

Characterization of Banni buffalo of Western India

B. P. Mishra¹, K.P. Singh², D.B. Chavan², D.K. Sadana¹, R.S. Kataria¹, P. Kathiravan¹ & S.P.S. Ahlawat^{1,3}

¹National Bureau of Animal Genetic Resources, Karnal -132 001, Haryana, India

²Department of Animal Genetics & Breeding, College of Veterinary & Animal Husbandry, SDAU, Sardarkrushinagar, Gujarat, India

³Present address: Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

Summary

The Banni buffaloes distributed in the Kachchh region of Gujarat state in western India are medium to large in body size with a compact body and typical coiled horns. Mean body length, heart girth and height at withers estimated during the survey were 153.7 ± 0.4 cm, 205.5 ± 0.6 cm and 136.7 ± 0.2 cm, respectively. Data on 397 adult milking buffaloes from Banni area based on interviews with farmers, revealed the mean age at first calving to be 39.7 ± 0.4 months, a mean service period of 66.4 ± 1.3 days, a mean lactation length of 293.3 ± 1.5 days and a mean peak yield of 15.7 ± 0.1 litres. Genetic diversity analysis of Banni buffaloes using a set of 15 heterologous bovine microsatellite markers revealed a high degree of allelic polymorphism with a total of 81 alleles and a mean of 5.4. The observed heterozygosity was found to be moderate with a mean of 0.506 and ranged from 0.125 (ILSTS 045) to 0.795 (ILSTS 008). The mean F_{is} value (0.181) across 15 microsatellite loci was significantly positive indicating heterozygote deficiency in the population. The test for Hardy-Weinberg equilibrium revealed seven of the 15 microsatellite loci analyzed showing significant deviations.

Résumé

Les buffles de Banni ont distribué dans la région de Kachchh d'état de Gujarat dans Inde de l'ouest sont moyen à grand dans la taille de corps avec le corps compact et les cornes embobinées typiques. La longueur de corps, la circonférence de coeur et la hauteur moyens à se rabougrit estimé pendant l'étude étaient $153,7 \pm 0,4$ cm, $205,5 \pm 0,6$ cm et $136,7 \pm 0,2$ cm respectivement. Les données sur

397 buffles de milking adultes du secteur de Banni ont basé l'entretien de fermiers, révélés signifier que l'âge vêlant au début pour être $39,7 \pm 0,4$ mois, signifier la période de service de $66,4 \pm 1,3$ jours, la longueur de lactation moyenne de $293,3 \pm 1,5$ jours et signifie le rendement de sommet de $15,7 \pm 0,1$ litres. L'analyse génétique de diversité de buffles de Banni utilisant une série de 15 heterologues les bornes de microsatellite bovines ont révélé un haut degré de polymorphisme d'allelic avec un total de 81 alleles et un moyens de 5,4. Le heterozygosity observé a été trouvé pour être modéré avec un moyens de 0,506 et étendant de 0,125 (ILSTS 045) à 0,795 (ILSTS 008). La valeur moyenne de F_{is} (0,181) à travers 15 lieux de microsatellite était indiquer le manque de heterozygote significativement positif dans la population. Le test pour l'équilibre de Hardy-Weinberg a révélé sept des 15 lieux de microsatellite ont analysé montrant des déviations significatives.

Resumen

Los búfalos de Banni se distribuyen en la región de Kachchh, en el Estado de Gujarat en el oeste de la India. Son de tamaño medio-grande, cuerpo compacto y cuernos típico enroscados. La largura del cuerpo, la circunferencia del torax y la altura media durante el estudio fueron de $153,7 \pm 0,4$ cm; $205,5 \pm 0,6$ cm y $136,7 \pm 0,2$ cm, respectivamente. Los datos sobre 397 búfalos de leche de la zona de Banni se basan sobre encuestas a los ganaderos y muestran una media de edad al primo parto de $39,7 \pm 0,4$ meses, un periodo medio de monta de $66,4 \pm 1,3$ días, una media de lactación de $293,3 \pm 1,5$ días y una producción media de $15,7 \pm 0,1$ litros. Los análisis sobre diversidad

genética de los búfalos de Banni con la utilización de 15 marcadores microsatelitares heterologos bovinos han mostrado un grado elevado de polimorfismo alelico con un total de 81 alelos y una media de 5,4. La heterocigosis observada ha sido moderada con una media de 0,506 y un rango de 0,125 (ILSTS045) a 0,795 (ILSTS008). La media del valor F_{is} (0,181) entre los 15 loci microsatelitares fue positiva de forma significativa, lo que indica un déficit de heterocigosis en la población. El test Hardy-Weinberg de equilibrio muestra siete de los 15 loci microsatelitares analizados con desviaciones significativas.

Key words: Banni buffaloes, Phenotypic characterization, Production performance, Genetic diversity, Microsatellites markers.

Introduction

Water buffalo (*Bubalus bubalis*) is the mainstay of the Indian dairy industry with a contribution of about 54% of the total milk production in the country. Buffaloes are valuable not only as milk producers, but have multiple roles in rural livelihood system, where it forms a part of the cultural structure of the

society apart from employment generation and nutritional security. In some areas, buffalo keeping is a way of life for certain social groups, particularly amongst tribal people (the Todas of Nilgiris in Tamil Nadu) and pastoralists/semi pastoralists (the Maldharis of Banni area in Gujarat). India possesses a wide variety of buffalo genetic resources comprising 10 well recognized breeds and many lesser known populations which are equally important to buffalo husbandry in India. Characterization and documentation of these lesser known buffalo populations in different parts of the country is of prime significance.

