús de Attappady en sistemas de pastos extensivos. Los animales son negros con ojos color bronce. Las orejas son medianas (13,5 cm) y caen a los lados de la cara. Los cuernos están presentes tanto en machos como en hembras y se curvan lateralmente hacia arriba y luego hacia abajo. Algunos animales presetan también borla. La cola es de tipo pequeña y curvada. En su fase adulta la media de largura corporal, altura al garrete, altura a la cadera, circunferencia torácica son, respectivamente, 67±0,8; 80±0,8; 76±0,8; 71±1,3; 75±1,3 cm en los machos y 63±0,4; 69±0,4; 71±0,3; 69±0,4; 75±0,3 cm en las hembras. Los machos adultos a los 18 meses presentan un peso medio de 35±1,1 kg y las hembras de 31±0,4 kg. La raza Attappady Black se cria principalmente para producción de carne.

Introduction

There are 122.7 million goats and 20 recognized breeds of goat in India, according to the livestock census of 1997 (Anonymous, 1997). Attappady Black goats, found exclusively in the Attappady area in the Palakkad district of Kerala and reared mostly by the tribes in Attappady, are not yet recognized as a breed despite their unique characteristics. They are identified by their

solid black body colour, bronze coloured eyes and long strong legs. Other goats in the area are crosses of the Attappady Black with other breeds, mainly the Malabari this being the only other breed existing in Kerala, as well as with a small number of Saanen goats and other exotic breeds.

The Malabari is a dairy type breed in Kerala with a milk yield of 1-2 litres per day, where as the Attappady Black is a meat type breed with a milk yield of less than 200 ml daily. The eye colour of Malabari is yellowish brown. Distinguishing the Attappady Black from other groups is not at all difficult because of the distinctive features of the Attappady Black, Malabari and other exotic breeds. There is an Attappady Black goat breeding farm run by the Government of the State in Attappady, the native tract of these animals. Recently a study was completed comprising a survey, characterization and evaluation of Attappady Black goats as a part of the network projects of the National Bureau of Animal Genetic Resources, India to develop breed descriptors for many of the unrecognized breeds in India.

Materials and Methods

The region of Attappady which is the home tract of the Attappady Black goats lies in the north-east of the Palakkad district of Kerala, India. The three villages Agali, Pudur and Sholayur constitute the entire Attappady area of Palakkad district (Figure 1). There are 37 wards in the whole Attappady area, 17 in Agali and 10 wards each in Pudur and Sholayur villages. Each village forms the stratum, the wards within the village forming the first unit and houses within the ward forming the second units. Seven wards were randomly selected from each village and survey was conducted in these 21 wards for complete enumeration of the demographic distribution of the breed.

The questionnaire provided by the National Bureau of Animal Genetic Resources was used, with necessary modifications, to conduct the survey work. In total 9 207 households were surveyed within which goats were maintained in only 1 234 (13%) of households. General information about the households, management practices and animals maintained was collected from these 1 234 households. The surveyors were educated properly on the distinguishing features of different types of goats in the area and were shown the purebreds reared in the Kerala state Government Attappady goat farm.
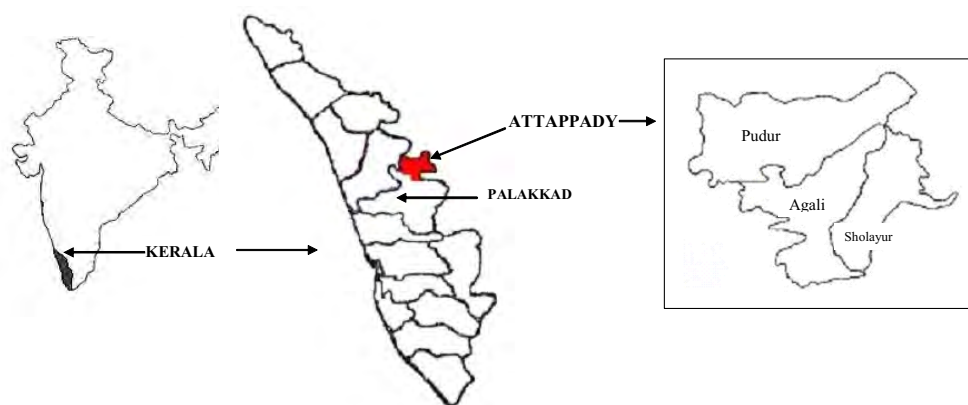

Figure 1. The three villages Agali, Pudur and Sholayur constitute the entire Attappady area of Palakkad district, breeding tract of Attappady goat.

Results and Discussions

The native tract of the Attappady Black goat and its distribution

Attappady is an isolated place in the high range areas of Kerala and lies between two hills of the Western Ghats namely the Nilgiris Hills (2300 meters above the sea level) in the north and the Muthikulam Hills (2000 meters above the sea level) in the south. The region is situated between 10°55' 0" N and 11°14' 9" N latitude and 76° 27' 11" E and 76° 48' 8" E longitude. The total geographical area of Attappady is 874.2 square km. The mean annual rainfall of this region is 3 396 mm. The rains fall mainly between June and November. The total cultivable area comes around 20% of the total geographical area of Attappady. The rest of the region is forest (50%), waste lands (25%) and water bodies (5%). Banana, coconut, pepper, groundnut and cotton are the main crops cultivated in this region.

Goat population

A total number of 13 760 goats were present in the 1 234 house holds surveyed and of these only 5 595 were Attappady Black goats. As the name indicates these animals are pure black with bronze coloured eyes and are taller than Malabari goats. The distribution of goats in the surveyed units in Agali, Pudur and Sholayur villages were 2 689, 5 775 and 4 296, respectively and the number of Attappady Blacks in these villages were, respectively, 1 358, 2 394 and 1 843. Age based classification of the data showed that 21% of the total goats were kids up to three months of age, 19% belonged to kids aged 4-6 months, 8% were young stock, 5% were yearlings, 6% were adult males and 41% were adult females.

The village based data were extrapolated to estimate the total number of goats in the whole Attappady area. The overall total goat population in the Attappady Block was estimated to be 23 346, and of them only 9 351 (40%) were Attappady Black goats

Socio-economic status

The total human population in the Attappady Block is 67 672 [Development report of Attappady Block Panchayets, (2002-2007)]. Of this 42% are Scheduled Tribe (ST), 7% are Scheduled Caste (SC) and the rest 51% belong to Other Community (OC). Among the households surveyed 73% of goat owners (904) belonged to the ST community indicating that the goat rearing is mainly in the hands of the tribal communities of the area. The total human population in the 1 234 households was 5 016 consisting of 2 530 males and 2 486 females. The overall average family size of goat farmers in the Attappady Block was 4.06. The information collected revealed that 56% of the total members were illiterate. The monthly income of most (80%) of the tribes was less than Rs.1000 (22 $). Most of the men were working as labourers or engaged in agricultural crop cultivation and very few (13%) men were interested in goat husbandry. Therefore goat rearing was mainly in the hands of women (48%) and aged people. Of the farmers, 27% were landless.

The percentages of farmers with below 1 acre, 1-2 acres and above 2 acres of land were 8, 35 and 30%, respectively. Even though 73% of the goat owners owned agricultural land, most of these lands did not have irrigation facilities and hence were not used for the cultivation of agricultural crops. Only 14% of the land-holding farmers had irrigation facilities from bore wells, canals or rivers. The agricultural lands on the banks of the Bavani and Siruvani rivers are well irrigated.

Goat management practices

Tribes in the Attappady area mainly maintain the Attappady Black breed of goat.

Generally, 10-20 goats constitute a herd owned by a single owner. All the herds in the area were stationary and maintained entirely on an extensive grazing/browsing system. Concentrate feeding was not practiced at all. Goats were taken to the nearest forest land and hilly areas during day time for grazing. Community grazing was also a common practice. Two to three flocks were taken out together for grazing.

Goat sheds were constructed just to keep the goats in during night time. Around 62% of the goat owners constructed the goat sheds separately away from their houses while 38% housed their animals either in a part of their own house or in sheds sharing a common wall with the residence. The majority (52%) of the goat houses were on the ground and the remaining (48%) houses were on raised platforms. The floor and the sidewalls were constructed using bamboo or other locally available wooden materials and in most households coconut or other tree leaves were used as the roofing material.

Breed Characteristics

Physical characteristics

The morphological characters of Attappady Black goats (Figure 2 and 3) such as the colour of the coat, skin, muzzle, eyelids, hooves and tail switch; body conformation; orientation of ears; horn pattern; tassel/wattle pattern; presence of beard; type and shape of tail; hair characters; udder and teat conformation, etc are presented in Tables 1 and 2.

The colour of animals is black. Rarely white spots were noticed on the forehead. The skin was either light black or grey. Tassels/wattles were noticed in some of the goats. In most of the adult goats horns were present and they were curved laterally upwards and backwards. Ears were medium length (13.5 cm), drooping over the lateral side of the face. The hair was glossy and straight. The tail was of a curved bunchy type.

Figure 2. Adult female of Attappady black goat.

Table 1. Physical characteristics of Attappady black goats at different ages.

Sl. (No.)	Particulars	0-3 No.	0-3 %	4-6 No.	4-6 %	7-12 No.	7-12 %	Above 12 No.	Above 12 %
1.	*Head*								
	a) Forehead								
	Convex	201	99.02	251	98.82	368	97.10	586	9.49
	b) Tassels								
	Present	45	22.06	45	17.79	86	22.81	123	20.99
	c) Beard								
	Absent	202	99.51	247	99.60	371	98.41	545	93.16
2.	*Horns*								
	Present	77	37.75	203	79.92	304	79.79	469	79.49
	a) Shape								
	Straight	41	80.39	133	80.61	154	52.20	58	12.61
	Curved	10	19.61	32	19.39	141	47.80	402	87.39
	b) Orientation								
	Lateral	18	100.00	94	98.95	253	98.44	430	94.71
	Upward	50	89.29	172	97.18	279	93.00	329	70.60
	Backward	12	92.31	67	87.01	183	75.31	357	79.33
3	*Ears*								
	Orientation	1	0.52	1	0.40	4	1.06	3	0.51
	Horizontal	188	98.43	246	98.40	366	97.34	581	98.81
	Pendulous	2	1.05	3	1.20	6	1.60	4	0.68
	Erect								
4	*Tail*								
	a) Type								
	Slender	128	64.00	24	9.45	2	0.53	4	0.68
	Bunchy	72	36.00	230	90.55	376	99.47	583	99.32
	b) Shape								
	Straight	---	---	1	0.90	3	0.80	7	1.20
	Curved	199	100.00	251	99.60	372	99.20	575	98.80
5	*Udder characters*								
	a) Shape	---	---	---	---	7	26.92	296	72.02
	Bowl	---	---	---	---	5	19.23	55	13.38
	Round	---	---	---	---	14	53.85	55	13.38
	Trough	---	---	---	---	---	---	5	1.22
	Pendulous								
	b) Teat Shape								
	Cylindrical	---	---	---	---	2	8.70	4	0.98
	Funnel	---	---	---	---	21	91.30	393	95.85
	Pear	---	---	---	---	---	---	13	3.17

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Table 2. Physical characteristics of Attappady Black goats.

	Age groups in months							
	0-3		4-6		7-12		Above 12	
Particulars	No.	%	No.	%	No.	%	No.	%
Color								
a) Coat								
Black	206	100.00	255	100	381	100	590	100
b) Skin								
Light black	98	47.57	204	80.00	304	79.79	484	82.03
Gray	108	52.43	51	20.00	77	20.21	106	17.97
c) Forehead								
Black	179	86.89	234	91.76	350	91.86	553	93.73
White spot	27	13.11	21	8.24	31	8.14	37	6.27
d) Ears								
Black	196	99.49	239	98.35	364	98.91	545	98.73
Gray	1	0.51	3	1.24	4	1.09	7	1.27
White spots			1	0.41				
e) Muzzle								
Black	204	99.51	253	99.22	377	98.95	589	99.83
White spot	1	0.49	2	0.78	4	1.05	1	0.17
f) Eyelids								
Black	204	99.03	254	99.61	381	100.00	589	99.83
Others	2	0.97	1	0.39	---	---	1	0.17
g) Iris								
Bronze	196	95.1	247	97.25	372	97.64	580	98.47
Yellowish brown	10	4.9	7	2.75	9	2.36	9	1.53
h) Hooves								
Black	206	100	225	100	381	100	589	99.83
Others	---	---	---	---	---	---	1	0.17
i) Tail switch								
Black	206	100	254	99.61	380	99.74	587	99.49
White	---	---	1	0.39	1	0.26	3	0.51
Hair Characters								
a) Sheen								
Glossy	184	91.54	177	69.69	322	84.96	535	90.83
Dull	17	8.46	77	30.31	57	15.04	54	9.17
b) Curl								
Curly	19	9.50	63	24.80	89	23.54	132	22.41
Straight	181	90.50	191	75.20	289	76.46	457	77.59

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Average body measurements of Attappady Black goats of different age groups are given in table 3. Attappady goats are medium sized. The data shows that the height at rump of these animals, except in the case of adult males (>18 months), is more than the height at withers. Raghavan and Raja (2004) have reported the overall average body length, height at withers, chest girth and paunch girth of Malabari goats of one year of age reared by the farmers as 61, 60, 69 and 76 cm, respectively. The comparison of the measurements of these two Keralan breeds shows that Attappady Black is taller than the Malabari.

The average birth weight of 78 male kids was 1.7 kg and of 72 females was 1.6 kg. Birth weights are comparable to those of Malabari kids, as reported by Mathew *et al.,* (1994) and Raghavan and Raja (2004). The average body weights of these goats in different age groups are also given in table 3.

Reproductive performance

Even though there was no particular season of breeding, the incidence of kidding was greater during the months from September to March and it was at its highest in the month of November. The overall age at first mating, age at first kidding and gestation length of 150 female goats were 260±2.6, 413±2.6 and 153±0.5 days, respectively. The overall average service period was 77.2±1.9 days and the average inter-kidding interval was 247.3±2.5 days.

The length of oestrus cycle of Attappady Black goat does was 20.5±0.2 days and the overall duration of oestrus was recorded as 39.8±0.7 hours. The overall average of litter sizes from first parity to sixth parity was 1.3±0.02. The incidence of singles was greater (73%) and the rate of twinning was 26%. The incidence of triplets (0.8%) and quadruplets (0.1%) was low. The incidences of multiple births was 11%, 36%, 47%, 47% and 36% in the first, second, third, fourth and fifth kidding, respectively.

Figure 3. Adult male of Attappady black goat.

Table 3. Average body weights and body measurements and their standard errors in Attappady Black goats.

Trait	Age groups on months					
	0-3	4-6	7-12	>12	>18	
Body weight (kg)						
Male	4.8 ± 0.25 (103)	10.1 ± 0.28 (122)	15.7 ± 0.30 (149)	26.2 ± 0.71 (125)	34.5 ± 1.08 (69)	
Female	5.28 ± 0.24 (95)	9.8 ± 0.26 (135)	14.6 ± 0.30 (227)	23.1 ± 0.25 (465)	31.3 ± 0.35 (329)	
Body length (cm)						
Male	37.2 ± 0.66 (103)	46.4 ± 0.43 (122)	53.8 ± 0.42 (149)	63.8 ± 0.61 (125)	66.6± .83 (69)	
Female	37.8 ± 0.59 (95)	46.5± 0.40 (135)	53.5 ± 0.33 (227)	61.3 ± 0.26 (465)	62.8 ± 0.35 (329)	
Height at withers (cm)						
Male	40.8 ± 0.72 (103)	51.1 ± 0.49 (122)	58.3 ± 0.40 (149)	68.8 ± 0.63 (125)	79.5 ± 0.77 (69)	
Female	42.8 ± 0.69 (95)	50.6 ± 0.40 (135)	57.7 ± 0.31 (227)	65.5 ± 0.22 (465)	66.8 ± 0.35 (329)	
Height at rump (cm)						
Male	43.8 ± 0.79 (103)	54.5 ± 0.45 (122)	62.5 ± 0.40 (149)	73.2 ± 0.59 (125)	75.7 ± 0.76 (69)	
Female	45.0 ± 0.76 (95)	54.6 ± 0.44 (135)	61.5 ± 0.32 (227)	69.8 ± 0.22 (465)	71.0 ± 0.32 (329)	
Chest girth (cm)						
Male	40.1 ± 0.59 (103)	50.0 ± 0.40 (122)	58.2 ± 0.38 (149)	69.5 ± 0.64 (125)	71.0 ±1.30 (69)	
Female	40.5 ±0.59 (95)	49.5± 0.44 (135)	57.8 ± 0.33 (227)	67.3 ± 0.26 (465)	68.9 ± 0.35 (329)	
Paunch girth (cm)						
Male	42.7 ± 0.71 (103)	54.1 ± 0.47 (122)	63.5 ± 0.39 (149)	72.9 ± 0.69 (125)	74.7 ± 1.26 (69)	
Female	42.6 ± 0.71 (95)	53.9 ± 0.54 (135)	62.8 ± 0.44 (227)	73.7 ± 0.34 (465)	75.0 ± 0.33 (329)	

Note: Values in parenthesis are number of observations.

