



Morphological characterization of the Rembi sheep population in the Tiaret area (West of Algeria)

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ABSTRACT

Morphological characterization of Rembi breed was carried out from the study of 3 representative herds. Ewes (41) and rams (13) with an average age of 4.30 ± 1.48 years were recorded for their live weight and 21 morphological measures with qualitative characters. Differences between sexes were revealed for several measures, whereas no differences were revealed between regions. A factorial analysis of multiple correspondences was performed on the morphological measures and revealed two main principal components accounting for 36.85 and 18.63 % of the inertia, being related to the color of the head (face and neck), neck and legs, the presence and absence of horns and sex. The cluster analysis allowed establishing differences with relevant implications to be taken into account for the breed conservation programme.

Key words: Morphology, Qualitative characters, Quantitative characters, Rembi, Sheep

Morphological characterization of sheep breeds in Algeria still has to be done extensively, hence this work aims to study the Rembi breed of the West of Algeria. The Rembi breed is known with a marked orientation to meat production and occupying mainly the West of Algeria including the province of Tiaret. Sagne (1950) represented Rembi and Ouled Djellal as sub-breeds of Algerian Arab population, with 2 varieties in the Rembi: Arab sheep with tawny head or sub-breed Rembi of Amour, and Arab sheep with black head or sub-breed Rembi of Sidi Aissa. Trouette (1929), Jores D'Arces (1947), Magneville (1959) have given only one variety of the Rembi breed with fawn or yellow head, which occupies the Eastern, Southern Tiaret and Jebel Amour. According to them, Rembi sheep is derived from a cross between sheep of Djebel Amour (also called Laroui) and Ouled Djellal breeds, because it has the shape of the Ouled Djellal and color of the Bighorn which also has huge horns.

More recently, Feliachi *et al.* (2003) identified two types of this breed: Rembi of Djebel Amour (Mountain); and Rembi of Sougueur (Steppe). This breed has the largest body size sheep in Algeria, with signs of adaptation to the l'Ouarsenis and mountains of Tiaret environments. Rembi breed occupies the intermediate zone between the Ouled

Djellal breed in the East and Hamra breed in the West. It is limited to the extension area and it is not found anywhere else (Chellig 1992).

MATERIALS AND METHODS

The study area: The wilaya of Tiaret is located in the west of Algeria. It has physically three distinct areas: North: a mountainous area of the Tellian Atlas; Center: the highlands; South: semi arid areas. The province of Tiaret is characterized by a continental climate with harsh winter, and hot and dry summer, and the rainfall of 300–400 mm per year on average. The three sites of different reliefs were chosen: Ksar Chellala, Mahdia and Medroussa.

Sheep samples: The study was carried out during the spring between April 2013 and June 2013 at the experimental centers for the development of the breed. The number is chosen based on the availability of breeding animals in experimental centers for the development of the breed.

Animals (Figs 2–4) divided by sex and region (54 animals with an average age of 4.30 ± 1.48 years) including 41 females (Ksar Chellala: 14, Mahdia: 10, Medroussa: 17) and 13 males (Ksar Chellala: 7, Mahdia: 3, Medroussa: 3) were used in the study. Linear body measurements were taken on each animal. Animals were housed in traditional pens, reared through the semi-extensive system of management under identical conditions. Animals were allowed to graze the land surrounding their housing.

In cold period, the animals received 2 types of rations: feed concentrate (barley) and wheat straw. However, in hot season, animals were allowed to graze all day on grassland

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(grass in the spring, hay and fallow in summer). Straw is available throughout the year and offered to animals the morning.

Body measurements: Phenotypic characterization was done as per work on the Algerian sheep population (Chellig 1992, Benyoucef 1994, Djaout *et al.* 2012) and other works worldwide (Desta 2009, Esquivelzeta *et al.* 2011, Khaldi *et al.* 2011, Ravimurugan *et al.* 2012, Yakubu 2013). The body measurements were taken and Fig. 1 schematically shows the locations of measuring. The measurements were recorded in animals after shearing period.

Zootechnical indexes: In order to evaluate the morphological characteristics of the Rembi breed, 6

zootechnical indexes were calculated according to Sotillo and Serrano (1985) and Alderson (1999). Cephalic, thoracic, pelvic and corporal indexes are ethnological, which gave us general information about the breed characteristics in terms of describing structure and proportions (i.e. compactness, height, length and weight). The remaining indexes are functional, providing information about the type, aptitude and production performance of the animal (Sotillo and Serrano 1985, Alderson 1999).