The Banni area of Kachchh district in Gujarat state is one of the finest pasture lands in Asia with about 30 varieties of grasses and is well known for its livestock wealth. The Banni buffalo, which was evolved by the Maldhari community in this region, has good adaptability to harsh climatic conditions, drought resistance and survival on scanty fodder and shrubs. They have good genetic potential for milk production and form a main source of livelihood for Maldharis. Also, Banni buffaloes are gaining popularity among the farmers and private dairy owners in North Gujarat and Mumbai (Maharashtra) due to their high milk production potential, fairly good lactation length, hardy nature and regular breeding. However, information



Figure 1. Breeding tract of Banni buffaloes in Kachchh district of Gujarat state in Western India.

regarding this buffalo population is very scanty in the literature. The present study was undertaken with the following objectives:

1. To evaluate the Banni buffalo for its morphological characteristics and production performance in its natural habitat.
2. To assess the genetic diversity of Banni buffalo using heterologous microsatellite markers.

Material and Methods

Information on Banni buffalo regarding their habitat, distribution and management practices was collected using preset questionnaires. Data regarding various morphometric traits were recorded on 397 adult buffaloes from the Banni area. Data on production and reproduction traits were collected based on interviews with farmers in different parts of the breeding tract. Blood samples were collected from unrelated animals from various villages in the breeding tract (Figure 1). As pedigree records are not available under field conditions, care was taken by way of interviewing the farmers in order to ascertain that the animals tested during sample collection were not related. Genomic DNA was extracted from whole blood following the standard Phenol-Chloroform extraction method (Sambrook and Russell, 2001). A total of 15 heterologous bovine specific microsatellite markers evaluated in buffaloes for genetic diversity studies (Navani *et al.*, 2002) were utilized to generate microsatellite genotypic data on 47 animals. The PCR conditions were standardized for all the 15 primer pairs and PCR was carried out in the PTC-200 Thermal Cycler (MJ Research, Inc, MA, USA) using cycling conditions: 2 min at 94°C, followed by 30 cycles of 1 min at 94°C, 1 min at precise annealing temperature, 1 min at 72°C and final extension at 72°C for 10 min. PCR products were resolved on 6% denaturing PAGE (Sequi GT System, Bio-Rad, USA) and allele size estimated using a 10bp ladder (Invitrogen, Life Technologies, CA, USA) run in parallel to the samples. Gels were stained by the silver staining method of Bassam *et al.* (1991) and genotypes were scored manually for each microsatellite locus.

Different measures of genetic variation such as observed number of alleles (n_a), effective number of alleles (n_e), observed (H_o) and expected heterozygosity (H_e) estimates were computed after Nei (1973) using POPGENE software (Yeh *et al.*, 1999). Polymorphism Information Content was

calculated in accordance to Botstein *et al.* (1980). Tests for departure from Hardy-Weinberg equilibrium and Ewens Watterson's test for neutrality of markers (Manly, 1985) were performed using POPGENE software.

Results and Discussion

Habitat, distribution and population status

Banni buffaloes are distributed throughout the Kachchh district of Gujarat and in some parts of the Banaskantha and Patan districts of North Gujarat. These buffaloes are centered between the Hajipur and Khavada areas of Kachchh district. Typical Banni animals are seen in Bhirandara, Hodka, Luna, Mithadi, Udama, Dhorda, Goravali, Kaduli, Rabvir and Kakar villages of Banni region (Bhuj circle) and in Anjar, Bhachua, Nakhatrana and Lakhpat circles of Kachchh district. The Banni area is about 840 square miles of flat land comprised of about 45 villages, which are bounded by a desert area (Rann of Kachchh) in the North. The Banni region is one of the finest pasture lands supporting a traditional livestock system. The name '*Banni*' buffalo originated from the name of this region and the Maldharis (traditional livestock keepers) evolved this population through conventional breeding.

Rainfall in this area is generally very erratic (250-500 mm) with average maximum and minimum temperatures of 42°C and 12°C respectively. The soil of the Banni area is highly calcareous, saline and loam sandy with poor water holding capacity, low permeability and is prone to erosion. The nature of the soil has limited agricultural farming to a great extent in this area and grasses grow naturally in the rainy season. Moreover, Banni area has been preserved for the grazing of livestock by the Maldharis under the regulations of the district revenue department.

The total cattle and buffalo population in the Kachchh district of Gujarat is 3 190 000 and 1 780 000, respectively (17th Livestock Census, 2003, Government of India). Most of the buffalo population in the district except in eastern Kachchh region is of Banni type, reared especially for milk production. Among the cattle population, only a negligible 0.013% are estimated to be crossbreds with the farmers rearing Zebu cattle, mostly for draught purposes. Thus it is clear that farmers in

this region prefer buffaloes as their main milk animals. However, according to the Maldharis of this region, there has been a decline in Banni buffaloes in the last two decades. This declining trend is mainly because of a significant reduction in pasture land due to drought in consecutive years and extensive vegetation by *Prosopis juliflora* (Israeli Babool), an undesirable weed for livestock grazing. Also, selling of buffaloes by Maldharis to farmers in North Gujarat and in cities like Mumbai, Ahmedabad, Surat and Pune for milk production has substantially affected the population status.

Management practices

Banni buffaloes are mostly maintained by Maldharis whose livelihood is totally dependent on buffalo rearing for the sale of milk, milk products and animals. In each village, herds of buffaloes are maintained by a group of villagers under an exclusive traditional production system. The animals are taken to the forests in the evening, stay for grazing overnight and come back to the owner's door early in the morning. Most of the time, the owners do not accompany the animals, and the buffaloes follow the routine on their own. The animals stay loose in the village near the owner's

house and no special housing and supplementary feeding is provided.