Table 4. *Average body weights and body measurements and their standard errors in Attappady Black goats.*

Trait	Age in months			
	0-3	4-6	7-12	>12
Ear length (cm)				
Male	10.1 ± 0.18 (101)	11.8 ± 0.12 (121)	12.3 ± 0.19 (148)	13.4 ± 0.12 (124)
Female	10.0 ± 0.18 (95)	11.7 ± 0.14 (134)	12.6 ± 0.11 (227	13.6 ± 0.06 (462)
Horn length (cm)				
Male	0.8 ± 0.66 (35)	1.9 ± 0.11 (102)	4.3 ± 0.19 (122)	9.2 ± 0.42 (101)
Female	0.6 ± 0.59 (25)	1.5 ± 0.09 (103)	3.7 ± 0.15 (179)	7.2 ± 0.18 (373)
Eye to eye length (cm)				
Male	6.6 ± 0.72 (103)	7.7 ± 0.08 (122)	8.4 ± 0.08 (149)	10.0 ± 0.13 (125)
Female	6.7 ± 0.69 (95)	7.6 ± 0.07 (135)	8.3 ± 0.06 (227)	9.4 ± 0.05 (465)
Face length (cm)				
Male	8.6 ± 0.15 (103)	10.7 ± 0.11 (122)	12.7 ± 0.13 (149)	14.0 ± 0.59 (125)
Female	8.6 ± 0.13 (95)	10.7 ± 0.09 (135)	12.1 ± 0.09 (227)	14.0 ± 0.22 (465)
Face width (cm)				
Male	14.5 ± 0.15 (103)	16.8 ± 0.18 (122)	18.7 ± 0.15 (149)	20.8 ± 0.23(125)
Female	14.5 ± 0.13 (95)	16.5 ± 0.12 (135)	17.9 ± 0.14 (227	19.4 ± 0.09 (465
Tail length (cm)				
Male	9.2 ± 0.21 (103)	11.2 ± 0.12 (122)	12.5 ± 0.12 (148)	13.8 ± 0.14 (125)
Female	9.3 ± 0.28 (95)	11.0 ± 0.12 (134)	11.9 ± 0.09 (224)	12.6 ± 0.07 (465)

Note: Values in parenthesis are number of observations.

The age at first kidding and inter-kidding intervals of Attappady goats are comparable to those of Malabari goats in the field conditions reported by Raghavan and Raja (2004). However, Mukundan (1980) and Stephen and Rai (1993 and1994) reported a higher age at fist kidding and kidding intervals for Malabari goats under farm conditions.

Milk yield

Milking of the does is not practiced by the tribes who rear them and it was difficult to assess the milk yield of Attappady Black goats. The entire milk production of the dams was left to the kids for suckling. With the cooperation of certain farmers, the milk yield of 23 goats was measured and the average daily milk yield was found to be only 170 ml in an average lactation period of 100 days. In comparison to Malabari which produces 0.5 to 1.5 litres of milk daily (Raghavan and Raja, 2004) the Attappady Black goats are very poor milk producers and therefore these animals can be utilized only for meat purposes. The average fat percentage of was observed to be 4.11±0.06.

Disease prevalence

It was observed that goats were mainly affected by respiratory tract infections and worm infestation. When the goats were sick, only 30% of the owners treated their goats. General methods of treatment were herbal (63%) followed by allopathic (36%) and very few used local treatments (1%).

Importance of the Breed

Attappady Black goats, reared mainly by the tribes of the Attappady region for meat purposes have evolved over a long period adapting to the agro-ecological conditions of the area and are resistant to many diseases. The body weight performance of these breeds reared entirely on grazing without any grains or concentrates is comparable to that of any meat breed of goat in India. These animals have a great potential to be developed as an excellent meat breed. The total number of this breed of goats is less than 10 000 and due to indiscriminate breeding with other types of bucks, the purity of this group is becoming increasingly diluted. Therefore there is an urgent need for the conservation and genetic improvement of this unique goat genetic resource of India.

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Breed characteristics of Mecheri sheep

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Summary

This study was carried out on
2 309 households in 60 villages with the
objective of documenting the performance of
Mecheri sheep in their native environment.
The study revealed that Mecheri sheep were
distributed in Salem, Erode, Karur,
Namakkal and parts of Dharmapuri districts
of Tamil Nadu. This tract lies in the
north-western agro-climatic zone of Tamil
Nadu and the climate is generally hot,
semi-arid and tropical in nature.

The average flock size of Mecheri sheep
was 24, of which, there were 1 ram, 17 ewes
and 6 lambs. Mecheri sheep of medium size
with a compact body and covered with short
hairs, which are not shorn. They are light
brown in colour. Their profile reveals a
slightly Roman nose. Both males and females
are polled. The pooled means for height at
withers, chest girth and body length at above
24 months of age were 67±0.4, 74±0.4 and
66±0.4 cm, respectively. The body weight of
the animals at birth 3, 6, 9 and 12 months of
age was 2.82±0.01, 10.9±0.1, 15.6±0.1,
17.6±0.2 and 21.1±0.1, kg respectively. The
dressing percentage of males and females
was 54.4±0.4 and 51.8±0.5, respectively.
Average ages at first oestrus, mating and
lambing were 12.1±0.1, 12.4±0.1 and
17.4±0.1 months, respectively. The average
lambing interval was 226±0.7 days and the
average litter size was one.

Resumen

El presente estudio se llevó a cabo con
2 309 granjas en 60 poblados con el fin de
documentar los rendimientos de la oveja
Mecheri en su entorno natural. El estudio
reveló que la oveja Mecheri se distribuye
entre las zones de Salem, Erode, Karur,
Namakkal y partes de los distritos de
Dharmapuri en la region de Tamil Nadu.
Esta zona se encuentra en el noroeste de la
parte agroclimática de Tamil Nadu y el clima
es generalmente caliente, semi árido y
tropical. La media de los rebaños es de
24 animales de los cuales 1 macho,
17 hembras y 6 crías. La oveja Mecheri es de
tamaño medio con cuerpo compacto y
cubierto de pelo corto que no se esquila. Su
perfil denota una narz romana. Tanto los
machos como las hembras están registrados.
Las medidas indicadas para la altura al
garrete, circunferencia torácica, largura
corporal a los 24 meses es, respectivamente,
de 67±0,4; 74±0,4 y 66±0,4 cm. El peso
corporal de los animales al nacer, a los 3, 6, 9
y 12 meses es, respectivamente, de 2,82±0,01;
10,9±0,1; 15,6±0,1; 17,6±0,2 y 21±0,1 kg. El
porcentaje de manto en los machos y
hembras es, respectivamente, de 54,4±0,4 y
51,8±0,5. Le media de edad al primer estro,
apareamiento y parto es de 12,1±0,1,
12,4±0,1 y 17,4±0,1 meses, respectivamente.
El intervalo medio entre parteos es de
226±0,7 días y la media de crías por parto de
uno.

Key words: *Mecheri sheep, Meat type,
Performance, Characteristics, India.*

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Introduction

India is rich repository of sheep germ plasm being home to 42 breeds of sheep with a total population (as per the 1997 census) of 47.61 million, producing 152.3 million kg of mutton annually. The contribution of sheep meat to the total meat produced in the country is 5.4% (Bhattacharya *et al.*, 2000). Tamil Nadu is situated in the southern part of India and has eight recognized breeds of sheep. The sheep population as per the 1998 census was 5.54 million (Report, 1998). This constitutes 11.6% of the total sheep population in India.

Mecheri sheep are one of the recognized breeds of sheep in Tamil Nadu, and belong to the hairy type, polled breeds of sheep (Acharya, 1982; Mason, 1988). The breed occupies first position in terms of population and area of distribution in the state. Though this breed of sheep has excellent meat and skin quality no detailed study has been made of them under their natural ecological conditions. Hence, this study was carried out to document the habitat, population statistics, and production and reproduction performance of Mecheri sheep in their breeding tract.

Materials and Methods

This study was carried out in 2 309 households in 60 villages, with the objective of studying the habitat and distribution of Mecheri sheep and documenting their performance within that habitat. Physical measurements were recorded on 1 777 males and 3 030 females of varying age groups. Body weights (kg) were recorded for 1 175 males and 2 769 females. Data on reproduction performance of males (n = 830) and females (n = 780) were recorded from the yearlings and ewes present in the flock by questioning the owners on each animal specifically.

Data on carcass characteristics were collected on 206 animals varying in age and of both sexes, which were slaughtered at local slaughterhouses. For analysis, Mecheri sheep were grouped into birth, 3, 6, 9, 12, 12-24, 24-36 and above 36 months age groups. Data collected were subjected to basic statistical analysis as per Snedecor and Cochran (1989).

Results and Discussion

Origin, habitat and geographic distribution

In India, most breeds have generally been named after their habitat or on the basis of prominent characteristics. The name Mecheri has been derived from its place of origin i.e., the Mecheri Block in Mettur Taluk of Salem District in Tamil Nadu. Mecheri sheep have synonyms like *Maiylambadi, Kannivadi and Thuvaramchambali.* They are distributed in Salem, Namakkal, Erode and Karur districts and a part of Dharmapuri district (Figure 1) in Tamil Nadu and these places lies between approximately 10°35" N and 12°53" N latitude and 76°5" E and 78° 5" E longitude with a approximate total area of 24 124 km². The elevation of the tract ranges between approximately 150 m and 500 m a.s.l. In the majority of places in the breeding tract farmers rear only Mecheri sheep. In the areas bordering the breeding tract, in addition to Mecheri sheep, farmers also rear Coimbatore, Tiruchy Black and non-descript breeds of sheep.

The Mecheri sheep breeding tract lies in the north-western agro-climatic zone of Tamil Nadu. The climate is generally hot, semi-arid and tropical in nature. Mean annual maximum and minimum temperatures are 34.3°C and 21.9°C respectively. Mean annual relative humidity recorded at 0830 h and 17.30 h are 77.2% and 55.1% respectively. The tract receives an average annual rainfall of 1 112.5 mm.
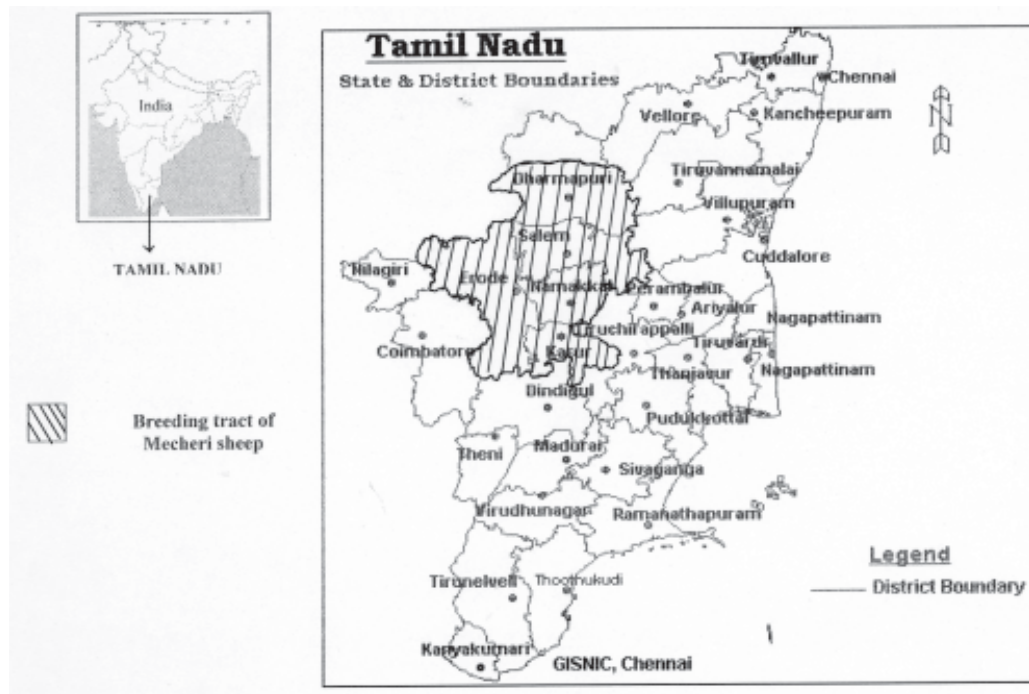
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Figure 1. Breeding tract of Mecheri sheep.

Population statistics

The total estimated Mecheri sheep population in the breeding tract, according to the 1998 census figures, counted 12 53 184 heads, which constituted 93.2% of the total sheep population in this tract at that time. Among the total sheep population of Tamil Nadu, Mecheri sheep account for 22.6%. Acharya (1972) reported that the Mecheri sheep was distributed in Salem and Bhavani taluk of the Erode district and the total population according to 1972 and 1977 census was 0.956 and 0.917 million, respectively. However, in the present study, Mecheri sheep, in addition to Salem and Bhavani taluk of Erode district, were distributed in other parts of Erode district, Karur and parts of Dharmapuri district. Hence, the present estimated population is much higher than those reported earlier by Acharya (1982). Average flock size of Mecheri sheep in the breeding tract was 24, of which there were 1 ram, 17 ewes and 6 lambs. Acharya (1982) observed a higher average flock size of 44.

Morphological characteristics

Mecheri sheep are medium sized animals with a compact body covered with short hairs, which are not shorn. They are light brown in colour (Figures 2 and 3). The head is medium in length with a medium to broad forehead which is well carried. The profile reveals a slightly Roman nose. The ears are medium-long, leaf like and semi pendulous. The eyes are small and bright and the eyelashes are white in colour. They have brown coloured tapering muzzle. Both males and females are polled. The proportion of animals possessing wattles in males and females were 49% and 46% respectively. Beards are present in 6% of the males and completely absent in females. The neck is short and slender in females, but in males it is thick, broad and well set to the thorax. Rams have straight and moderately fleshed shoulders. Udders are not well developed, being small and round and tightly attached to the belly with small conical teats placed laterally.

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Figure 2. Mecheri sheep male.

Figure 3. Mecheri sheep female.