Qualitative traits: The qualitative traits studied are: color of head (face and neck), color of legs and the absence or presence of horns in both sexes. The color of fleece was not taken into account, because the entire herd has a white, closed and semi-invasive fleece.

Statistical analysis: The data were processed using descriptive statistics ie frequencies for qualitative variables (batch type) and the values for quantitative variables (continuous type).

The observed differences in quantitative variables were analysed under the following linear model:

$$Y_{ijk} = \mu + R_i + S_j + \text{Sex (region)}_{ij} + \sum ijk$$

where, Y_{ijk} , traits analyzed included weight and body measurements; μ , population mean; R_i , effect of the region (Ksar Chellala, Mahdia or Medroussa); S_j , effect of the sex (male or female); Sex (region) $_{ij}$, effect of the sex (M or F) prioritized in the i th region; and $\sum ijk$, residual error.

Data collected were subjected to various statistical tools in a one-way analysis of variance followed by the Student Newman-Keuls multiple comparison test, implemented in

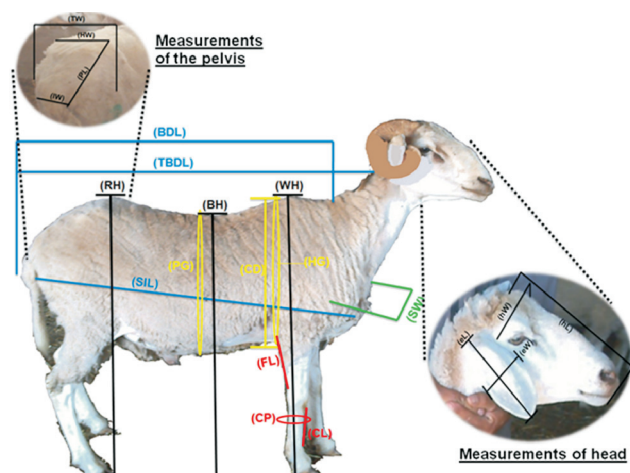


Fig. 1. Body measurements taken

Table 1. Descriptive statistics of the quantitative traits

Measurements	Mean	Min	Max	Variance	SE	CV	Standard error
Body weight (BW), kg	57.94	37	100	255.98	16	27.61	2.18
Total body length (TBDL), cm	100.30	82	117	49.46	7.03	7.01	0.96
Body length (BDL), cm	83.50	70	101	44.44	6.67	7.98	0.91
Scapular-ischial length (SIL), cm	80.57	72	97	28.21	5.31	6.59	0.72
Withers height (WH), cm	78.91	71	92	19.71	4.44	5.63	0.60
Back height (BH), cm	76.40	69	89	14.65	3.83	4.99	0.52
Rump height (RH), cm	77.26	70	89	15.29	3.91	5.06	0.53
Heart girth (HG), cm	95.93	74	112	59.16	7.69	8.02	1.05
Chest depth (CD), cm	35.33	31	41	5.92	2.43	6.89	0.33
Paunch girth (PG), cm	109.04	95	130	54.45	7.38	6.77	1.00
Shoulder width (SW), cm	20.28	17	25	4.17	2.04	10.07	0.28
Hip width (HW), cm	20.65	17	29	5.74	2.40	11.60	0.33
Trochanter width (TW), cm	22.46	20	26	3.08	1.76	7.82	0.24
Ischia width (IW), cm	10.98	9	14	1.72	1.31	11.93	0.18
Pelvis length (PL), cm	27.94	21	37	12.24	3.50	12.52	0.48
Head length (hL), cm	28.07	23	34	5.43	2.33	8.30	0.32
Head width (hW), cm	13.13	10	20	7.93	2.82	21.44	0.38
Ear length (eL), cm	17.27	13	20	3.84	1.96	11.34	0.27
Ear width (eW), cm	8.60	7	10	0.32	0.57	6.62	0.08
Cannon perimeter (CP), cm	8.53	7	11	0.83	0.91	10.71	0.12
Cannon length (CL), cm	12.80	10	19	4.09	2.02	15.80	0.28
Fore leg length (FL), cm	22.31	19	26	2.45	1.56	7.01	0.21