Two types of production systems were found to exist in the Banni area. One is an extensive management system as described above which is prevalent in the Nakhatrana and Hajipir areas (Lower Banni region), where only one time milking is practiced as transport facilities for marketing milk are very limited. The Maldharis produce *khoa*, an indigenous milk product from buffalo milk made by concentration, which is later sold for sweet preparation. However, in areas like Anjar, Mundara, Bhachua, Hodka and Khavada (Greater Banni region), where comparatively better transport and marketing facilities are available, twice daily milking is practiced. Also, animals are relatively better fed with concentrate feeding during the time of milking and a semi-intensive type of production system with some housing is practiced in this region. Banni buffaloes are very docile in nature and are often milked by women villagers.

The Maldharis in Banni area breed their animals through their own buffalo bull adopting natural mating only. Artificial insemination is not practiced in this area. The survey of the Banni tract also revealed that the Maldharis are well aware of the importance of their breeding bull and they are very careful in selecting a bull calf from their high yielding buffaloes with good morphological



Figure 2. The head of a Banni buffalo.



Figure 3. A breeding bull of Banni buffalo.

features. Another important tradition prevalent in the Maldharis of Banni area is that they never allow mating between the bull and his daughters. Also, they use a breeding bull only for three years in a herd after which they exchange it with other villages thus avoiding possible inbreeding within Banni buffalo population. Thus the practice of breeding and replacement of bulls by Maldhari herdsmen, plays a very important role in the genetic improvement of production performance, fertility and maintenance of body conformation and morphological features in Banni buffaloes.

Physical characteristics

The Banni buffalo is medium to large in body size with a compact body and typical coiled horns, often with double coiling. The head of a Banni buffalo (Figure 2) is wide with slight depression in the middle and no slope towards base of the horns. The face is comparatively elongated and straight with wide muzzle. Eyes are prominent, black and bright. The body is generally covered with hair. The neck of Banni buffaloes is medium and thin without skin folds over the region. The dewlap is almost absent in both the sexes. The chest is slightly deep and the barrel is long with well sprung ribs. The hind quarter is wide, heavy and well developed. The

back is wide at the hip joint and overall the body is wedge shaped. The legs are medium in length with broad bones and hooves are black, small in size and firmly attached, which might be the effect of adaptation to grazing under extensive production systems.

The skin is soft, thin and generally black in colour but a few animals are also observed possessing copper colour. In some animals white patches are also observed on forehead, lower legs and tail. The udder of Banni buffaloes is well developed, round in shape and squarely placed. The hind and fore quarters are uniformly well developed. Typically, the whole udder of a Banni buffalo looks like four equal divisions with teats well attached to each quarter. The majority of animals have conical teats with round and pointed tips. The breeding bull, a she-buffalo and a herd of Banni buffalo are presented in figures 3, 4 and 5 respectively.

Morphological traits

The overall least squares means along with their standard error for various morphological traits are presented in table 1. The mean values for most of the morphological traits in Banni buffalo were found to be higher than that of Mehsana buffaloes (Pundir *et*

Table 1. Mean \pm S.E and range of different morphological traits in Banni buffalo.

Trait	Mean \pm S.E (cm)	Range (cm)	
		Min	Max
Body length	153.7 \pm 0.4	147	157
Heart girth	205.5 \pm 0.6	195	211
Height at withers	136.7 \pm 0.2	132	139
Face length	53.7 \pm 0.2	52	54
Ear length	29.3 \pm 0.1	28	30
Height at hip bone	127.8 \pm 0.3	125	129
Height at pin bone	120.3 \pm 0.3	117	121
Height at elbow joint	70.9 \pm 0.2	68	72
Distance between hip bone	55.4 \pm 0.3	53	57
Distance between pin bone	27.9 \pm 0.1	27	28
Tail length	88.4 \pm 0.5	87	91
Tail switch length	64.2 \pm 0.4	62	66
Width of forehead	26.6 \pm 0.1	26	29

Table 2. Mean \pm S.E and range of different performance traits in Banni buffalo.

Trait	No.	Mean \pm S.E	Range	
			Min.	Max.
Age at first calving (months)	337	39.7 \pm 0.4	38.1	41.5
Service Period (days)	350	66.4 \pm 1.3	60.0	71.0
Calving interval (months)	349	12.2 \pm 0.7	11.9	12.4
Services per conception	375	1.0 \pm 0.1		
Lactation length (days)	348	293.3 \pm 1.5	282.0	298.0
Dry period (days)	347	71.8 \pm 1.4	69.0	74.0
Peak milk yield (litres)	397	15.7 \pm 0.1	12.0	17.0



Figure 4. A she-buffalo of Banni.

al., 2000) whereas they are fairly similar to that of reported for Murrah buffaloes (Nivsarkar *et al.*, 2000).

Performance

The overall least squares means \pm S.E for various production and reproduction traits of Banni buffaloes as recorded based on interviews with farmers are presented in table 2. The mean age at first calving observed for Banni buffaloes (39.7 ± 0.4 months) was found to be less than that reported for Murrah [43.9 ± 0.2 months (Dhara, 1994) to 53.9 ± 0.7 months (Kumar, 2000)] and Mehsana buffaloes [42.8 ± 0.4 months (Pundir *et al.*, (2000))]. Similarly reproductive traits like service period and calving interval were found to be less than that of Murrah (Sadana *et al.*, 2006) and Mehsana buffaloes (Pundir *et al.*, 2000). The mean peak milk yield in Banni buffalo was estimated to be 15.7 ± 0.1 litres. However, it should be mentioned that the values obtained in the present study are based on the reports of the farmers gathered through structured questionnaires. Hence data recording needs to be initiated in farmers herds of Banni buffaloes regarding various performance characteristics to delineate the breed descriptor.