Table 1. *Average (± S.E) of some physical measurements (cm) of Mecheri sheep.*

Age	Sex	Characters				
		Height at withers	Body length	Chest girth	Ear length	Tail length
Birth	Male	34.8±0.3 (350)	29.0±0.3 (350)	32.1±0.3 (350)	11.0±0.1 (328)	6.8±0.1 (350)
	Female	34.2±0.3 (438)	29.5±0.3 (438)	33.3±0.3 (438)	11.2±0.1 (410)	6.4±0.3 (438)
	Pooled	34.5±0.4?? [34.2]	29.3±0.2 [19.2]	32.8±0.2 [18.0]	11.1±0.1	6.6±0.1
Three months	Male	53.5±0.4 (143)	51.2±0.4 (256)	54.7±0.4 (256)	12.6±0.1 (164)	8.6±0.1 (143)
	Female	54.0±0.4 (153)	52.5±0.3 (342)	54.8±0.3 (345)	11.7±0.0 (262)	8.9±0.0 (153)
	Pooled	54.6±0.4 [12.3]	52.0±0.3 [11.8]	54.8±0.3 [11.2]	4.4 ±0.1	8.4±0.0
Six months	Male	58.6±0.8 (119)	56.4±0.5 (119)	62.5±0.6 (119)	14.3±0.1 (68)	10.4±0.8 (119)
	Female	57.6±0.2 (589)	54.9±0.8 (589)	60.2±0.2 (589)	14.7±0.1 (120)	9.4±0.3 (589)
	Pooled	57.8±0.2 [11.04]	55.2±0.7 [33.3]	60.6±0.2 [8.8]	14.5±0.1	9.8±0.4
Nine months	Male	58.8±0.6 (89)	57.3±0.6 (89)	62.1±0.6 (89)	15.0±0.2 (52)	9.8±0.3 (89)
	Female	59.2±0.4 (391)	58.9±0.3 (391)	62.7±0.3 (391)	14.6±0.0 (88)	8.6±0.3 (391)
	Pooled	59.1±0.3 [11.9]	58.7±0.3 [10.1]	62.6±0.3 [10.1]	14.8±0.1	9.0±0.2
12 months	Male	67.9±0.6 (134)	65.0±0.5 (134)	71.6±0.5 (134)	14.5±0.3 (54)	9.6±0.4 (134)
	Female	63.9±0.3 (497)	61.1±0.3 (497)	67.3±0.3 (497)	14.3±0.2 (67)	8.8±0.3 (497)
	Pooled	64.7±0.3 [8.6]	61.9±0.2 [9.3]	68.2±0.2 [8.8]	14.4±0.1	9.1±0.3
12-24 months	Male	68.1±0.5 (600)	63.8±0.5 (600)	71.7±0.5 (600)	14.4±0.1 (289)	9.2±0.2 (600)
	Female	66.1±0.4 (265)	62.2±0.5 (265)	70.7±0.5 (265)	13.4±0.5 (7)	8.3±0.2 (265)
	Pooled	67.5±0.4 [16.1]	63.3±0.4 [16.3]	71.4±0.4 [16.1]	14.4±0.1 (296)	9.0±0.2 (865)
Above 24 months	Male	71.1±0.5 (229)	70.9±0.6 (229)	80.0±0.6 (229)	14.6±0.1 (200)	8.2±0.3 (229)
	Female	65.7±0.5 (505)	63.1±0.5 (505)	71.0±0.6 (505)	14.6±0.1 (228)	7.9±0.1 (505)
	Pooled	67.4±0.4 [16.5]	65.5±0.4 [17.8]	73.8±0.4 [15.8]	14.6±0.1	8.1±0.2

Notes: Figures in the round bracket are number of observations.
SE for pooled estimates cannot exceed the highest individual estimate.
Figures in the square bracket are coefficient of variation (%).

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Physical measurements

The mean (± SE) of body measurements of Mecheri sheep are given in Table 1. The pooled means for height at withers, body length and chest girth at above 24 months of age were 67.4, 65.5 and 73.8 cm, respectively. This is similar to the earlier reports of Ganesakale and Rathinasabapathy (1973) and Acharya (1982). In general, body measurements in adults were higher in males than females. The coefficient of variation for these three measurements was higher in lambs than adults.

Production performance

Body weight

The mean (± SE) of body weight of Mecheri sheep is presented in table 2. Ram lambs had significantly higher body weight than ewe lambs in all age groups except at birth and 3 months of age. Body weight observed in the present study was slightly higher than the earlier reports (Acharya, 1982; Ganesakale and Rathinasabapathy, 1973). The coefficient of variation for body weight

ranged between 9.9% and 18.7% in lambs and between 13.6% and 14.4% in adults.

Carcass characteristics

The mean (±SE) of carcass characteristics of Mecheri sheep is presented in table 3. The dressing percentage observed was similar to the earlier reports of Acharya (1982), Report (1975) and Arumugam *et al*. (1978). Since the consumers in the breeding tract generally prefer meat from ram lambs, a higher percentage of ram lambs (85%) were slaughtered at the age of 6-12 months. Slaughter of ewe lambs for meat purposes was rarely practiced and only aged and unproductive females were slaughtered. The higher dressing percentage observed in Mecheri sheep was the distinguishing feature of this breed. Skin weight accounted for 10.2% of the pre-slaughter live weight of the animal.

Reproduction parameters

The reproductive performances of Mecheri sheep are presented in table 4. There was

Table 2. Average (± S.E) of body weight (kg) of Mecheri sheep.

Age	Male	Female	Pooled
Birth	2.88 ± 0.0	2.77 ± 0.0	2.82 ± 0.0
	(348)	(437)	[9.9]
Three months	11.0 ± 0.1	10.8 ± 0.1	10.9 ± 0.1
	(259)	(348)	[15.8]
Six months	17.6 ± 0.3	15.2 ± 0.2	15.6 ± 0.1
	(119)	(586)	[17.4]
Nine months	19.4 ± 0.3	17.1 ± 0.2	17.6 ± 0.2
	(89)	(391)	[18.7]
12 months	23.7 ± 0.3	20.4 ± 0.1	21.1 ± 0.1
	(131)	(495)	[16.6]
24-36 months	31.2 ± 0.3	28.1 ± 0.2	29.8 ± 0.2
	(166)	(342)	[13.6]
Above 36 months	34.6 ± 0.6	28.6 ± 0.2	30.3 ± 0.3
	(63)	(162)	[14.4]

Notes: Figures in the round bracket are number of observations.
Figures in the square bracket are coefficient of variation (%).

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Table 3. Average (± S.E) of carcass characteristics of Mecheri sheep.

Parameters	Male	Female	Pooled
Average age of slaughter (years)	1.6±0.1	2.6±0.1	2.0±0.1
Average pre slaughter live weight (kg)	17.7±0.5	20.9±0.6	18.9±0.4
Dressed carcass weight (kg)	9.7±0.3	10.8±0.4	10.1±0.3
Dressing percentage (%)	54.4±0.4	51.8±0.5	53.4±0.3
Skin weight (kg)	1.9±0.0	2.1±0.0	1.9±0.0
Skin length (cm)	91.1±1.0	99.7±1.2	94.4±0.8
Skin width (cm)	67.6±2.8	69.5±1.7	68.3±1.6
No. of observations	128	78	206

Figure 4. Grazing of animals in their natural environment (males and females are razing together).

only a marginal difference between the age at first oestrus and age at first mating as most of the animals were mated in the first oestrus itself. Maintaining breeding rams along with ewes in the pen and grazing fields might be the reason for this lack of difference. The age at first mating observed in females was lower than the earlier report of 15 months by Acharya (1982). Ewes mostly gave birth to singles at lambing and the twin births were very rare and accounted only for 0.1% of the total births. In males,

cryptorchid condition was observed in 9.4% of males born.

Breeding management

Breeding of Mecheri sheep was random and unplanned (Figures 4 and 5). Generally males and females were run together in the flocks throughout the year. The majority of the ewes were mated in the months of June

Table 4. Reproductive performance of Mecheri sheep.

Particulars	Number of observation	Mean±S.E	Coefficient of variation (%)
Male			
Age at 1st mating (months)	830	12.6±0.1	20.6
Female			
Age at 1st oestrus (months)	780	12.1±0.1	16.2
Age at 1st mating (months)	780	12.4±0.1	15.8
Age at 1st lambing (months)	769	17.4±0.1	11.2
Interval from lambing to 1st conception (days)	741	73.6±0.8	28.5
Lambing interval (days)	720	226±0.7	8.4
Tupping percentage	50	93.0±1.1	7.5
Lambing percentage	50	95.9±1.1	7.8

Figure 5. Mecheri sheep males and females are housed together.

to November. This coincides with increased rainfall as the tract received its maximum amount of rain during this period. In permanent flocks, few ram lambs (Figure 6) were selected for future breeding while others were disposed of and almost all the females were retained for breeding. The rams were kept for mating up to four years of age.

Ewes were kept for breeding up to five to seven years of age.

Attempts at improvement

From 1971 to 1975, a scheme called 'Studies on carcass characteristics of Mecheri and Mandya lambs' was carried out in the

Figure 6. A flock of Mecheri lambs.

breed's home tract and recommended pure breeding (Report, 1975). Another study was carried out on the characterization and evaluation of breed from 2000 to 2003 under farmer's field conditions and indicated that this breed has considerable production potential under semi–arid tropical conditions. A nucleus flock of 300 breeding Mecheri ewes is being maintained at Mecheri Sheep Research Station, Pottaneri, Salem under the control of Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India, in the center of the breeding tract and acts as a center for supplying improved male stock to farmers.

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Conservation of poultry genetic resource in the Veneto region of Italy

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Summary

A conservation scheme for local poultry breeds from the Veneto region (Italy), the Co.Va. (*Conservazione e Valorizzazione di Razze Avicole Locali Venete* - Conservation and valorisation of local poultry genetic resources of Veneto region) project began in 2000 with finance provided by the Veneto Region. This project involved four organic farms located in different areas (mountain, hill and plain) in the region. The local chicken breeds included in the project were the Robusta Maculata, Robusta Lionata, Ermellinata di Rovigo, Pépoi and Padovana; the local duck breeds were the Germana Veneta and Mignon; the local turkey breeds were the Bronzato Comune and Ermellinato di Rovigo; and the local guinea fowl breed was the Camosciata. All breeds are dual-purpose breeds and are utilized for meat and egg production. The Department of Animal Science of the University of Padova planned a marker-assisted conservation scheme based on the maintenance and multiplication of these breeds within their production system (*in situ* conservation scheme). The objectives of the farmers involved in this project were to use these genotypes to generate typical regional products for local markets, to support the development of economically marginal areas through the revaluation of local breeds and to allow the preservation of animal biodiversity.

Resumen

En el año 2000 se empezó un esquema de conservación para razas avícolas locales de la region del Veneto en Italia a través del proyecto Co.Va (Conservación y Valorización de las Razas Avícolas Locales del Veneto) con financiamiento de la Región Veneto Este proyecto involucró cuatro granjas orgánicas situadas en distintas areas de la región (montaña, colina y llanura). Las razas locales de pollo incluidas en el proyecto fueron la Robusta Maculata, Robusta Lionata, Ermellinata de Rovigo, Pépoi y Padovana; las razas locales de patos utilizadas fueron la Germana Veneta y la Mignon; las razas locales de pavo la Bronzato Comune y la Ermellinato de Rovigo; y la raza local de ave de corral fue la Camosciata. Todas las razas son de doble propósito y se utilizan para la producción de carne y de huevos. El Departamento de Ciencias Animales de la Universidad de Padua planificó un esquema de conservación con marcador asistido basado en el mantenimiento y multiplicación de estas razas dentro de su sistema de producción (esquema de conservación in situ). Los objetivos de los granjeros involucrados en este proyecto eran la utilización de estos genotipos para generar productos típicos regionales para los mercados locales, apoyar el desarrollo de las zones economicamente marginales a través de la revaluación de las razas locales y permitir la conservación de la biodiversidad animal.

Introduction

An important action designed to safeguard the domestic animal biodiversity of the Veneto region of Italy was implemented in 2000. The Co.Va. (*Conservazione e Valorizzazione di Razze Avicole Locali Venete*) project was developed by the Veneto Agricultural Agency (VAA) (2004) with the scientific support of the Department of Animal Science of the University of Padova to provide economic support for an organic production system using local breeds. The Co.Va. project was the first marker-assisted conservation scheme for animal genetic resources in the Veneto region. Ten poultry breeds were included, these being the Robusta Maculata, Robusta Lionata, Ermellinata di Rovigo, Pépoi and Padovana chicken; the Germana Veneta and Mignon duck; the Bronzato Comune and Ermellinato di Rovigo turkey and the Camosciata guinea fowl. These ten breeds were added to the list of traditional Italian products recognised by the Ministry of Agricultural and Forestry Policy (MIPAF, 2003). It was hoped that the listing of these breeds and their subsequent description and characterization would assist in the development of economically marginal areas of the region through the revaluation of local and typical breeds and would thereby promote conservation of local breeds and preservation of biodiversity (De Marchi *et al.*, 2003).

The conservation of animal genetic resources is essential to enable farmers to adapt to changing environmental conditions and consumer demands. It is therefore in the best interest of societies to ensure that farmers and breeders have access to the widest possible range of animal genetic resources so that they can effectively respond to change (FAO, 2004). Biodiversity is essential for the survival of species and populations, and is assuming greater importance in modern animal science because of an expanding global emphasis on only a few highly selected breeds (Notter, 1999). The poultry breeds of the Veneto region showed distinctive meat quality characteristics (dark colour and good flavour) that distinguished them from the more common commercial birds (Cassandro *et al.*, 2002). The demand for products from the Veneto poultry breeds has also increased because of their perceived image as a source of nutritious and healthy natural products from birds that are reared in a clean and natural environment with no industrial residues. In developing systems of breeding, production and marketing for the Veneto avian breeds, emphasis was placed on an organic system of production including housing in an indoor pen with access to a grass paddock. Commercial diets supplemented with maize were provided, and a marker-assisted conservation scheme was developed to control inbreeding. The aim of this report is to provide a first general description of these Veneto poultry breeds.

Design and Establishment of the Project

The information for the study was gathered from 2000 through 2004. In this period, pedigree, performance, and reproductive data were recorded. The number of birds for each breed and the number of flocks involved in the conservation project, in the third year of activity (August 2003), are shown in Table 1. The four different flocks are located in the mountain (Feltre-BL), hill (Montebelluna-TV) and plain (Ceregnano-RO and Padova-PD) areas of the Veneto region.

Characteristics of the Chicken Breeds

The five breeds of Veneto chicken used in this project are the Robusta Maculata

Table 1. *Numbers of pure line birds by flock and breed in the Co.Va. project.*

Breeds	Feltre Breeding males	Feltre Breeding females	Montebelluna Breeding males	Montebelluna Breeding females	Ceregnano Breeding males	Ceregnano Breeding females	Padova Breeding males	Padova Breeding females
Chicken								
• Robusta Maculata	15	41	31	45	28	38		
• Robusta Lionata	16	44	27	46	28	52		
• Ermellinata di Rovigo	16	15	28	40	29	49		
• Pépoi	13	43	29	47	36	43		
• Padovana Camosciata							30	44
• Padovana Dorata							23	37
Duck								
• Germinata Veneta	24	39	30	38				
• Mignon	26	39	25	40				
Turkey								
• Bronzato Comune	16	34	20	43	18	35		
• Ermellinato di Rovigo	16	15	6	5				
Guinea fowl								
• Camosciata	24	35	29	37				

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Figure 1. Robusta Maculata chicken.

Figure 2. Robusta Lionata chicken.

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(Figure 1), Robusta Lionata (Figure 2), Ermellinata di Rovigo (Figure 3), Pépoi (Figure 4), and Padovana (Figure 5). Information about these breeds was previously published in an Italian report (Veneto Agricultural Agency, 2004). The Pépoi and Padovana are small-sized chicken breeds, whereas the other three breeds are medium-sized with heavier mature weights. Characteristics of the birds are shown in Table 2. All breeds showed a good environmental adaptability and stability for reproduction traits (Cassandro *et al.*, 2004).

A preliminary study estimated the daily weight gain of these chicken breeds during summer 2003 at the Agricultural Secondary School of Castelfranco Veneto (TV). This simple experiment involved four chicken breeds: Robusta Maculata, Robusta Lionata, Ermellinata di Rovigo and Pépoi. At hatching, chicks were individually weighed and reared in an indoor pen with an open grass paddock; feed and water were supplied *ad libitum*. Body weights were recorded every 10 days for 156 days. The average daily gains are reported in Table 3. As expected, the sex difference in average daily weight gain was highly significant in favour of males. The daily weight gain of the Pépoi breed was significantly different to that of the other breeds. There were no significant differences between the Robusta Lionata and Ermellinata breeds.

The Robusta Maculata chicken breed was developed in 1965 at the Rovigo Experiment Station from crosses between Tawny Orpingtons and White Americans and was selected to be a dual-purpose bird (providing eggs and meat). Adult birds have white plumage with black spots, the skin and tarsus are yellow (Figure 1). The Robusta Maculata exhibited an average daily weight gain to 156 days of 13.8 kg and 18.4 g, respectively. The daily weight gain of the Robusta Maculata was higher than the 9.6 g/d reported for the Ancona breed by Castellini *et al.* (1994).

Figure 3. Ermellinata di Rovigo chicken.

Table 2. Traits of Veneto chicken breeds (Veneto Agricultural Agency, 2004).

Trait	Breed				
	Robusta Maculata	Robusta Lionata	Ermellinata di Rovigo	Pépoi	Padovana
Age of sexual maturity (months)	5-7	5-7	5-7	5-6	5-7
Adult female body weight (kg)	2.8-3.3	2.8-3.3	2.2-2.6	1.0-1.1	1.5-2.0
Adult male body weight (kg)	4.0-4.5	4.0-4.5	3.0-3.5	1.3-1.5	1.8-2.3
Egg production	150-160	160-170	150-160	160-180	120-130
Egg weight (g)	55-60	55-60	55-60	40-45	50-60
Egg colour	Rose	Rose	Rose	Rose	White

Table 3. Average daily gains (g/d) of Robusta Maculata, Robusta Lionata, Ermellinata di Rovigo and Pépoi chickens of each sex.

Breeds	Number of observation	Average daily gain (g/d)	
		Female	Male
Robusta Maculata	20	13.8	18.4
Robusta Lionata	20	10.7	16.0
Ermellinata di Rovigo	28	11.6	15.7
Pépoi	26	5.6	8.7

Figure 4. Pépoi chicken.

Figure 5. Padovana chicken.

The Robusta Lionata chicken was developed in 1965, also at the Rovigo Experiment Station from crosses between Tawny Orpingtons and White Americans and is also a dual-purpose breed (providing eggs and meat). At hatching, chicks are a tawny colour with brown spots (Figure 2). Adult chickens retain this tawny coloration with black and greenish tail feathers. Females have a strong aptitude to brood. At 4 months of age, the Robusta Lionata chicken weighs around 1.9 kg to 2.0 kg, and is similar in adult male and female body weight to the Robusta Maculata (Table 2). The Robusta Lionata had an average daily weight gain to 156 days of 10.7 g/d and 16.0 g/d, respectively, for females and males (Table 3) which was similar to those observed in Ancona females (9.6 g/d) by Castellini *et al*. (1994).

The Ermellinata di Rovigo chicken was developed in 1959 for meat production from crosses between the Sussex and Rhode Island breeds. At three months, body weight was 1.7 kg to 1.8 kg. At hatching, chicks are yellow, but adult birds have white plumage with dark pens, helmsman and cape (Figure 3). The skin and tarsus are yellow. The Ermellinata di Rovigo had average daily weight gains that were similar to those of the Robusta Lionata (11.6 g/d and 15.7 g/d, respectively, for males and females) (Table 3).

The Pépoi chicken breed is very small but has high-quality meat. This breed is typically found in north-west Italy and at present is one of the few small breeds available in the markets. At hatching, chicks have a clear brown plumage that changes to a gilded colour (Figure 4). The skin and tarsus are yellow. Females have a strong aptitude to brood. The Pépoi breed grows relatively slowly, with average daily gains to 156 days of 5.6 g/d and 8.7 g/d, respectively, for females and males (Table 3). The daily weight gains of the Pépoi breed were significantly lower than those of the other breeds evaluated (Table 3) and were less than those reported for the Ancona breed (Castellini *et al*., 1994) and the Padovana breed (Lunardi *et al*., 2001).

The Padovana breed is a fancy breed (FAO, 2004). Its origin is very old, and it was described for the first time in the Ornitologiae book of Ulisse Aldrovandi (1600). The origin of this ancient breed is uncertain. It is thought that the Padovana was introduced to Italy from Poland in 1300 by a Padova noble, Giovanni D'ondi dell'Orologio. Before 1899, the Padovana chicken was confused with the Polverara breed. Trevisani (1900) and Pascal (1905) were the first authors to separately describe the Padovana and Polverara breeds. Adult males and females have an average weight of 2.0 kg and 1.8 kg, respectively, with an average daily weight gain of 8 g/d and exhibited maximum daily weight gains at around three months of age (Lunardi *et al*., 2001). The Padovana breed (Figure 5) has a crest with a very pronounced protuberance of the skull and muff and a beard. The Padovana has black, white, gold, silver, and

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Table 4. Traits of Veneto duck breeds (Veneto Agricultural Agency, 2004).

Trait	Germanata Veneta	Mignon
Age of sexual maturity (month)	6-8	7-8
Adult female body weight (kg)	2.7	0.8
Adult male body weight (kg)	3.0	0.8
Egg production	100-120	50-70
Egg weight (g)	70	45-50
Egg colour	White	White

Figure 6. Germanata Veneta duck.

buff coloured plumage with laced patterns within the feathers (FAO, 2004).

Characteristics of the Duck Breeds

Only two breeds of duck are found in the Veneto region: the Germanata Veneta (Figure 6) and the Mignon (Figure 7). The characteristics of the two breeds are shown in Table 4.

The Germanata Veneta duck (Figure 6) was derived from the Real German, and its coloration and form are unchanged. This breed is very rustic, and the female can be crossed with the Barberia duck to produce fat liver for pate. The female of the Germanata Veneta duck produces 100 to 120 eggs per year, which is lower than that reported for the brown Tsaiya and Pekin ducks (Velez *et al*., 1996). The Mignon is a small white duck with yellow legs, beak and skin (Figure 7). It is found in the southern and eastern part of the Veneto region and is

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Figure 7. Mignon duck.

very rustic. Egg production by the Mignon breed is not very important (50 to 70 eggs per year), but this light duck is used for meat production.

Characteristics of the Turkey and Guinea Fowl Breeds

The turkey breeds of the Veneto region are the Ermellinato di Rovigo and the Comune Bronzato. The only breed of guinea fowl is the Camosciata. Characteristic traits of the turkey and guinea fowl breeds are shown in Table 4.

The Ermellinato di Rovigo turkey (Figure 8) was derived from a mutation in the offspring of crosses of local birds to the American Narraganset breed in 1958 and was then selected for increased performance

(Veneto Agricultural Agency, 2004). This breed is of medium size and is early feathering. The Ermellinato di Rovigo is very rustic and well suited to pasture production. The Comune Bronzato turkey is a small breed. The breast, neck, shoulders, and rump are black with rainbow reflexes (Figure 9). Young turkeys have a dark brown tarsus, but the tarsus of adult birds ranges from red to violet. Females of this breed can produce 4 to 5 broods at a time, remaining on the nest for more than 100 days.

The Camosciata guinea fowl (Figure 10) was developed in 1922 (Veneto Agricultural Agency, 2004). The neck and throat skin are blackish, the pens are white with pearl stains, and the tarsus coloration varies from orange to grey. The Camosciata breed is small and at maturity, females are usually larger than the males (Table 5).

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Table 5. Traits of the Veneto turkey breeds and guinea fowl (Veneto Agricultural Agency, 2004).

Trait	Ermellinato di Rovigo	Comune Bronzato	Camosciata
Age of sexual maturity (month)	7	7	7-9
Adult female body weight (kg)	4-6	3.0-3.5	1.8-2.0
Adult male body weight (kg)	10-12	6-7	1.8
Egg production	70-100	70-100	100-120
Egg weight (g)	70-80	70-85	45
Egg colour	White – Rose	White – Rose	Reddish

Figure 8. Ermellinato di Rovigo turkey

Activities and Conservation Scheme in Co.Va. Project

The breeding activities and conservation scheme were developed at the same time and in the same manner in all flocks. The reproduction season starts in February and birds are hatched from April to June. In October, new males and females are selected according to the breed standard for use in the next season. Near the end of each year, birds are vaccinated and weighted and a blood sample is taken for AFLP (amplified fragment length polymorphism) analysis. In January, males of each breed are rotated among the flock. The aims of the conservation scheme established by the Department of Animal Science of the University of Padova were to increase the numbers of purebred animals of each breed and to maintain heterozygosity in populations by using the results of the AFLP analysis. Thus this is an *in-situ* conservation scheme that uses both traditional and molecular instruments. At the start of the

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Figure 9. Comune Bronzato turkey.

Figure 10. Camosciata guinea fowl.

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reproduction season, 34 pure females and 20 males in each flock represent each breed. Males are divided in two different groups on the basis of family relationships and AFLP analyses, and these two male families are rotated among the females groups.

Conclusion

Conservation of the local Veneto avian breeds could have a positive impact on the rural economy in some marginal agricultural areas of the region. The preservation of these local genetic resources will provide for their use in educational programmes that could both highlight a conservation point of view that builds upon the cultural legacy of each town, and also offer urban consumers a source of high-quality products.

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Status of Nili Ravi buffaloes in India

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Summary

Nili Ravi buffaloes are native to the Ferozepur, Amritsar and Gurdaspur districts of Punjab. A systematic survey was conducted in this area to study the socio-economic status of the farmers, and the demographic distribution and breed characteristics of Nili Ravi buffaloes. The majority of the farmers surveyed (84%) kept buffaloes. About 34 % of buffalo farmers were landless. Average land holdings were 1.50 hectares. Animals were provided with separate houses. The buffaloes were tied most of the time and fed chaffed fodder. Natural service was mainly practiced for the breeding of animals. Very few buffaloes had typical Nili Ravi characters (all extremities white). Most of the Nili Ravi type buffaloes now available have white markings on the forehead and hind legs only, and some have wall eyes i.e. eyes with a whitish iris. Average daily milk yield was 6.67 kg in a lactation period of 8-9 months. Nili Ravi type buffaloes constituted only 10.8 %, 8.7 % and 14 % of total buffaloes surveyed in Ferozepur, Amritsar and Gurdaspur districts, respectively. The estimated population of these buffaloes was about 0.2 million. The population of Nili Ravi is declining because of the non-availability of typical Nili Ravi bulls and non-marketability of Nili Ravi type (2-3 white extremities) animals.

Resumen

La raza de buffalo Nili Ravi es nativa del Ferozepur, en los distritos de Amritsar y Gurdaspur en la region de Punjab. Se llevó a cabo una encuesta sistemática en la zona para estudiar la situación socio-económica de los granjeros y la distribución demográfica y características de la raza Nili Ravi. La mayoría de los granjeros encuestados (84%) crían búfalos. Alrededor del 34% de estos granjeros no posee tierra. La media de tierra es de 1,5 hectarea. Los animales están atados y alimentados con paja y heno. Los apareamientos son naturals. Pocos animales poseen las características típicas de la raza Nili Ravi (todas las extremidades blancas). La mayoría de los búfalos de tipo Nili Ravi hoy en día poseen solo manchas blancas en la parte frontal y trasera de las patas, y algunos animales presentan ojos con el iris blanquecino. La media diaria de producción de leche es de 6,67 kg en un periodo de lactación de 8-9 meses. El buffalo tipo Nili Ravi representa solo el 10,8%, 8,7% y 14% del total de búfalos existentes en los distritos de Ferozepur, Amritsar y Gurdaspur, respectivamente. La población estimada es de alrededor de 0,2 millones. La población de Nili Ravi está en declino debido a la falta de disponibilidad de machos puros de esta raza y por la falta de mercado de animales del tipo Nili Ravi (2-3 extremidades blancas).

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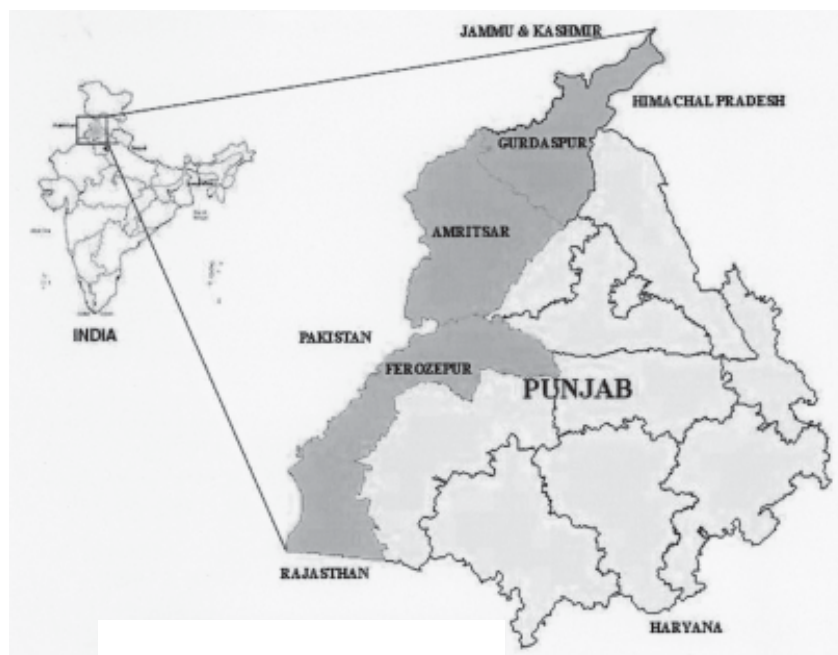

Figure 1. Breeding tract of Nili Ravi buffalo.

Introduction

Buffaloes on the Indian subcontinent play an important role as producers of milk, draught power, dung and other value added products. Nili Ravi is one of the best riverine breeds of buffaloes. Originally Nili and Ravi were two separate breeds but later became classified as one breed due to similarities in appearance. The home tract of this breed lies in Pakistan, but these buffaloes are also found in India in the Ferozpur, Amritsar and Gurdaspur districts of Punjab all along the Indo-Pak border (Figure 1). These buffaloes are best suited to the water logged conditions along the Sutlej, Ravi and Beas rivers of this region. The productivity of these buffaloes is comparable with the well-known dairy buffaloes, i.e. the Murrah. Nili Ravi buffaloes are different from Murrah in their morphology, for example their horn shape and five white markings (Figure 2 and 3). Punjab state is the second largest producer of milk in India with an annual production of about 8 million tonnes. About 72% of this milk comes from buffaloes. Nili Ravi is the

only recognized breed belonging to this area. Of late, the population of this breed has been declining. The breed characters have also been diluted as a result of mixing with other breeds especially Murrah. Hence, this study was undertaken to generate information on the present status of the breed in its breeding tract.

Materials and Methods

A survey was carried out in the breeding tract of Nili Ravi buffaloes, i.e. Ferozepur, Amritsar and Gurdaspur districts of Punjab. Sixteen clusters were identified randomly in the three districts for conducting the survey. Farmers were classified into six groups on the basis of land holding size viz. landless, marginal (0-1 ha), small (1-2 ha), lower medium (2-4 ha), upper medium (4-8 ha) and large (>8 ha). A total of 13 571 farmers were contacted through a door-to-door survey in order to record information on the socio-economic status of the farmers and the demographic distribution and breed

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Table 1. Frequency of farmers in various categories (%).

Distrcits	Total farmers contacted	Landless	Margina l0-1 ha	Small 1-2 ha	Medium		Large>8 ha
					Lower 2-4 ha	Upper 4-8 ha	
Ferozepur	4 639	44.5	9.2	17.5	16.4	8.2	4.2
Amritsar	5 560	34.7	14.1	26.0	18.3	5.9	0.9
Gurdaspur	3 372	48.2	20.3	19.2	8.6	3.0	0.7
Buffalo keepers							
Ferozepur	3 763	36.2	10.3	19.8	19.1	9.6	5.0
Amritsar	5 139	31.05	14.6	27.6	19.6	6.3	1.0
Gurdaspur	2 501	37.5	23.4	23.2	11.1	3.9	0.9

characters of Nili Ravi buffaloes. Test day milk yield was recorded at monthly interval starting from the first 15 days of calving. The population of Nili Ravi buffaloes in the three districts was estimated by superimposing the proportion obtained in this survey on the total buffalo population of these districts as per the livestock census (1997).

Results and Discussion

Socio-economic status

The greatest number of farmers in all the three districts were landless (41%) followed by small (22%), lower medium (15.2%), marginal farmers (14%) and upper medium (6%) (Table 1). The percentage of large farmers was lowest (2%) in all the districts. Average land holdings varied from 0.94 to 1.99 hectares with an overall average of 1.50 hectares. About 81%, 92% and 74% of the farmers contacted in Ferozepur, Amritsar and Gurdaspur districts respectively, kept buffaloes. Among these buffalo farmers, 34.1% were landless, 15.1% marginal, 24% small, 17.6% lower medium, 6.9% upper medium and 2.3% large farmers. The landless farmers were dependent mostly on animal rearing and buffalo constituted one of the major components of their income. The

Figure 2. Nili Ravi bull.

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Table 2. Average family status in the survey area.

District	Family members	Literacy (%)	Involved in animal rearing		Average land holding (hectares)
			Male	Female	
Ferozepur	5.35	37.2	0.96	1.11	1.99
Amritsar	5.39	18.7	0.62	0.30	1.44
Gurdaspur	6.32	35.4	0.56	0.12	0.94

distribution for buffalo farmers was almost comparable in the marginal and lower medium categories whereas it was minimal with regard to large farmers in the survey area.