Genetic characterization of Banni Buffaloes

Genetic diversity measures

Different measures of genetic variation like observed number of alleles, effective number of alleles, observed and expected heterozygosity and polymorphism information content (PIC) with respect to Banni buffaloes are presented in table 3. A high degree of allelic polymorphism was found to exist in the Banni buffalo population with 12 of the 15 microsatellite loci analyzed exhibiting 4 or more alleles. A total of 81 alleles was observed across 15 microsatellite loci ranging from 2 (ILSTS 045 and ILSTS 073) to 10 (ILSTS 058). The observed heterozygosity was found to be moderate with a mean of 0.506 and a range of 0.125 (ILSTS 045) to 0.795 (ILSTS 008) across different microsatellite loci. The overall mean polymorphism information content was found to be 0.578 with 11 of the 15 microsatellite loci having values of more than 0.5, 3 having values between 0.25 and 0.50 and only one microsatellite locus (ILSTS 019) having a PIC value of less than 0.25. According to Botstein *et al.*, (1980), those polymorphic markers which were classified as highly informative had a PIC value

Table 3. Measures of genetic variation across 15 microsatellite loci in Banni buffalo.

Locus	No.	n _a	n _e	Ho	He	Nei's He	PIC
CSRM 060	40	5	2.42	0.625	0.594	0.587	0.547
ILSTS 026	43	4	2.04	0.488	0.515	0.509	0.463
HEL 013	45	7	4.88	0.644	0.804	0.795	0.765
ILSTS 030	39	5	2.86	0.564	0.659	0.651	0.607
ILSTS 033	43	6	3.18	0.256	0.694	0.686	0.638
ILSTS 017	41	4	3.05	0.610	0.681	0.673	0.618
ILSTS 019	46	3	1.22	0.196	0.183	0.181	0.172
ILSTS 045	32	2	1.93	0.125	0.490	0.482	0.366
ILSTS 058	41	10	5.68	0.610	0.834	0.824	0.803
ILSTS036	46	6	4.11	0.717	0.765	0.757	0.715
ILSTS095	40	8	2.38	0.200	0.587	0.580	0.556
ILSTS052	41	7	4.32	0.634	0.778	0.768	0.737
ILSTS073	44	2	1.88	0.523	0.474	0.469	0.359
ILSTS061	38	7	2.94	0.605	0.669	0.660	0.630
ILSTS008	39	5	3.94	0.795	0.756	0.746	0.700
Mean	41	5.4	3.12	0.506	0.632	0.624	0.578

No.=No. of observations.

n_a=observed no. of alleles.

n_e=effective no. of alleles.

Ho=Observed heterozygosity.

He=Expected heterozygosity.

PIC=Polymorphism Information Content.

Table 4. Locus wise heterozygote deficit (F_{IS}) and Hardy Weinberg equilibrium at 15 different microsatellite loci in Banni buffalo.

Locus	F_{IS}	H-W Equilibrium		
		DF	Chi-Square	P-Value
CSRM 060	-0.065	10	8.72	0.559
ILSTS 026	0.041	6	13.51	0.036
HEL 013	0.189	21	43.14	0.003
ILSTS 030	0.133	10	25.41	0.005
ILSTS 033	0.627	15	82.16	0.000
ILSTS 017	0.093	6	7.58	0.270
ILSTS 019	-0.082	3	0.48	0.924
ILSTS 045	0.741	1	18.37	0.000
ILSTS 058	0.260	45	59.07	0.078
ILSTS 036	0.052	15	52.86	0.000
ILSTS 095	0.655	28	110.21	0.000
ILSTS 052	0.174	21	31.12	0.072
ILSTS 073	-0.115	1	0.47	0.411
ILSTS 061	0.083	21	18.70	0.604
ILSTS 008	-0.066	10	9.76	0.462
Overall	0.181	-	-	-



Figure 5. A herd of Banni buffalo.

greater than 0.5, reasonably informative a PIC value ranging between 0.25 and 0.50 and relatively less informative if the PIC value was below 0.25. The allelic diversity and observed heterozygosity values are comparable to those reported for Bhadawari and Tarai buffaloes (Arora *et al.*, 2004), while they were relatively lower compared to that reported for other buffalo breeds by Kumar *et al.*, (2006) with a different set of microsatellite markers.

Heterozygosity deficit and Hardy-Weinberg equilibrium

The mean F_{IS} (0.181) across 15 microsatellite loci was significantly positive indicating considerable heterozygosity deficit within the population. Seven of the 15 microsatellite loci analyzed showed significant deviations from Hardy-Weinberg equilibrium (Table 4). These results showed the possible existence of subdivisions within the population. Possible reasons could include selective breeding with fewer available bulls and relatedness of a few samples analyzed as proper pedigree records are not available under field conditions. However, the major role of selective breeding in the heterozygosity deficit was not supported by the results of Ewens-Watterson neutrality test as all the microsatellite markers under the present study except ILSTS 008 were found to be neutral. The observed F -value for ILSTS 008 did not fall within the range of 95% confidence interval when the test was performed using 1000 simulated samples. Thus, the genetic analysis showed that Banni buffaloes have a reasonably moderate level of diversity as reflected by average heterozygosity estimates.

Conclusion

Banni buffalo, reared in the Kachchh region of western India by the traditional Maldhari community are found to have a better production potential under an extensive management system. They are found to have moderate genetic variation as revealed by microsatellite markers. Their genetic diversity combined with their superior production potential and demand make a strong case for the necessity of initiating genetic improvement programs. Further studies need to be carried out in

order to establish their genetic superiority by means of performance recording under field conditions. Also, analysis with a greater number of microsatellite markers and comparisons with other buffalo breeds of the region will delineate the genetic structure of this germplasm of western India.

Acknowledgements

We thank the Director, NBAGR, Karnal for providing all necessary facilities to carrying out the present study. Thanks are due to field staff of Department of AH & Vety Services, Govt. of Gujarat for their assistance in field work and blood sample collection.