The analysis revealed that the average family size was 5.35, 5.39 and 6.32 with average literate members being 1.99, 1.01 and 2.24 in Ferozepur, Amritsar and Gurdaspur districts respectively (Table 2). More male family members were involved in animal rearing than female members in Amritsar and Gurdaspur districts whereas in Ferozepur district more females were involved.

Management practices

Most of the farmers (98%) tied their buffaloes all the time. The animal houses, though separate, were located in the same premises as the residence of the farmer in most of the cases (86%). The animal houses were usually open (57%), made up of mud (49%) and bricks (46%), full walled (54%) and had mud floors (66%). These were well ventilated (91%) and clean (88%). Drainage was provided in 51% of the houses. Some of the farmers had even dug ponds in which buffaloes could wallow. Most of the farmers (73%) grew fodder for feeding to their animals and on an average a farmer had 0.50 ha of land under fodder production. Most of the farmers chaffed the fodder and fed the animals in groups. Natural service was mostly practiced (67%).

Morphological characters

The typical characteristics of Nili Ravi buffaloes as available in the literature include a black-brown hide colour, wall eyes and white markings on the forehead, face, muzzle, legs and tail. The breed is also known as *'Panch Kalyani'* due to the possession of these five white markings. The survey has revealed that their morphological characteristics have also undergone some changes. The true Nili Ravi animals with all five white extremities are rarely available. Most of the Nili-type buffaloes now available in the field have white marking on the forehead and hind legs and some also have wall eyes. Animals typically have a white moustache. These buffaloes are of a medium to large size. The head is elongated, bulging at the top and depressed between the eyes. Horns are small and tightly curled (slightly less than that of the Murrah). The tail is long, extending below the hocks and has a white switch. The udder is well shaped, capacious and extends well forward up to the naval flap.

Milk production

The average daily milk yield (Table 3) increased from 8.01 kg on the first test day (15 to 20 days from calving) to 8.24 kg on the second test day (45 to 50 days from calving) and then declined gradually to 3.23 kg on the ninth test day (approximately 8-9 months of lactation). The overall average daily milk yield was 6.67 kg. Estimated milk yield was about 1600 to 1800 kg in a lactation period of

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about 8 to 9 months. Nivsarkar *et al.* (2000) reported total lactation yields in Nili Ravi buffaloes ranging from 1 586 kg to 1 929 kg with lactation length ranging from 263 to 316 days.

Population

The populations of buffaloes surveyed were largest in Amritsar followed by Ferozepur and Gurdaspur districts with average herd sizes of 5.2, 3.7 and 3.3, respectively (Table 4). Ferozepur district, which is otherwise considered as a breeding tract of

the Nili Ravi, had more than 50 % buffaloes of the Murrah type. Ferozepur and Amritsar districts had only 10.8 % and 8.7 % of Nili Ravi type buffaloes respectively. On the contrary, Gurdaspur district, not known earlier as major breeding area of Nili Ravi, had the highest proportion (14%) of Nili Ravi type buffaloes. The majority of buffaloes (61%) were of non-descript type (not confirming to any particular breed). The greatest number of non-descript buffaloes (73%) were found in Amritsar district and the least (36%) in Ferozepur district. The large proportion of non-descript animals shows that the breeding of buffaloes in these

Figure 3. Nili Ravi she buffalo.

Table 3. Test day milk yield (kg) of Nili-Ravi buffaloes.

Test day	Average	No. of records
1	8.01	492
2	8.24	504
3	7.92	513
4	7.40	486
5	6.78	478
6	6.00	446
7	4.86	359
8	3.69	287
9	3.23	199

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Table 4. Breedwise proportion of buffaloes in survey area.

District	Total buffaloes surveyed	Percentage of			Estimated population of Nili Ravi
		Nili-Ravi	Murrah	Non-descript	
Ferozepur	1 4092	10.8	53.1	36.1	66 284
	(3.7)	(1.7)	(2.9)		
Amritsar	2 6806	8.7	18.7	72.6	65 527
	(5.2)	(1.9)	(3.7)		
Gurdaspur	8 221	14.2	17.1	68.7	63 236
	(3.3)	(2.3)	(2.5)		

( ) Numbers in brackets are household.

Figure 4. Nili ravi buffaloes bathing in a pond in the house of a farmer.

areas lacks proper planning. The estimated population of Nili Ravi type buffaloes in the three districts was around 0.2 million. The three districts had almost equal numbers of Nili Ravi buffaloes.

The interaction with the farmers has indicated a decline in the population of purebred Nili Ravi buffaloes. The primary reason for this decline is the higher market value placed on the black buffaloes. Earlier the true *Panch Kalayni* (with all extremities white) had very good physical appearance and was the first choice of the traders. Due to the lack of a planned breeding program,

the Nili Ravi buffalo could not retain its true characteristics and presently hardly any animal with all five extremities being white is seen. Buffaloes with 2-3 white extremities have a lower market price when compared to pure Nili Ravi or black buffaloes. Taking the benefit of market conditions, the breeders also started maintaining Murrah type bulls as very few Nili Ravi bulls are available. This has resulted in a farmer's preference for completely black buffaloes over the Nili type buffaloes. There is a definite market preference towards the Murrah type black animals while the population of pure Nili has declined considerably in spite of its milk yield

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being not less than that of the Murrah. This trend needs to be checked to prevent the erosion of this gene pool in India. There is a need to provide semen of typical Nili Ravi bulls in its breeding tract so as to produce progeny true to its characteristics and propagate the breed.

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Phenotypic characterization and production performance of local pigs under village settings in the Southern Highland zone, Tanzania

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Summary

Indigenous pigs in Tanzania are descendants of earlier European introductions. However, a lack of systematic breeding plans, poor husbandry practices, genetic drift and possibly mutation have led to pigs of varied phenotypes. A study undertaken in Mbeya region showed that the predominant management system practised was free ranging and occasionally tethering. The average mature body weights for boars and sows were 57.4 kg and 54 kg, respectively. Coat colour varied, but the predominant colours were white (28%), black and white (24%), and solid black (19.8%). The majority (78%) of pigs had droopy ears and such pigs were found to be significantly ($P<0.01$) heavier with a longer trunk and increased body length when compared with those with erect ears. Other features included a long and straight face and a short curled tail. The overall mean birth weight was 0.9 kg while the mean weaning weight was 10.8 kg. The average litter size for local pigs was 6.6 piglets and litter size at weaning was 4.3 piglets. Locally raised pigs served a number of functions including among others, income, provision of meat, cooking fat and manure.

Resumen

Las razas indígenas porcinas existentes en Tanzania descienden de razas europeas introducidas con anterioridad. Sin embargo, la falta de planificación sistemática en la reproducción, las escasas prácticas en la cría, así como las posibles mutaciones genéticas han llevado a una serie de cerdos con amplia variedad fenotípica Un estudio llevado a cabo en la región de Mbeya muestra que el sistema mayormente utilizado es la cría al suelo con los animales ocasionalmente atados. La media del peso corporal de un macho y hembra adultos es de 57,4 kg y 54 kg, respectivamente. El color del manto varía pero es principalmente blanco (28%), blanco y negro (24%) y todo negro (19,8%). La mayoría de los cerdos (78%) poseen orejas caídas y resultaron ser significativamente ($P<0,01$) de mayor peso y con un tronco más largo en comparación con los animales con orjeas erectas. Otros de los rasgos son la cabeza larga y estrecha y la cola corta y enroscada. La media del peso al nacimiento es de 0,9 kg, mientras que la media al destete es de 10,8 kg. La camada media al nacimiento es de 6,6 cochinillos y al momento del destete de 4,3. En la cría local los animales sirven para diversas funciones, incluidas, entre otras, el suministro de carne, la provisión de grasa para cocinar y de abono, además de ser una moneda de cambio.

Key words: *Local pigs, Phenotypic characteristics, Production characteristics.*

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Introduction

Local pigs raised by the rural poor have received little attention, which could be attributed in part to the failure of agriculture development policies to accord importance to this genetic resource. In Tanzania past research has concentrated on exotic pigs, and mainly on the use of locally available agro-industrial by-products for inclusion in rations. Although reliable figures are hard to obtain, it is estimated that the pig population in Tanzania is about 500 000. The majority of these animals are of an unimproved type and are to be found mostly in three regions of the Southern Highland zone viz. Mbeya, Ruvuma and Iringa (MAFS, 2001).

Documented information has often disregarded the existence of indigenous pigs in Tanzania. According to Mason and Maule (1960) the Tanzanian indigenous pigs are believed to be descendants of earlier introductions by missionaries during the colonial period. More than 90% of these pigs are found under traditional systems and are an integral part of smallholder farming systems (Kimbi *et al.*, 2001; Lekule *et al.*, 1990). However, no concerted efforts have been made to study and describe these pigs despite their roles in rural peoples' livelihoods. In view of the global concern regarding the disappearance of indigenous/local animal genetic resources a

study was undertaken to describe the phenotypic and production attributes of local pigs found in the Southern Highlands of Tanzania.

Materials and Methods

Study sites

The study was conducted in the Mbeya region, located in southwestern corner of the Southern Highlands of Tanzania. The region lies between latitudes 7° and 9° South and between longitudes 32° and about 35° East (Figure 1). Mbeya region has an altitude ranging from 800 to 2 981 meters above sea level. Temperatures range between minus 6°C in the highlands and 25°C in the lowland areas. The region enjoys abundant and reliable rainfall. Annual total rainfall varies between 650 mm and 2 600 mm.

Four districts, namely, Mbozi, Rungwe, Mbeya rural and Ileje were purposely selected due to the abundance of local pigs found there. In this region 87% of pigs are of a local/indigenous type and account for 33.8% of the total indigenous pigs in Tanzania (MAFS, 2001). From these districts, a total of 10 villages were sampled for investigation based on the fact that they were relatively un-influenced by large-scale urbanization.

Data collection and analysis

Data were collected by surveying methods using a structured questionnaire, onsite observation and physical measurement of pigs. 75 farmers who keep pigs were selected at random and interviewed. For phenotypic characterization, a total of 480 mature pigs were randomly sampled for various body measurements. Simple descriptive statistics for various parameters and quantitative variables were analyzed using SPSS statistical package.

Figure 1. Mbeya region, located in southwestern corner of the Southern Highlands of Tanzania.

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Results and Discussions

Management and role of pigs

Southern Highland is among the major agriculture zones in Tanzania and pig-raising is one of the diverse activities pursued by farmers there. The major role of pig keeping as revealed by the interviewed farmers was income generation (97.1%). Other roles included provision of meat (48.6%), manure (12.9%), provision of cooking fat (18.6%) and as an asset (7.1%). These findings are incongruent with observations made by Anderson *et al., (*2000) and Moll and Heerink, (2003) where in the smallholder situations cited, providing for household needs is the prime objective in pig keeping rather than profit maximization *per se.* The majority of pig keepers were also crop producers and men owned most of the pigs. However, women were had greater responsibilities in pig management compared to men.

In the study villages, the average herd size of pigs in the household was 7.6±4.4 pigs (inclusive of immature animals) and the majority of pig keepers tended to keep all categories/classes of pigs in a single herd. The average number of breeding sows was 1.9±0.78 with a range of between 1 and 4 sows. A few farmers (4.3%) kept crossbred pigs, however local pigs were predominant (95.7%). The study further revealed that scavenging was the common method of feeding, especially during the off-farming season. Other methods such as tethering and total confinement were common. Mpofu (1999) made similar observations in Zambia. This system has the disadvantage of limiting animals to scavenging for a variety of food

materials to fulfill their requirements while supplementation is normally minimal or absent. Scavenging has also been associated with a higher risks of cystericosis (Lekule and Kyvsgaard, 2003; Ngowi *et al,* 2002).

Housing was observed to be poor and piglets were often exposed to extremely cold weather conditions. Confinement and tethering were normally applied during the farming season to avoid crop destruction. About 73% of respondents had no disease control strategies in their herd leading to higher incidences of mortality among the piglets. Some pig keepers experienced pre-weaning mortalities of up to 100%. To counteract early death among the piglets, it has been necessary for farmers to extend the weaning period to between 3 and 4.5 months. The study also observed that less attention to feeding and disease control might have predisposed pigs to other problems such as poor growth, agalactia and general weakness of the animals.

Morphological traits

Results on live weights and linear body measurements for the local boars and sows are presented in Table 1. The weights of mature pigs were quite variable ranging from 30 kg to 64 kg. The overall mean weights for the adult local pigs were 57.4±2.4 kg and 54.0±1.3 kg for boars and sows, respectively. Adebambo (1982) reported similarly low mature live-weights ranging between 45 kg and 56 kg for Nigerian indigenous pigs. Local breeds of pigs tend to be smaller in size and are often mistakenly thought to be inferior to commercial breeds. For a resources

Table 1. The Least Squares Means (±S.E.) for body weight and linear measurements for local pigs in surveyed area by sex.

Sex	Body weight (kg)	Trunk length (cm)	Body length (cm)	Heart girth (cm)	Height at wither (cm)
Boars	57.4±2.4	82.8±1.4	97.3±1.7	85.6±1.4	59.7±1.4
Sows	54.0±1.3	78.8±0.8	92.4±0.9	86.6±0.8	60.2±0.8

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Figure 2. A typical local boar standing on a wooden stall

poor farmer, small sized animals are cheaper to maintain than large commercial breeds. It appears that the ability to survive under the harsh conditions could be linked to evolutionary adaptation to a low-input production environment, hence the smaller size (Lekule and Kyvsgaard, 2003).

The result of linear body measurements showed that body length, heart girth and height at wither averaged 97.3 cm, 85.6 cm, 59.7 cm in boars and 92.4 cm, 86.6 cm and 60.2 cm in sows, respectively. Overall, boars were significantly ($P>0.05$) heavier and had

Table 2. Frequency of coat colours among local pigs (N=405).

Colour	Frequency	Percentage
White	114	28.1
Black	80	19.8
Brown	16	4.0
Reddish brown	8	2.0
Grayish	8	2.0
Black and white	97	24.0
Black and brown	14	3.5
Black + white patches	13	3.2
Black + brown spot	2	0.5
Black and brown + white patches	3	0.7
Black and brown + white spots	6	1.5
Black and white + brown spots	3	0.7
Reddish brown + black spots	3	0.7
Brown + black spots	16	4.0
Gray and white	1	0.2
White + black spots	14	3.5
White + brown spots	7	1.7

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longer trunks as well as greater body length. Height at wither and heart girth did not differ significantly (*P*<0.05) between the sexes. Figures 2 and 3 give some typical features of local pigs found in Southern Highlands.

Table 2 shows the proportion of the various colours of pigs in the study areas. Great variation in terms of coat colour was observed. The majority of the pigs were white (28.1%), followed by a mixture of black and white (24%) and solid black (19.8%), the rest had mixed colour patterns. Association between coat colour and linear body measurements revealed that pigs with a white coat colour had significantly (*P*<0.05) longer (98.3±1.4 cm) body length followed by black pigs (93.5±1.7 cm), black and white pigs (92.6±1.5 cm) and white pigs with black spots (88.6±3.1 cm) with brown pigs having the shortest linear body measurements (81.1±5.0 cm). The majority of pigs (96%) had long, straight faces and droopy ears. Pigs with droopy ears were found to be significantly (*P*<0.01) heavier when compared with those with erect ears. Also, in terms of linear body measurements, animals with droopy ears had significantly (*P*<0.01) longer body trunk length (*P*<0.001), body

length (*P*<0.05), heart girth (*P*<0.001), height at withers (*P*<0.01), snout length (*P*<0.001), tail length and ear length (*P*<0.001), compared to the pigs with erect ears. Regarding tail shapes, curled tails were the most common type of tail (60.2%).

The number of teats (Table 3) among sows observed in this study ranged between four and seven pairs similar to observations made by Cheng (1984) on Kele indigenous pigs found in southwest China. Pigs with five pairs of teats were observed to be most common (61.5%), followed by those with six pairs (32.6%) of teats. No significant (*P*>0.05) differences were observed in body weight or height at withers for animals with four, five, six and seven pairs of teats. However, significant (*P*<0.05) differences in trunk length and body length were observed when pigs with five pairs of teats were compared with those having six or more pairs of teats. The droopy ears, white coat and longer body characteristic of white local pigs may suggest that crossing with exotic breeds like the Landrace at some stage cannot be ruled out. This supports the contention that these pigs are indeed descendants of European breeds (Lekule *et al.*, 1990).