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Establishing a conservation flock for “Vorwerkhuhn” chicken breed – a case study of *in-situ* conservation of local chicken breeds in Germany

S. Weigend¹, K. Stricker² & F.-G. Röhrßen³

¹Institute for Animal Breeding Mariensee, Federal Agricultural Research Centre, 31535 Neustadt, Germany

²49196 Bad Laer, Germany

³Hof Arche Noah, 27726 Worpswede, Germany

Background

There is an increasing concern about losing genetic diversity in farm animals, and poultry genetic resources are considered to be one of the most endangered (Crawford, 1990). A large number of local dual-purpose breeds used at the beginning of the last century have been replaced with highly specialised lines. Market orientated intensive livestock breeding programs tend to concentrate on just a limited number of breeds, and the proportion of low-input, low-output breeds used in agricultural production in developed countries has been decreased almost to zero. Decreasing numbers of breeds results in reduced genetic variability, and limits the flexibility of future breeding programs. On the other hand, an increase in income in these countries leads to a rise in demands for specialised food, diversification in the product supply, and changes in preferences of production conditions.

In developed countries, a wide spectrum of poultry breeds comprising, to some degree, the genetic diversity of local middle-level food producers no longer used, are nowadays maintained by fancy breeders. Clearly, without their efforts many of these poultry breeds would have disappeared. However, in most cases fanciers aim at achieving a certain phenotype. This may lead to inbreeding, and as a consequence of inbreeding depressions, crossbreeding between populations follows, in most cases unrecorded. Pedigree records and performance information are missing. Consequently, a classification and labeling of individuals given by an investigator might not accurately describe the true genetic structure of the gene pool, and limit the success of conservation and utilisation of genetic resources.

Objective

Success in animal breeding is dependent on the genetic composition of populations. Efficient *in-situ* conservation and utilisation of genetic resources require a population management system that allows the maintenance of genetic variability within a given population. Thus, the goal of the Vorwerkhuhn project is to establish a conservation flock of chickens according to a well defined concept recommended by FAO (FAO, 1998).

Principle

The conservation flock of the Vorwerkhuhn chicken was established in 1999 by collecting individuals from fancy breeders. At that time, the breed was at risk of extinction. The project started with nine breeders, and currently 14 breeders are involved. The genetic management of the population is based on sire rotation, i.e. each sire is replaced by one of his sons in every generation. This principle of rotating sires (via hatching eggs) across families avoids mating of closely related birds, and hence reduces the inbreeding rate. Each breeder keeps one breeding sire which he got from direct neighbour within the breeding chain, and four breeding females. All birds have pedigree information from the father's side. Sire families are usually established in January of each year, and hatching eggs are collected for three hatches. The first hatching eggs rotate, i.e. they are given to the next breeder in the chain. From these, males hatched are the potential sires for the next generation. The second and third hatches within the breeding season are used to obtain the potential breeding hens. The generation interval is one year.

Record keeping

All pedigree information and phenotypic records (including body weight) are recorded electronically. Information is available to the founder population. All potential breeding cocks and dams are phenotypically evaluated (in the fall) according to the breed standard. The weight of hatching eggs (which should be above 54g) is recorded as well as body weight at weeks 2, 8, 16, and 20 weeks of age. A few breeders record laying performance during the whole year – this is optional.

Veterinary control

Blood samples from two males and two females in each flock are taken and checked for *salmonella pullorum* and *mycoplasma gallisepticum* infection. Excrements (one sample per flock collected from four different sites in each chicken house) are analysed for endoparasites, bacteria in general, and salmonella. In some cases (depending on the region) blood samples are tested for H5- and H7-antibodies.

Cross breeding and niche market

Population management and flock book recording require additional effort. Financial support is hardly forthcoming from public sources, and hence breeders need to find other ways. Since the laying performance of the Vorwerkhuhn is rather low (about 180 eggs) and eggs are small (50-55g), it is difficult to place the breed into a niche market. To improve the economic situation for breeders we started a crossing experiment to obtain hybrids for egg (and partly meat) production. Thereby, the conservation flock is being maintained through pure breeding only. We used hens from a commercial line from Lohmann Tierzucht GmbH (Lohmann Tierzucht is supporting the project) to be mated with Vorwerkhuhn cocks. Chicks can be colour sexed. This hybrid is called the 'Kollbecksmoor Huhn'. Our first results show that this hybrid has acceptable laying performance (250 eggs, 60g) and the bird can be sold at a reasonable price at small producers.

Perspectives

Under current conditions, it is difficult to define the genetic features of a given poultry breed and to establish it in niche markets. Overall, the Vorwerkhuhn project has contributed to identifying ways in which to establish conservation flocks in practice, and the difficulties facing breeders. Their continued existence will depend on the motivation of breeders to continue this activity, public acceptance and support, and the success of the crossbred Kollbecksmoor Huhn in niche markets.

Additional information

More information of the Vorwerkhuhn conservation flock can be found at: <http://www.erhaltungszucht-vorwerkhuhn.de/index.html>. To learn more about the "Kollbecksmoor Huhn" look at: <http://www.kollbecksmoorhuhn.de/>.

In chickens, a similar conservation flock as for the Vorwerkhuhn has been established for the breed "Ostfriesische Möwen" (<http://www.ostfriesische-moewen.de>, contact: Michael Ruhнау, E-Mail: M-Ruhnau@t-online.de).

The Society for the Conservation of Old and Endangered Livestock Breeds (GEH) has initiated a wide range of activities to conserve endangered breeds of farm animal genetic resources in Germany (Address: Am Eschenbornrasen 11, D-37213 Witzenhausen, Tel. 05542/1864, Fax: 05542/72560; E-Mail: info@g-e-h.de - Internet: <http://www.g-e-h.de>).

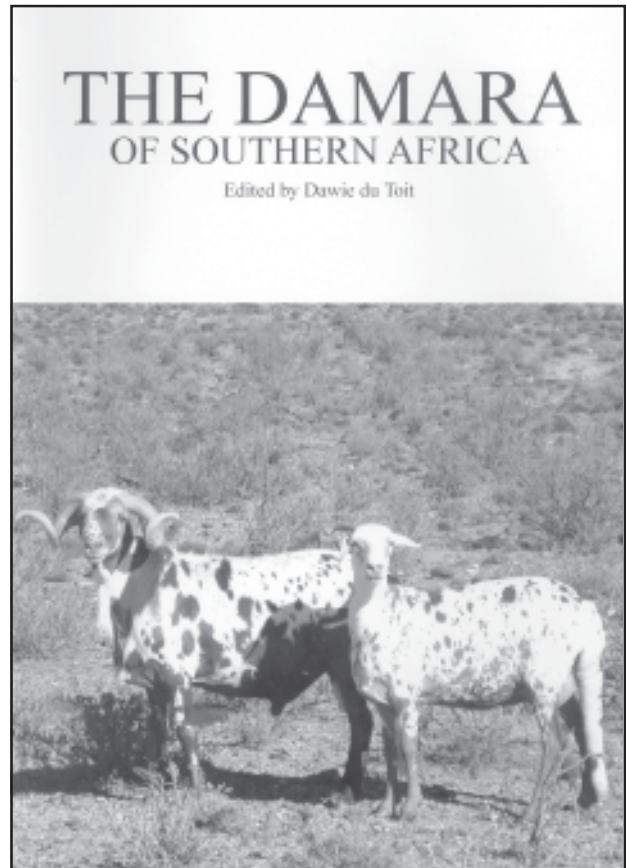
List of References

Crawford, R.D. 1990. Origin and history of poultry species. In: Poultry Breeding and Genetics (Crawford, R.D., Ed.), Elsevier, Amsterdam, The Netherlands, pp. 1-42.

FAO. 1998. Secondary Guidelines: Management of Small Populations at Risk, 1998 <<http://dad.fao.org/en/home.htm>>

The Damara of Southern Africa,
D. du Toit (Ed.)
Published in 2007, pp. 128
ISBN 978-0-620-38877-1

The core of this new book on the Damara sheep breed of Southern Africa consists of two papers on the colour genetics of the Damara, one by Professor Phillip Sponenberg and one by Roger Lundie. The former presents an overview of coat colours and patterns in the Damara. The latter, and longer, paper provides an introduction to sheep coat colour genetics and then seeks to relate the colour patterns of the Damara to what is known in woolled breeds. The discussion of colour genetics is put into context by a number of shorter chapters. The book starts with a brief history of the breed. A chapter on conservation describes some of the management principles that need to be borne in mind to ensure that the status of the Damara as an adapted landrace is maintained for the future. A chapter on commercial farming with the Damara focuses on the value of the fitness traits that make it ideally suited for production under harsh African conditions; a short discussion of carcass and meat quality characteristics is also included. The book is beautifully illustrated with many colour photographs.



Adaption and fitness in animal populations. Evolutionary and breeding perspectives on genetic resources management.

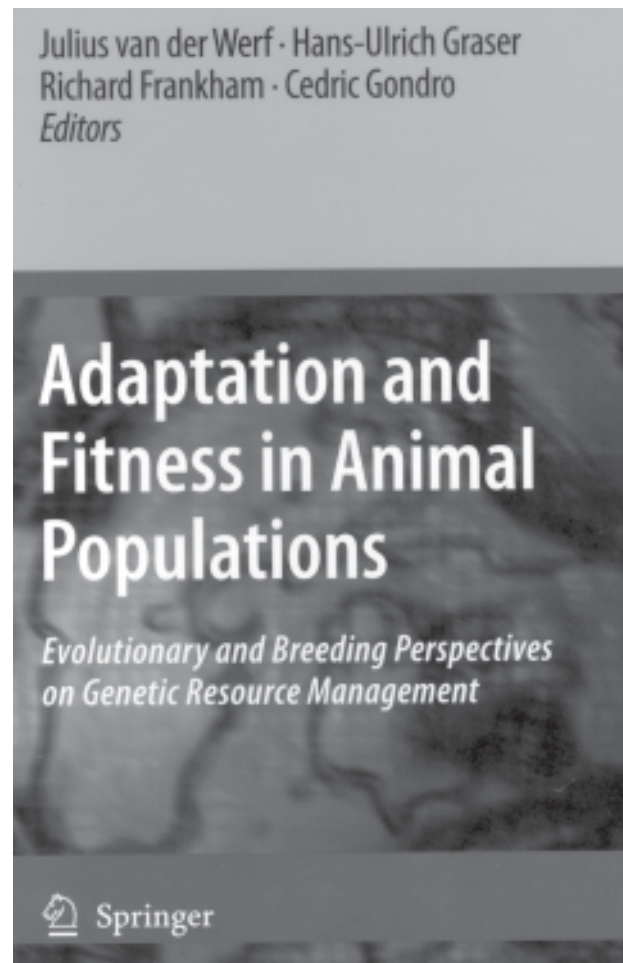
J. van der Werf, H.-U. Graser, R. Frankham & C. Gondro (Eds)

Published by Springer Science

Published in 2009, pp. 258

ISBN: 978-1-4020-9004-2

This book, the outcome of a symposium held in Armidale Australia in 2007, brings together a series of papers by some of the world's leading scientists in animal breeding and evolutionary genetics. As the title indicates, the objective was to explore the concepts of adaptation and fitness and their relevance to the management of (particularly animal) genetic resources for food and agriculture. The book comprises four sections: modelling fitness; maintaining fitness, the genetic basis of adaptation; and strategies for managing diversity – each made up of three papers and a summary of the discussion that followed the respective session of the symposium. The target audience is quantitative geneticists, animal and plant breeders, evolution and population geneticists, ecologists, researchers and graduate students.