Table 3. *Body shapes and number of teats among local pigs.*

	Frequency	Percentage
Tail shape		
Curled	154	60.2
Straight	102	39.8
Ear shape		
Droopy	196	78.4
Erect	54	21.6
Face		
Long and straight	192	95.5
Medium	9	4.5
Pair of teat number		
4	1	0.2
5	249	61.5
6	132	32.6
7	23	5.7

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Table 4. Reproduction performance of local pigs in Mbeya region.

Trait	Mean
Age at first farrowing (months)	13.8±2.5
Farrowing intervals (months)	12.0±2.2
Litter size at birth	6.6±1.2
Number of lifetime farrowings per sow	6.4±0.7
Average litter size at weaning	4.3±0.9
Weaning age (months)	3.4±0.4

Reproductive characteristics

Table 4 shows the mean performances for different reproductive traits of the local pigs. The observed litter size is within the range reported by Els, (2000) and Adebambo (1982) in South Africa and Nigeria, but slightly lower than that of Kele pigs (7-8) (Cheng, 1984) and Mukota pigs in Zimbabwe whose litter size ranges from 7.3 to 7.9 piglets. Some farmers reported that often some sows lost almost all the piglets before weaning. The higher pre-weaning mortalities could by and large be attributed to poor management and lack of veterinary and livestock support services, in addition to low input management. About 57% of the

interviewed farmers indicated that access to breeding boars was a problem. Pathiraja (1986) expressed a similar observation in small village populations of pigs in Nigeria.

A lack of organised breeding and poor access to improved boars largely contributes to the observed low productivity. An observed feature was greater age at first farrowing (13.9±2.5 months), late weaning and delayed age at mating. Cases of stillbirth, abortion and morphological deformities were also common. This could be explained in part by possible higher levels of inbreeding. Results from the Mashari research station in Namibia showed that with improved management, nutrition and weaning at 8 weeks of age, indigenous sows

Figure 2. A tethered sow close to the homestead during the cropping season.

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could produce 2 litters per annum (Els, 2001). The practice of pig keepers to leave piglets to suckle without restriction until they wean themselves also contributes to delayed heat by sows after weaning and invariably causes the long farrowing intervals.

Population trend

About 40% of the farmers interviewed indicated that their herds have been increasing over time, while 28% and 27% indicated that their flocks were stable or decreasing, respectively. In contrast previous studies in the same region observed that in general, the population of local pigs was increasing (Kimbi *et al.*, 2001). In general, availability of a ready market was a limiting factor to herd expansion and farmers were compelled to keep only a few animals for trading between 'market and subsistence'.

The study found that only 4.3% of the households surveyed kept crosses. This was firstly due to remoteness of the villages surveyed, and secondly most farmers were poor and could not afford to purchase improved boars and additional inputs such as cereal by-products. A few farmers who kept crosses had better connections with the town markets. It appears that for the majority of farmers, the current system of raising local pigs will continue unchanged for the foreseeable future unless deliberate efforts are made to improve both the husbandry and breeding practices.

Conclusion

The local pigs found in the Southern Highlands of Tanzania have morphological features common to other indigenous pigs found under low-input traditional systems in Africa. They serve functions that are not reflected in simple economic balance. However, the lack of improved breeding boars and poor support services have led to the observed poor productivity. There is a

need for institutional support to these communities to allow for active and sustainable utilization of this genetic resource.

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Ghoongroo pig: A new found animal genetic resource of sub-Himalayan West Bengal, India

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Summary

A breed of pig with distinctive productive and reproductive characteristics has been identified in the eastern Sub-Himalayan region of West Bengal state, India and adjoining Nepal. The breed is known as Ghoongroo (meaning anklet in the local language). The breed is most prevalent within 88º E to 90º E longitudes and 26.3º N to 27.3º N latitudes. Two distinct climates viz., cold moist and hot humid are observed during the year. Farmers manage the animals both under stall-feeding and stall-feeding-cum-grazing systems. Simple housing principally made up of bamboo and jute stick is used with an emphasis on giving protection from the rain.

The population in the breeding tract varies depending on market demand. Generally, the population varies from 8 000 to 10 0000. Pigs are black in colour with a compact body, long thick coarse hair, a long tail and an upwardly curved snout. The face is broad and flattened with large, heart shaped ear resembling that of an elephant. Average litter size at birth is11.92±0.06 and a litter size of up to eighteen is not uncommon on a low to medium plane of nutrition. Body weights at birth, five months and one year of age are 1.08±0.22, 38.91± 1.49 and 106.3±0.31 kg respectively, irrespective of sex.

This unique germ plasma has the potential to replace exotic breeds from temperate zones currently used in improved pig production programs. However the breed is under constant threat due to indiscriminate crossbreeding with other varieties. Thus the immediate implementation of conservation and improvement programs is essential to salvage the breed.

Resumen

Une race de cochons avec des caractéristiques spécifiques de production et reproduction a été identifiée dans l'Est de la région du Sub-Himalaya dans l'Ouest de l'Etat du Bengal en Inde, tout près du Nepal. La race est appelée Ghoongroo (cela signifie dans la langue locale bijou que l'on porte autour de la cheville). La race est la plus répandue sur la longitude de 88° à 90° E et la latitude de 26.3° à 27.3° N. Il existe deux types différents de climat dans cette région - froid et humide, ainsi que chaud et humide. Les agriculteurs élèvent ces animaux avec du fourrage dans les étables et aussi sur pâturage naturel. On utilise du bambou et des bâtons de jute pour des simples constructions pour sauvegarder les animaux en particulier contre la pluie.

La population dans les élevages varie selon la demande du marché. En général cela varie de 8 000 jusqu'à 10 000. La race est de couleur noire avec un corps compact, un pelage gros et long, une queue longue et un museau courbé vers le haut. La visage est large et applati avec des oreilles grandes et façonnées comme celles des éléphants. En moyenne le nombre à la naissance est de 11.92±0.06 et jusqu'à 18 est considéré assez fréquent avec un niveau moyen-faible de nutrition. Ils pèsent 1.08±0.22 kg à naissance,

38.91±1.49 kg à 5 mois après la naissance et 106.3±0.31 kg quand ils ont un an, indpéndemment du sexe.

Ce germoplasme unique a le potentiel de remplacer les races exotiques des zones tempérées, qui sont utilisées dans les programmes d'amélioration pour la production de cochons. Cependant cette race est menacée par l'élevage de races 'scrub' sans faire de distinction. Ainsi, pour la sauver, il est essentiel de démarrer un programme immédiat pour la conservation et l'amélioration.

Key words: Pig, Ghoongroo pig, Sub-Himalayan, West Bengal, India.

Introduction

The commercial value of pig genetic resources on the Indian sub-continent is low owing to their poor economic traits. Domestic pigs found in this region are believed to have a common origin with the wild pig *Sus scrofa cristatus* (Macdonald, 2001). Phenotypic variations among different subgroups are very low and they are generally called 'local pig'.

A breed of pig with distinctively superior productive and reproductive characteristics has recently been identified in the eastern Sub-Himalayan region of West Bengal, India and adjoining Nepal. The breed is commonly known as Ghoongroo (meaning anklet in local language) to farmers, researchers, planners and development workers. However no history or justification can be given for the nomenclature. The breed is also known by other names by different small tribal sub-groups in their dialects. Planners and developers are using this breed more than exotic breeds which are much more costly considering the available resource base of local farmers. This paper presents the characteristics of this pig and assesses conservation needs of the breed.

Distribution

The Ghoongroo pig is most prevalent in Dooars valley of the eastern Sub-Himalayan region of West Bengal between 88° E and 90° E longitude and 26.3° N and 27.3° N latitude. The area belongs to the civil districts of Darjeeling, Jalpaiguri and northern Cochbehar (Figure 1). The breed is also found in the eastern part of Nepal adjoining the Darjeeling district.

Topography and Climate

Being located in the Sub-Himalayan region, the topography is undulating. The northern part is hilly with altitudes of up to 3 000 m above mean sea level. The southern part is plain and ranges in altitude from 150 m to 300 m above mean sea level (Dooars plain). The soil is Brown Mountain in the extreme north followed by Terai and New Alluvial towards the south. The minimum temperature plunges to 10ºC during January while maximum temperatures reach 34ºC during July. Average annual rainfall is 3 456 mm. Two distinct climates, viz. cold moist (November to April) and hot humid (May to October) could be identified during the year (Figure 2).

Management Practices

Farmers manage their animals in both under stall-feeding and stall-feeding-cum-grazing systems. Tethered grazing is the usual practice. Herd size is generally low ranging from one to five reproductive animals. Organised farms with up to fifteen reproductive animals are also not uncommon in the breeding tract. Farmers change their herd size frequently depending upon market trends. Occasionally they even wind up and restart farms. Housing systems are very simple and are designed only to provide feeding and watering facilities to the animals, minimum fencing and protection
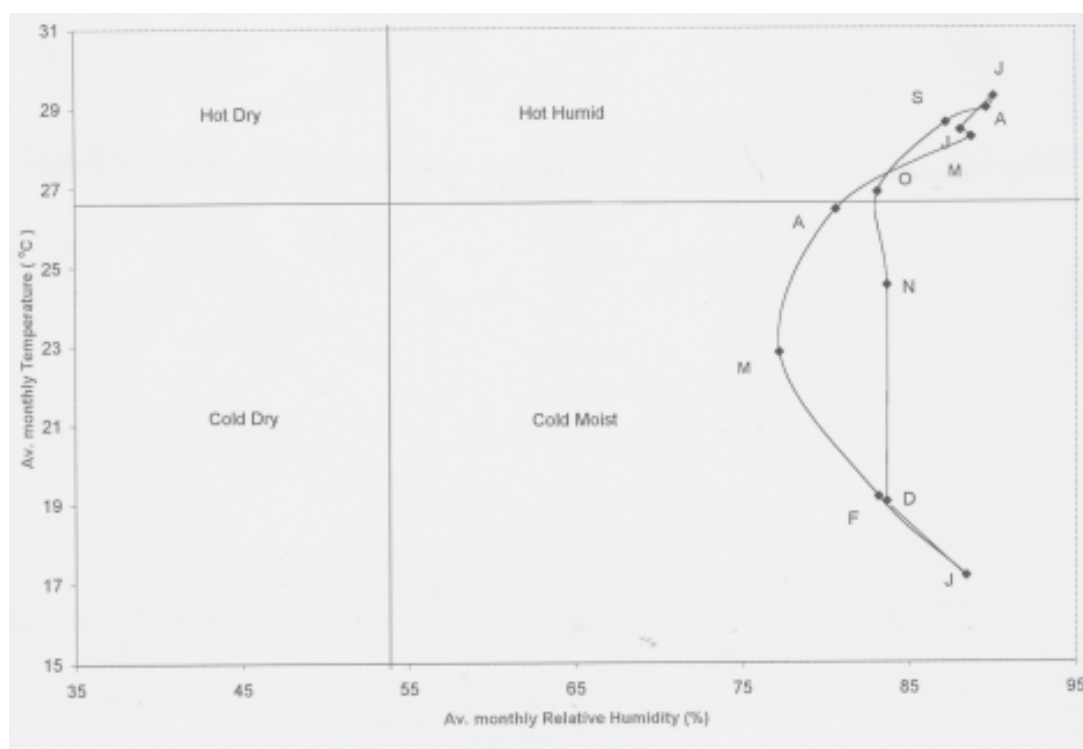
Figure 1. Breeding tract of Ghoongroo pig.

Figure 2. Climatography of Ghoongroo pig breeding tract

from rain. Major housing materials are bamboo and jute-stick which are freely available locally, and earthen or cement-cast mangers. Earthen floors are adequate for animals being raised under a stall-feeding-cum-grazing system but are not hygienic for animals on stall-feeding only. Foodstuffs utilised for stall-feeding consist of rice husks, rice gruel, kitchen and hotel waste and fresh fish offal. Concentrated feed is considered a costly option in the existing production system.

Population Trends

The population of the Ghoongroo pig in the breeding tract varies depending upon market demand. Farmers start or increase Ghoongroo production based on expected profitability. The high reproduction rate of the breed makes this approach possible. Middlemen, on demand, also procure animals from Nepal. As nondescript variety pigs are also raised side-by-side with the Ghoongroo pigs, farmers often interbreed Ghoongroo with nondescript varieties out of negligence. Generally 8 000 to 10 000 animals constitute the population in

the breeding tracts depending upon different factors. However, no systematic estimate of population size in Nepal is available.

Physical Characteristics

The animal is black in colour with a compact body, thick coarse long hair and a long tail reaching to below hock. The face is broad and flattened with an upwardly curved snout. The ears are large and heart shaped resembling those of an elephant. The hindquarters are heavier and rumps are drooping (Figures 3 and 4). The scrotum loosely hangs from the body (Figure 5).

Behaviour

The breed is highly docile and amenable to any form of management. Their docility is evident from their adaptation to tethered management (Figure 6). Sows show strong mothering abilities. Stampede death of piglets during nursing is negligible as sows always lie down very carefully. Intra- and inter-sex agonistic interactions are minimal. This makes group management much easier.
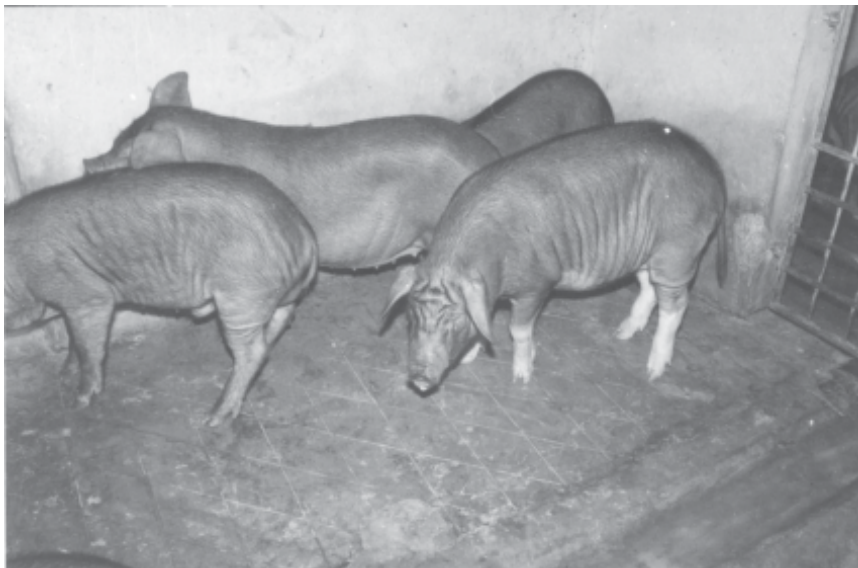

Figure 3. Ghoongroo gilt

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Figure 4. Ghoongroo sow

Figure 5. Ghoongroo boar.

Production Performance

The production performance of Ghoongroo pigs is of special interest. Present reporting is based on information collected from farmers' herds maintained on a low to medium plane of nutrition. Average litter size at birth is 11.92±0.06 and litter size of up to eighteen is not uncommon. Body weights at birth, five months and one year of age are 1.08±0.22, 38.91 ±1.49 and 106.3±0.31 kg respectively (n=80) irrespective of sex. The breed attains puberty at seven months of age. Gestation length, farrowing interval and service period

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Figure 6. Ghoongroo pig under tethered management.

are found to be 109.1±0.04, 175.7±1.12 and 68.4±0.31 days respectively.

Survivability

The Ghoongroo, being a local breed, evolved in response to their natural environment, and exhibit a strong adaptation to it. Adult animals hardly require any climatic protection except when constant rain persists over several days. They are capable of deriving necessary nutrition from locally available feed resources. The incidence of piglet anaemia is very low, even when they are not given any concentrated feed. Pre-weaning mortality at farmers' houses was estimated as 11.8 %. Though the breed exhibits good resistance to different diseases, they remain susceptible to swine fever.