Animal diversity and emerging diseases. Prediction and prevention

O.A.E. Sparagano, J-C Maillard and JV. Figueroa (Eds)

Annals of the New York Academy of Sciences, Volume 1149

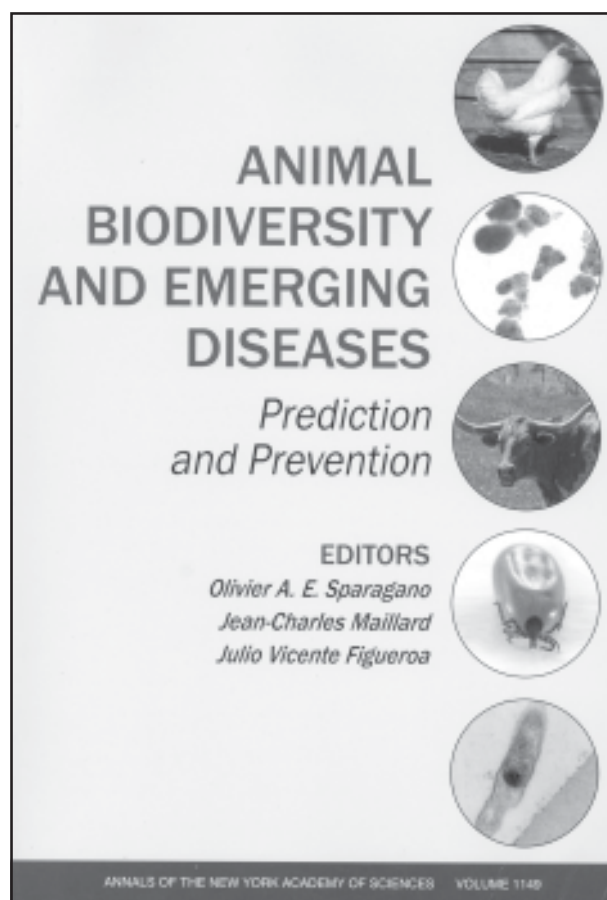
Published by Blackwell Publishing on behalf of the New York Academy of Sciences, Boston Massachusetts, United States of America

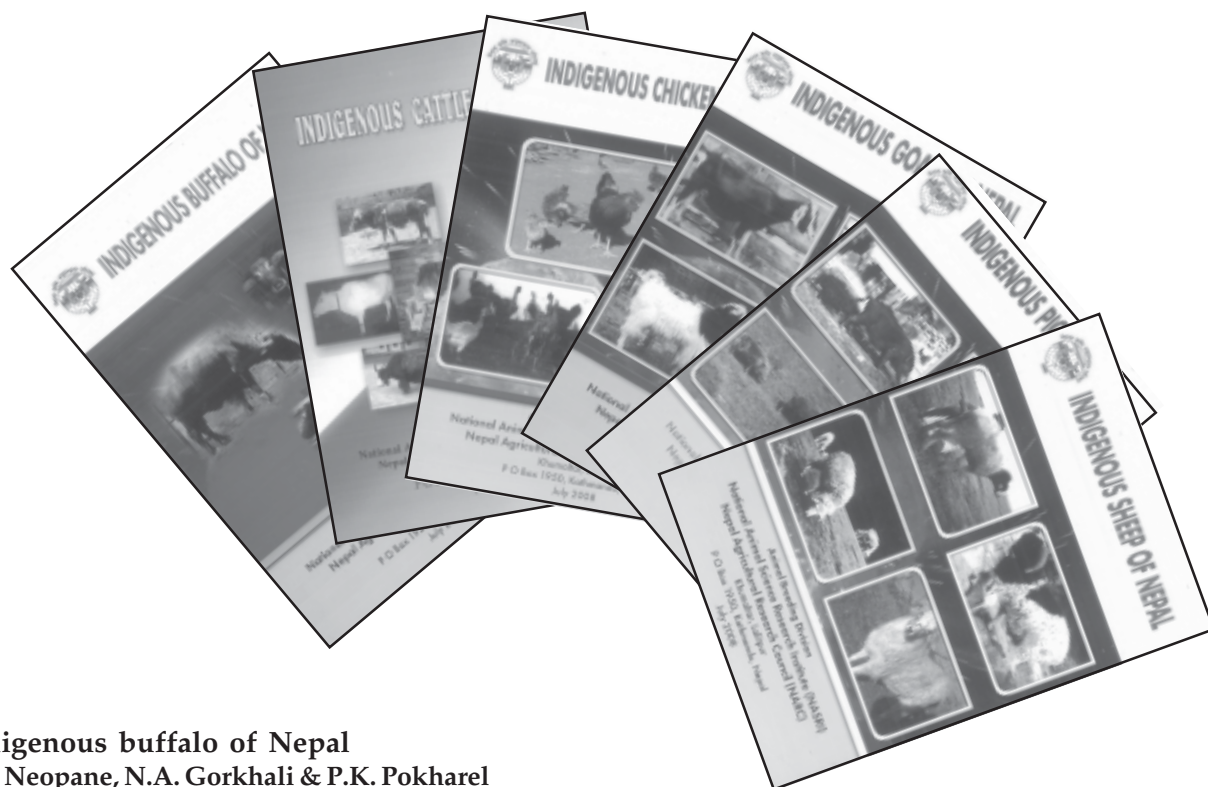
Published in 2008, pp. 404.

ISBN: 978-1-57331-714-6

This publication is a compilation of communications and posters presented during the Ninth Biennial Conference of the International Society for Tropical Veterinary Medicine (STVM), held in Merida, Mexico, in June 2007. The approximately 100 articles are grouped into 13 sections: globalization; anti-arthropod vaccines; genetics; viruses; *Anaplasma*; *Babesia*; helminths; ticks and tick-borne diseases; farm animal diseases; microbiology; wildlife; *Trypanosoma/Leishmania*; and general tropical veterinary medicine. The coverage ranges from cellular pathogenesis to the driving forces of global pandemics. Its target audience includes researchers, academics, governmental and NGOs representatives, technicians, veterinarians and other professionals from the industry sector interested in tropical veterinary medicine.

The introduction, written by Jean-Charles Maillard and Olivier A.E. Sparagano, respectively president and president-elect of the STVM, notes the potential role of genetic diversity in reducing the risk of disastrous economic consequences in the event of epidemics, and concludes that "*All players involved in the farming production pipeline, whether political, economical or professional, should be aware of the importance of valorizing biodiversity through the diversification other animal strains used for breeding. Strains with different potential and qualities would, in turn, diversify economic markets and offer a wider choice of products to the consumer.*"





Indigenous buffalo of Nepal

S.P. Neopane, N.A. Gorkhali & P.K. Pokharel
Nepal Agricultural Research Council, Kathmandu.
Published in 2007, pp. 14.

Indigenous cattle of Nepal

S.P. Neopane & P.K. Pokharel
Nepal Agricultural Research Council, Kathmandu.
Published in 2005, pp. 18.

Indigenous chicken of Nepal

S.P. Neopane & N.A. Gorkhali
Nepal Agricultural Research Council, Kathmandu
Published in 2008, pp. 10.

Indigenous goats of Nepal

S.P. Neopane & P.K. Pokharel
Nepal Agricultural Research Council, Kathmandu
Published in 2008, pp. 14.

Indigenous pigs of Nepal

S.P. Neopane & R. Kadel
Nepal Agricultural Research Council, Kathmandu
Published in 2008, pp. 10.

Indigenous sheep of Nepal

S.P. Neopane, N.A. Gorkhali & P.K. Pokharel
Nepal Agricultural Research Council, Kathmandu
Published in 2008, pp. 14.

Chickens, goats, pigs and sheep are the latest species to be added to the series of pamphlets on indigenous livestock from the Nepal Agricultural Research Council. Pamphlets on cattle and buffalo were published in 2005 and 2007, respectively. Each publication provides information on the distribution of the breeds within the country, their phenotypic and in some cases molecular characteristics, their performance levels and an estimate of their risk status and population trends. A further section is devoted to the specific positive attributes of the indigenous animals - multiple uses, marketable products and adaptation to local topography, feed resources, climate, etc. In several of the pamphlets it is suggested that these positive attributes are not duly recognized. The final section of each pamphlet outlines future prospects for the indigenous breeds and their production systems, including descriptions of initiatives taken or planned in the fields of, characterization, genetic improvement, marketing and conservation. All pamphlets contain a number of photographs (colour in the case of cattle, black and white for the other species).

Editorial policies and procedures

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. 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.

The suitability of manuscripts for publication in AGRI is judged by the Editors and reviewers.

Electronic publication

AGRI is available in full electronically on the Internet, in addition to being published in hard copy, at: www.fao.org/dad-is

Types of articles

The following types of articles are published in AGRI.

Research articles

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.

Review articles

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.

Position papers

Solicited papers on topical issues will also be published as deemed required.

Other published material

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

Manuscript submission

Manuscripts prepared in English, French or Spanish with an English summary and another summary in either French or Spanish, should be submitted to AGRI Editor, AGAP, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy. Additionally the manuscript must be sent as a WinWord Electronic Mail attachment to agri-bulletin@fao.org.

Photographs, coloured or black and white, and figures must be always sent by mail.

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.

Headings

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 indentation. 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 "&".

Tables and figures

Tables and figures must be enclosed with the paper and attached at the end of the text according their citation in the document. Photos will not be returned

Tables

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.

Figures

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, maps, diagrams etc.

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.

References

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.

-
- Example for reference in a periodical is:
Köhler-Rollefson, I. 1992. The camel breeds of India in social and historical perspective. *Animal Genetic Resources Information* 10, 53-64.
 - When there are more than one author:
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.
 - For a book or an ad hoc publication, e.g., reports, theses, etc.:
Cockrill, W.R. (Ed.). 1994. *The Husbandry and Health of the Domestic Buffalo*. FAO, Rome, Italy, pp. 993.
 - For an article in the proceedings of a meeting:
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.
 - Where information included in the article has been obtained or derived from a World Wide Web site, then quote in the text, e.g. "derived from FAO. 1996" and in the References quote the URL standard form:
FAO. 1996. *Domestic Animal Diversity Information System*, <http://www.fao.org/dad-is/>, FAO, Rome, Italy.

For all future manuscript dispatch and correspondence regarding
AGRI, please use the following mailbox:

agri-bulletin@fao.org

Thanks for the collaboration

Normes et règles éditoriales

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. 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 descriptions 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 majeure partie des terres consacrées à l'élevage, à la production totale des aliments et l'agriculture provenant 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.

L'opportunité ou non de publier un article dans AGRI sera jugée par les éditeurs et les réviseurs.

Publication électronique

En plus de sa version imprimée, la version totale de AGRI se trouve disponible sur Internet, sur le site:

<http://www.fao.org/dad-is/>

Types d'articles

Les articles suivants pourront être publiés sur AGRI.

Articles de recherche

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 compris les mises à jour des différentes zones de AnGR, seront pris en considération.

Articles spécifiques

Ponctuellement, des articles sur des thèmes spécifiques pourront être demandés pour la publication d'éditions spéciales.

Autre matériel pour publication

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

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, 00153 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 compris 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 31/2") 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, 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 exemple 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 exemple "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 correspondance au sujet d'AGRI, vous êtes prié d'utiliser l'adresse suivante:

agri-bulletin@fao.org

Merci pour votre collaboration

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. 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, 00153 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 31/2") 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 escribirá 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 título 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 una 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.

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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:
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- Cuando se trate de más de un autor:
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- 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:

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Gracias por su colaboración



ISBN 978-92-5-006269-3 ISSN 1014-2339



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TC/M/0831Tr/1/5.09/2300