Conservation Needs

The unique germ-plasm is under constant threat due to indiscriminate breeding with nondescript varieties. Slackness in the domestic market often leads to a reduction in population size. No effort has been made so far either to improve the genetic merit of the breed or to guide the farmers towards an efficient production system. Most significantly, the breed has the potential to replace the exotic breeds from temperate zones used for improved pig production programs. Detailed characterisation of the breed including DNA profiling and estimates of genetic distance are needed immediately to establish the distinctiveness of the breed. The breed is under detailed study with the establishment of experimental herds in different environmental locations.

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International Agreement of Recording Practices
Published by the International Committee for Animal recording (ICAR)
Via G. Tomassetti 3, 00161 Rome, Italy
Published in 2005
pp. 390

The International Committee for Animal Recording (ICAR) is the world-wide organisation for the standardisation of animal recording and productivity evaluation. Its aim is to promote improvement of farm animal recording and evaluation through the formulation of definitions and standards for the measurement of traits of economic importance. Together with the definitions and standards ICAR establishes specific guidelines for the purpose of identifying animals, the registration of their parentage, recording their performance and their evaluation, and publish the findings.

This new version of the Guidelines for animal recording is divided in 11 chapters. covering general rules, standards and guidelines for recording of productive and non-productive traits of economic importance and on genetic evaluation of farm animals constitute part of this Agreement.

In particular the publication is divided in the following sections
1.   General rules
2.   Rules, standards and guidelines for dairy production recording
3.   Rules, standards and guidelines for meat production recording
4.   Other production traits recording
5.   Icar guidelines on conformation recording methods in dairy cattle
6.   Fertility recording
7.   Guidelines for health recording
8.   Data definition and data transfer
9.   Standard methods of genetic evaluation
10.   Testing and approval of devices used in animal identification

11.   Rules, standards and recommendations for testing, approval and checking of milk recording devices

A copy of the publication can be requested from: icar@icar.org

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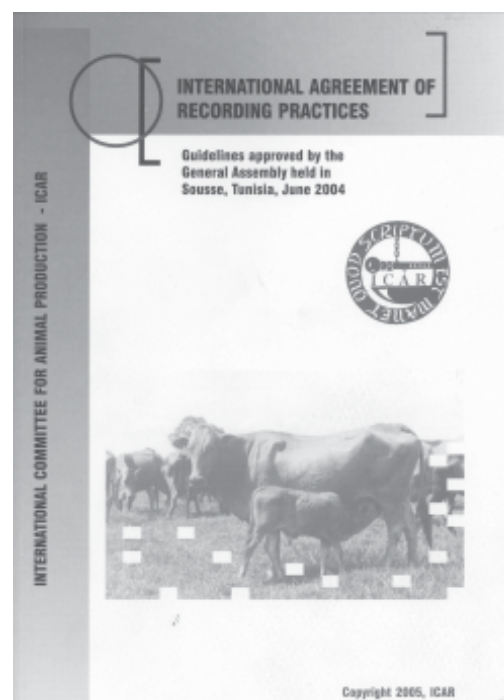
Colón y La Gomera: La colonización de La Isabella (Repubblica Dominicana) con animales y plantas de Canarias (Columbus and La Gomera island: The colonisation of La Isabella (Dominican Republic) with animals and plants from the Canary islands)

The aim of the present publication is the study of the events produced by the first colonisation of La Española (actually the Dominican Republic and Haiti) and the early evolution of animals and plants originating from La Gomera, an island of the Canary arcipelagus, that were transferred there by Columbus during his four expeditions.

One of the problems encountered during the realisation of the book was the clear and unambiguous identification of the breeds and the identification of the species, originally endogenous to the island.

This publication underlies the relevance of specific plants and animals of the Canary islands and their contribution to the colonisation of the Americas. La Gomera island played a relevant role not only in the first expedition, realised in 1492, but also in the following ones who are known as the colonisation of the New World. Many of the plants and animals that were taken onboard in the first boats and that were used for the food sustainenance of the early inhabitants were originating from La Gomera. In particular, the Canary sheep and goats were used for breeding with the local material producing the first Creole breeds. The wild goat of La Caldera, the Fuerteventura goat, the Tinerfeña goat, the Majorera goat and the Canary pigs were the first source of

hexogen genes introduced into local American gene pool, reminding again of the role of the discoveries and the breeding between geographic isolated material in defining the genetic resources of the New World.


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Proceedings of the 4th All Africa Conference on Animal Agriculture. The role of biotechnology in animal agriculture to address poverty in Africa: Opportunities and challenges
Arusha, Tanzania, 20-24 September 2005-10-28
Published in 2005
pp. 155

This publication contains the Proceedings of the Conference held in Arusha and presents the abstracts of the papers presented during the meeting. Around 350 participants took part in the event and about 120 papers were presented in 14 sessions divided into plenary or parallel sessions.

The meeting focussed on the relevance of biotechnology in the animal production sector, with interventions that linked this aspect with genetic improvement, animal feeding and nutrition, trade and political and social aspects.

Great attention was given to the trade aspects and to the animal genetic resources, since these are key elements that maintain a relevant potential for the economic advancement of the region.

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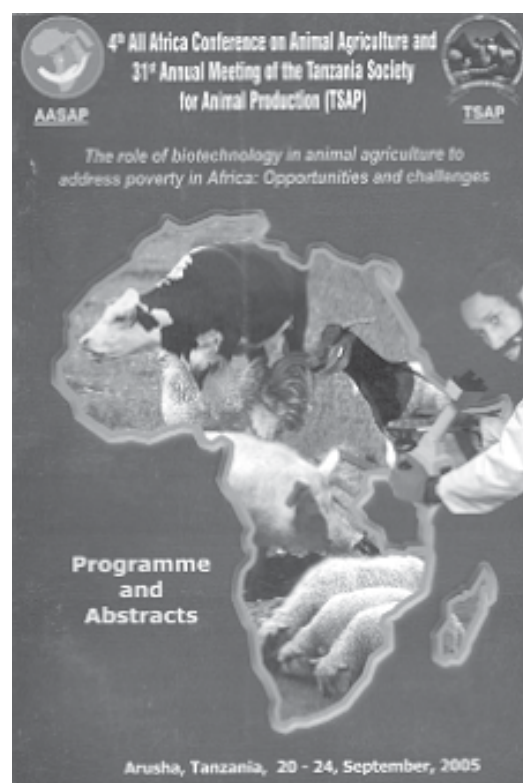
## Le chévre dans l'arganeraie
(Goats in the argan tree forest)

The argan tree (Argania spinosa) forest is a unique landscape recognised by UNESCO as a biosphere reserve; it extends in the south of Morocco and includes around 70 000 small villages. This publication describes the economic relevance of such ecosystem of the forest. The multi-functionality aspects of the argan tree is well known: its oil production is much appreciated for its organoloptic and cosmetic reasons, while it also offers a nutrientive feed for local goats, with consequent manure production. It can be said that its agro pastoral ecosystem allows the self sufficiency of a large base of Moroccan population that satisfies its need through the appropriate management of such resources.

This publication is thus based on the description of the whole chain based on the argan tree, its ecologic context, historical citations, geographic distribution and processing techniques of the seeds used for oil production. An example of ethologic study is also given, describing the feeding behaviour of the goats and their preferences for the tree.

The various type of breeding and production systems are also described, in which argan tree provides the basic nutritional elements to the flocks in association with cereals, legumes and other local plants.

A series of original pictures and clear diagrams visually illustrates the ecosystem and the various existing relations between the local goats and the argan tree, making the book appropriate for scientists and all those interested in such production system.
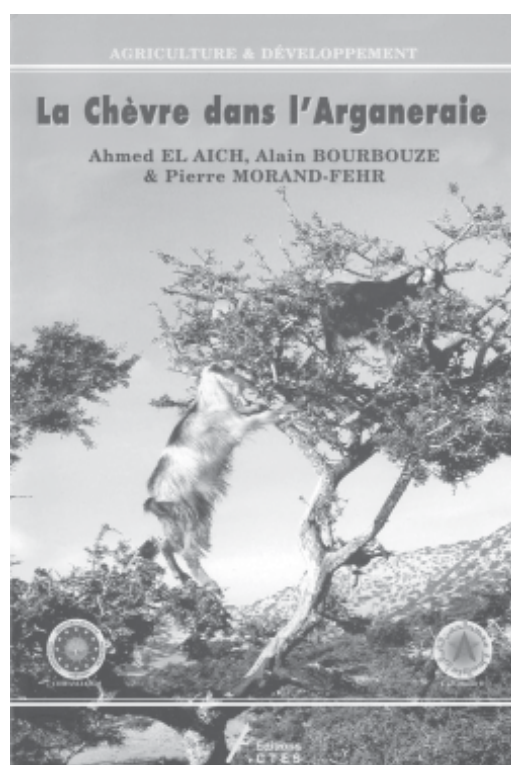
Avaliação genética raça bovina Martolenga. Catálogo de touros 2005 (Genetic evaluation of Martolenga cattle breed. Bull catalogue 2005)

The Martolenga cattle breed is traditionally recognized in Portugal for its reproductive efficiency and maternal instinct. These characteristics have been the reasons for its progressive expansion, particularly in the last years. A programme of genetic improvement developed in lately has made the breed even more economically valuable.

This comprehensive catalogue, published on the occasion of the National Competition of the Martolenga Breed held in Ovibeja in 2005, reports the best reproductive bulls and their pedigree. The genetic evaluations were based on the Martolenga herdbook by the Department of Genetic and Animal Breeding of the National Station for Animal Production.

The characteristics considered in the breeding plan were:
- Calving interval.
- Maternal instinct.
- Growth capacity.

All the above characteristics were analysed by the BLUP multi-trait analysis.

For each bull, pedigree , performances and the available semen characteristics are reported together with a photo and his genetic evaluation. To complete the data, the owner and the breeder of the animal are clearly detailed. At the end of the publication, a ranking value of the best animals is summarised, making the volume an interesting opera for breeders, scientists and researchers.
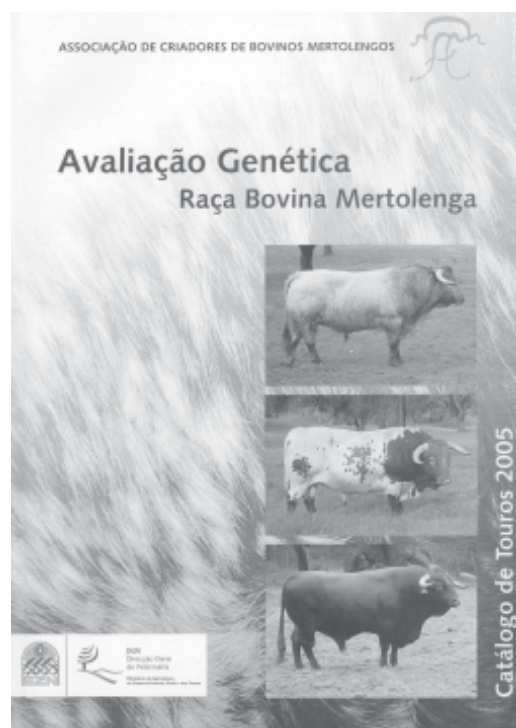
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The mission of the Animal Genetic Resources Information Bulletin (AGRI) is the promotion of information on the better use of animal genetic resources of interest to food and agriculture production, under the Global Strategy for the Management of Farm Animal Genetic Resources. All aspects of the characterization, conservation and utilization of these resources are included, in accordance with the Convention on Biological Diversity. AGRI will highlight information on the genetic, phenotypic and economic surveying and comparative description, use, development and maintenance of animal genetic resources; and on the development of operational strategies and procedures which enable their more cost-effective management. In doing this AGRI will give special attention to contributions dealing with breeds and procedures capable of contributing to the sustainable intensification of the world's medium to low input production environments (agro-ecosystems), which account for the substantial majority of the land area involved in livestock production; the total production of food and agriculture from livestock; and of our remaining farm animal genetic resources.

Views expressed in the paper published in AGRI represent the opinions of the author(s) and do not necessarily reflect those of the institutions which the authors are affiliated, FAO or the Editors.

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Findings of work on characterization, conservation and utilization of farm animal genetic resources (AnGR) in well described production environments, will be considered for publication in AGRI. Quality photographs of these genetic resources viewed in the primary production environment to which they are adapted, accompanying the manuscripts are encouraged.

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Unsolicited articles reviewing agro-ecosystems, country-level, regional or global developments on one or more aspects of the management of animal genetic resources, including state-of-the-art review articles on specific fields in AnGR, will be considered for publication in AGRI.

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This includes book reviews, news and notes covering relevant meetings, training courses and major national, regional and international events and conclusions and recommendations associated with the outcomes of these major events. Readers are encouraged to send such items to the editors.

Guidelines for Authors

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Manuscripts prepared in English, French or Spanish with an English summary and

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Manuscripts should be typed double-spaced and with lines numbered in the left margin. All pages, including those of references, tables etc., must be consecutively numbered. The corresponding author is notified of the receipt of a manuscript.

For manuscripts that are accepted after revision, authors are encouraged to submit a last version (3½" disc format) in Word 6.0 for Windows of their revised manuscript along with the printed copy.

Preparation of the manuscript

The first page of the manuscript must include the running head (abbreviated title), title, names of authors, institutions, full addresses including postal codes and telephone number and other communication details (fax, e-mail, etc.) of the corresponding author. The running head not exceeding 45 characters plus spaces, should appear at the top of page 1 of the manuscript entirely in capital letters. The title of the manuscript is typed in upper and lower case letters. The title should be as brief as possible not exceeding 150 characters (including spaces) with species names when applicable. Authors, institutions and addresses are in upper and lower case italics. There is one blank line between the title and the authors. Addresses are typed as footnotes to the authors after leaving one blank line. Footnotes are designated numerically. Two lines are left below the footnotes.

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Headings of sections, for example Summary, Introduction, etc., are left-justified. Leave two blank lines between addresses footnotes and Summary and between the heading Summary

and its text. Summary should not exceed 200 words . It should be an objective summary briefly describing the procedures and findings and not simply stating that the study was carried on such and such and results are presented, etc. Leave one line between the summary text and Keywords which is written in italics as well as the keywords themselves. All headings of sections (14 regular) and sub-sections (12 regular) are typed bold and preceded and succeeded by one blank line and their text begins with no indention. The heading of a sub-subsection is written in italics, and ends with a dot after which the text follows on the same line. Keywords come immediately after the summaries. They should be no more than six, with no "and" or "&".

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Tables, including footnotes, should be preceded and succeeded by 2 blank lines. Table number and caption are written, above the table, in italics (12) followed by a dot, then one blank line. For each column or line title or sub-title, only the 1st letter of the 1st word is capitalized. Tables should be numbered consecutively in Arabic numerals. Tables and captions should be left justified as is the text. Use horizontal or vertical lines only when necessary. Do not use tabs or space-bar to create a table but only the appropriate commands.

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Figures including titles and legends should be preceded and succeeded by two blank lines. Figure number and title are written, below the figure, in italics (12) and end with a dot. The term figures includes photos, line drawings,

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All the submitted diagrams, must be accompanied with the original matrix of the data used to create them. It is strongly advised to submit diagrams in Word 6.0 or Excel 5.0. Figures should be numbered consecutively in Arabic numerals.

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Every reference cited in the text should be included in the reference list and every reference in the reference list should have been mentioned in the text at least once. References should be ordered firstly alphabetically by the first author's surname and secondly by year.

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Thanks for the collaboration

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L'objectif du Bulletin d'information sur les ressources génétiques animales (AGRI) est la vulgarisation de l'information disponible sur la meilleure gestion des ressources génétiques animales d'intérêt pour la production alimentaire et agricole, d'après les recommandation de la Stratégie mondiale pour la gestion des ressources génétiques des animaux domestiques. Tous les aspects relatifs à la caractérisation, la conservation et l'utilisation de ces ressources seront pris en considération, suivant les normes de la Convention pour la Biodiversité.

AGRI désire diffuser de l'information sur la génétique, les enquêtes phénotypiques et économiques et les desciptions comparatives, l'utilisation et la conservation des ressources génétiques animales, ainsi que toute information sur le développement de stratégies opérationnelles et de normes qui puissent permettre une meilleure gestion de la relation coût/efficacité. C'est pour cela que AGRI prendra spécialement en considération toutes les contributions référées aux races et aux normes capables de permettre une intensification durable des milieux (agroécosystèmes) à revenus moyens et bas dans le monde; qui comprennent la majeur partie des terres consacrées à l'élevage, à la production totale des aliments et l'agriculture provenants de l'élevage; et tout ce qui reste comme ressources génétiques des animaux domestiques.

Les opinions exprimées dans les articles publiés dans AGRI appartiennent seulement aux auteurs et donc ne représentent pas nécessairement l'opinion des instituts pour lesquels ils travaillent, la FAO ou les éditeurs.

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Seront prises en considération pour leur publication sur AGRI les études sur la caractérisation, la conservation et l'utilisation des ressources génétiques des animaux domestiques (AnGR) accompagnées d'une bonne description du milieu. On encourage les auteurs à envoyer des photographies de bonne qualité qui montrent les races en question dans leur milieu naturel de production.

Révisions

Occasionnellement, des articles contenant une révision des agroécosystèmes, au niveau national, régional ou mondial, avec un ou plusieurs aspects se rapportant à la gestion des ressources génétiques animales, y compriss les mises à jour des différentes zones de AnGR, seront pris en considération.

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Ceci comprend la révision de livres, nouvelles et notes de réunions importantes, cours de formation et principaux évènements nationaux, régionaux et internationaux; ainsi que les conclusions et recommandation par rapport aux objectifs des ces principaux évènements. Les auteurs sont priés d'envoyer ce genre de matériel aux éditeurs.

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Guide pour les auteurs

Présentation du manuscrit

Les articles se présenteront en anglais, français ou espagnol, avec un résumé en anglais et sa traduction en français ou en espagnol; ils seront envoyés à l'éditeur de AGRI, AGAP, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italie. En outre, l'article devra être envoyé par courrier électronique comme document attaché en version WinWord à *agri-bulletin@fao.org*. Les photographies, en couleur ou en blanc et noir, seront toujours envoyées par courrier normal.

Les manuscrits se présenteront à double interligne et avec le numéro correspondant à chaque ligne sur la marge gauche. Toutes les pages seront numérotées, y compriss celles avec les références bibliographiques, les tableaux, etc. L'auteur recevra une lettre lui donnant bonne réception de son document.

Lorsqu'un article, après sa révision, sera accepté, on demandera à l'auteur d'envoyer la version finale révisée sur disquette (format $3_{1/2}''$) en Word 6.0 x Windows, ainsi qu'une copie sur papier.

Préparation du manuscrit

Sur la première page du manuscrit on indiquera le titre de l'article en abrégé, le titre et noms des auteurs, des institutions, les adresses complètes (y compris code postal et numéro de téléphone); ainsi que tout autre moyen de contact tel que télécopie, courriel, etc. avec l'auteur principal. Le titre abrégé ne devra pas dépasser 45 caractères, plus les espaces nécessaires, et s'écrira sur la partie supérieure de la page 1 du manuscrit en majuscules. Le titre en entier du manuscrit sera écrit en majuscules et minuscules; il devra être aussi bref que possible, sans dépasser 150 caractères (y compris les espaces nécessaires), et avec l'indication des noms des espèces. Les noms des auteurs, des institutions et les adresses seront en italique et en lettres majuscules et minuscules. On laissera un espace en blanc entre le titre et les

noms des auteurs. Les adresses seront indiquées comme de bas à pied de page pour chacun des auteurs après avoir laissé un espace en blanc après les noms. Chaque note de bas de page sera numérotée. On laissera deux espaces en blanc après les adresses.

Titres

Les titres de chaque chapitre, par exemple Résumé, Introduction, etc. seront alignés à gauche. Laisser deux espaces en blanc entre les notes de bas de page avec les adresses et le Résumé, et entre le titre Résumé et le texte qui suit. Le résumé ne devra pas dépasser les 200 mots. Il s'agira d'un résumé objectif faisant une brève description des processus utilisés et des résultats obtenus, et non pas une simple présentation du travail réalisé avec une description générale des résultats. Laisser un espace en blanc entre la fin du texte du résumé et les mots clés, qui seront écrits en italique ainsi que le titre Mots clés. Les mots clés seront au maximum six et il ne devra pas y avoir de et ou &. Tous les titres principaux de chapitre (14 regular) et sous-chapitre (12 regular) seront en gras avec un espace en blanc avant et après. Le texte commencera sans retrait. Un titre à l'intérieur d'un sous-chapitre s'écrira en italique, suivi d'un point, avec le texte à continuation.

Tableaux et figures

Les tableaux et les figures iront à la fin du texte en suivant l'ordre d'apparition dans le texte. Les photographies ne seront pas dévolues aux auteurs.

Tableaux

Les tableaux, y compris les notes de bas de page, devront avoir un espace en blanc avant et après. Le numéro du tableau et le titre s'écriront sur la partie supérieure en italique (12) avec un point à la fin et un espace en blanc en dessous. Sur chaque colonne, titre d'en-tête ou sous-titre, seulement la première lettre du premier mot sera en majuscule. Les tableaux et leur titre seront alignés à gauche,

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ainsi que le texte. Les lignes verticales et horizontales seront utilisées seulement si nécessaire. Ne pas utiliser les "tabs" ou la barre d'espacement pour créer un tableau.

Figures

Les figures, y compris les titres et les légendes, seront précédés et suivis de deux espaces en blanc. Le numéro de la figure et le titre s'écriront sur la partie supérieure en italique (12) avec un point à la fin. Sous la rubrique figure on trouvera les photographies, les graphiques, les cartes, les diagrammes, etc. Dans le cas des diagrammes, la matrice originale avec les données utilisées pour son élaboration devra être envoyée. On recommande l'utilisation de Word 6.0 ou Excel 5.0 pour la présentation des diagrammes.

Références

Toute référence présente dans le texte devra apparaître sur la liste des références, et chaque référence de la liste aura été citée au moins une fois dans le texte. Les références iront en ordre alphabétique du nom de l'auteur, suivi de l'année.

- Exemple dans le cas d'une référence sur une revue:
  Köhler-Rollefson, I. 1992. The camel breeds of India in social and historical perspective. Animal Genetic Resources Information 10, 53-64.

- Lorsqu'il s'agit de plus d'un auteur:
  Matos, C.A.P., D.L. Thomas, D. Gianola, R.J. Tempelman & L.D. Young. 1997. Genetic analysis of discrete reproductive traits in sheep using linear and nonnlinear models: 1. Estimation of genetic parameters 75, 76-87.

- Dans le cas d'un livre ou d'une publication ad hoc, par example un rapport, une thèse, etc.:
  Cockrill, W.R. (Ed.). 1994. The Husbandry and Health of the Domestic Buffalo. FAO, Rome, Italy, pp 993.

- S'il s'agit d'un acte d'une réunion:
  Hammond, K. 1996. FAO's programme for the management of farm animal genetic resources. In C. Devendra (Ed.), Proceedings of IGA/FAO Round Table on the Global Management of Small Ruminant Genetic Resources, Beijing, May 1996, FAO, Bangkok, Thailand, 4-13.

- Lorsque l'information contenue dans l'article ait été obtenue ou dérive d'un site World Wide Web, il faudra mettre le texte entre guillemets; par example "tiré de la FAO. 1996" et indiquer dans les Références la forme standard URL:
  FAO. 1996. Domestic Animal Diversity Information System, *http://www.fao.org/dad-is/*, FAO, Rome, Italy.

Pour tout envoi de manuscrits ou correspondence au sujet d'AGRI, vous êtes prié d'utiliser l'adresse suivante:

agri-bulletin@fao.org

Merci pour votre collaboration

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Reglas y normas editoriales

El objetivo del Boletín de Información sobre Recursos Genéticos Animales (AGRI) es la divulgación de la información sobre una mejor gestión de los recursos genéticos animales de interés para la producción alimentaria y agrícola, siguiendo la Estrategia Mundial para la Gestión de los Recursos Genéticos de los Animales Domésticos. Todos los aspectos referidos a la caracterización, la conservación y el uso de estos recursos serán tomados en consideración, de acuerdo con el Convenio sobre la diversidad biológica.

AGRI publicará información sobre genética, encuestas fenotípicas y económicas y descripciones comparativas, uso, desarrollo y conservación de los recursos genéticos animales, así como sobre el desarrollo de estrategias operacionales y normas que permitan una gestión más eficaz de la relación costo/eficacia. Por ello, AGRI prestará especial atención a las contribuciones referidas a razas y normas capaces de contribuir a la intensificación sostenible de los medios (agroecosistemas) con ingresos medios y bajos en el mundo, que comprenden casi la mayor parte de las tierras dedicadas a la producción ganadera; la producción total de alimentos y agricultura provenientes de la ganadería; y el resto de los recursos genéticos de animales domésticos.

Los puntos de vista expresados en los artículos publicados en AGRI son solamente las opiniones de los autores y, por tanto, no reflejan necesariamente la opinión de las instituciones para las cuales trabajan dichos autores, de la FAO o de los editores.

La oportunidad o no de publicar un artículo en AGRI será juzgada por los editores y revisores.

Publicación electrónica

Además de su publicación impresa, la versión íntegra de AGRI se encuentra disponible electrónicamente en Internet, en el sitio: *www.fao.org/dad-is/*

Tipos de artículos

Serán publicados en AGRI los siguientes tipos de artículos:

Artículos sobre investigación

Se tomarán en consideración para su publicación en AGRI los estudios sobre la caracterización, conservación y uso de los recursos genéticos de los animales domésticos (AnGR) con una buena descripción del entorno. Se agradecerá el envío de fotografías de calidad que presenten a las razas en cuestión en su ambiente natural de producción.

Artículos de revisión

Se podrán tomar en consideración ocasionalmente aquellos artículos que presenten una revisión de los agroecosistemas, a nivel nacional, regional o mundial, con el desarrollo de uno o más aspectos referidos a la gestión de los recursos genéticos animales, incluidas las revisiones sobre el estado actual de las distintas áreas de AnGR.

Artículos específicos

Se solicitarán puntualmente artículos sobre temas específicos para ediciones especiales.

Otro material para publicación

Incluye la revisión de libros, noticias y notas referidas a reuniones importantes, cursos de formación y principales eventos nacionales, regionales e internacionales, así como conclusiones y recomendaciones relacionadas con los objetivos de estos principales eventos. Se invita a los lectores a enviar este tipo de material a los editores.

Guía para los autores

Presentación del manuscrito

Los artículos se presentarán en inglés, francés o español, junto con un resumen en inglés y su traducción en francés o español, y se enviarán al editor de AGRI, AGAP, FAO, Viale delle Terme di Caracalla, 00100 Roma, Italia. El artículo deberá ser enviado en versión WinWord en fichero adjunto por correo electrónico a *agri-bulletin@fao.org*. Las fotografías, color o en blanco y negro, se enviarán siempre por correo normal.

Los manuscritos se presentarán con doble espacio y con el número correspondiente a cada línea en el margen izquierdo. Todas las páginas serán numeradas, incluidas las de las referencias bibliográficas, cuadros, etc. El autor recibirá una notificación sobre la recepción de su documento.

En el caso de aceptación de un artículo después de su revisión, se solicitará al autor una versión final de su artículo revisado en disquete (formato $3_{1/2}''$) en Word 6.0 x Windows, así como una copia impresa del mismo.

Preparación del manuscrito

En la primera página del manuscrito se indicará el título abreviado del artículo, títulos y nombres de los autores, instituciones, direcciones completas (incluido código postal y número de teléfono); así como otros medios de contacto tales como fax, correo electrónico, etc. del autor principal. El título abreviado no deberá sobrepasar los 45 caracteres más los espacios correspondientes, y aparecerá en la parte superior de la página 1 del manuscrito en mayúsculas. El título entero del manuscrito se escibirá en mayúsculas y minúsculas. Dicho título debe ser lo más breve posible y no sobrepasar los 150 caracteres (incluidos los espacios necesarios), con los nombres de las especies, si necesario. Los nombres de los autores, instituciones y direcciones se escribirán en cursiva y en letras mayúsculas y minúsculas. Se dejará una línea en blanco entre el título y los nombres de los autores. Las direcciones se escribirán como notas de pie de página de cada autor después de dejar una línea en blanco entre los nombres y éstas. Cada nota de pie de página con la dirección será indicada numéricamente. Se dejarán dos líneas en blanco después de las direcciones.

Títulos

Los títulos de cada sección, por ejemplo Resumen, Introducción, etc., serán alineados a la izquierda. Dejar dos líneas en blanco entre las notas de pie de página con las direcciones y el Resumen y entre el título Resumen y el texto que sigue. El resumen no deberá exceder de 200 palabras. Deberá ser un resumen objetivo que describa brevemente los procesos y logros obtenidos, y no una presentación de cómo se ha llevado a cabo el estudio y una descripción genérica de los resultados. Dejar una línea en blanco entre el final del texto del resumen y las palabras clave, que se escribirán en cursiva así como el titulo Palabras clave. No deberán ser más de seis y no deberán contener "y" o "&". Todos los títulos principales de capítulo (14 regular) y subcapítulo (12 regular) serán en negrita e irán precedidos y seguidos de una línea en blanco. El texto correspondiente empezará sin sangrado. Un título dentro de un subcapítulo se escribirá en cursiva e irá seguido de un punto con a continuación el texto correspondiente.

Cuadros y figuras

Los cuadros y las figuras se incluirán al final del texto siguiendo el orden de cita dentro del mismo. Las fotografías no serán devueltas a sus autores.

Cuadros

Los cuadros, incluidas las notas de pie de página, deberán ir precedidos y seguidos por dos líneas en blanco. El número del cuadro y su título se escribirán en la parte superior en cursiva (12) con un punto al final y seguido

de una línea en blanco. En cada columna o título de encabezamiento o subtítulo, sólo la primera letra de la primera palabra irá en mayúscula. Los cuadros irán numerados de forma consecutiva con números árabes. Los cuadros y sus títulos se alinearán a la izquierda, así como el texto. Se utilizarán líneas horizontales o verticales sólo cuando sea necesario. No utilizar tabuladores o la barra espaciadora para crear un cuadro.

Figuras

Las figuras, incluidos los títulos y leyendas, irán precedidas y seguidas de dos líneas en blanco. El número de la figura y el título se escribirán en la parte superior en cursiva (12) con un punto al final. La palabra figura incluye las fotografías, los gráficos, los mapas, los diagramas, etc. En el caso del diagrama se enviará la matriz original con los datos utilizados para crearlo. Se recomienda encarecidamente la utilización de Word 6.0 o Excel 5.0 para la presentación de los diagramas.

Referencias

Toda referencia presente en el texto deberá aparecer en la lista de referencias y, de la misma manera, cada referencia de la lista deberá haber sido citada por lo menos una vez en el texto. Las referencias deben ir en orden alfabético del apellido del autor, seguido por el año.

- Ejemplo en el caso de una referencia de una revista:
Köhler-Rollefson, I. 1992. The camel breeds of India in social and historical perspective. Animal Genetic Resources Information 10, 53-64.
- Cuando se trate de más de un autor:
Matos, C.A.P., D.L. Thomas, D. Gianola, R.J. Tempelman & L.D. Young. 1997. Genetic analysis of discrete reproductive traits in sheep using linear and nonnlinear models: 1. Estimation of genetic parameters 75, 76-87.
- En el caso de un libro o de una publicación ad hoc, por ejemplo informes, tesis, etc.:
Cockrill, W.R. (Ed.). 1994. The Husbandry and Health of the Domestic Buffalo. FAO, Rome, Italy, pp 993.
- Cuando se trate de un artículo dentro de las actas de una reunión:
Hammond, K. 1996. FAO's programme for the management of farm animal genetic resources. In C. Devendra (Ed.), Proceedings of IGA/FAO Round Table on the Global Management of Small Ruminant Genetic Resources, Beijing, May 1996, FAO, Bangkok, Thailand, 4-13.
- Cuando la información contenida en el artículo haya sido obtenida o derive de un sitio World Wide Web, poner el texto entre comillas; por ejemplo "sacado de la FAO. 1996" e indicar en las Referencias la forma estándar URL:
FAO. 1996. Domestic Animal Diversity Information System, *http://www.fao.org/dad-is/*, FAO, Rome, Italy.

Se ruega enviar los manuscritos o la correspondencia relativa a AGRI a la dirección siguiente:

agri-bulletin@fao.org

Gracias por su colaboración