Table 2. Body measurements according to the factors studied

Measurements	According to region			P	According to sex		P
	Ksar Chellala Moy±SD	Mahdia Moy±SD	Medroussa Moy±SD		Males Moy±SD	Females Moy±SD	
BW (kg)	54.86±13.13	57.15±23.59	61.70±12.47	ns	78.69±14.00	51.37±9.80	***
TBDL (cm)	102.52±5.41	98.77±8.47	98.95±7.27	ns	107.31±6.59	98.07±5.61	***
BDL (cm)	84.19±6.81	83.46±8.06	82.80±5.75	ns	90.77±6.25	81.20±4.96	***
SIL (cm)	81.67±6.20	80.23±4.76	79.65±4.65	ns	87.00±4.78	78.54±3.59	***
WH (cm)	77.81±3.92	80.92±5.82	78.75±3.64	ns	84.15±4.51	77.24±2.87	***
BH (cm)	75.76±3.49	78.31±5.19	76.75±2.88	ns	81.46±3.64	75.24±2.43	***
RH (cm)	76.33±3.47	78.62±5.12	77.35±3.34	ns	82.31±3.61	75.66±2.33	***
HG (cm)	98.10±4.86	94.85±8.03	94.35±9.53	ns	103.38±4.70	93.56±6.92	***
CD (cm)	36.05±1.88	34.54±2.73	35.10±2.65	ns	38.15±1.72	34.44±1.88	***
PG (cm)	108.48±5.55	105.92±8.71	111.65±7.58	ns	113.85±7.50	107.51±6.73	**
SW (cm)	20.81±2.23	19.69±2.32	20.10±1.55	ns	22.62±1.45	19.54±1.60	***
HW (cm)	22.29±2.49	19.38 ^b ±1.56	19.75 ^b ±1.74	***	22.23±3.06	20.15±1.93	**
TW (cm)	21.62 ^b ±1.32	22.69 ^{ab} ±2.10	23.20 ^a ±1.61	*	23.54±2.03	22.12±1.54	**
IW (cm)	10.24 ^b ±1.22	11.15 ^a ±1.14	11.65 ^a ±1.14	**	12.08±1.04	10.63±1.20	***
PL (cm)	29.90±2.91	26.77 ^b ±3.68	26.65 ^b ±3.12	**	30.92±4.42	27.00±2.56	***
hL (cm)	26.29 ^b ±1.74	28.85 ^a ±1.91	29.45 ^a ±1.93	***	29.46±2.79	27.63±2.01	*
hW (cm)	16.14 ^a ±1.96	11.38 ^b ±0.87	11.10 ^b ±1.07	***	15.62±3.31	12.34±2.14	***
eL (cm)	15.69 ^b ±1.66	17.92 ^a ±1.44	18.50 ^a ±1.36	***	16.31±2.32	17.57±1.75	*
eW (cm)	8.31 ^b ±0.58	8.69 ^a ±0.48	8.85 ^a ±0.49	**	8.42±0.70	8.66±0.52	ns
CP (cm)	8.55±1.18	8.54±0.88	8.50±0.61	ns	9.85±0.69	8.11±0.47	***
CL (cm)	14.29 ^a ±2.24	12.54 ^b ±0.97	11.40 ^b ±0.99	***	15.08±2.50	12.07±1.15	***
FL (cm)	22.19±1.75	22.46±1.81	22.35±1.23	ns	23.69±1.75	21.88±1.23	***

* Significant at 0.05, ** significant at 0.001; *** significant at 0.001, ns: not significant. Body weight, BW; total body length, TBDL; body length, BDL; scapular-ischial length, SIL; withers height, WH; back height, BH; rump height, RH; heart girth, HG; chest depth, CD; paunch girth, PG; shoulder width SW; hip width, HW; trochanter width, TW; ischia width, IW; pelvis length, PL; head length, hL; head width, hW; ear length, EL; ear width, eW; cannon perimeter, CP; cannon length, CL; fore leg length, FL.

the General Linear Model procedure of SPSS software (Statistical Packages for Social Sciences, Version 19).

Factor analysis of multiple correspondences (MCA) was performed by the SPAD 5.5 (2002) software to group qualitative body traits into clusters and identify similar individuals to present the common characteristics of the color of the face, neck and legs.

RESULTS AND DISCUSSION

Body measurements: The Rembi breed is described generally based on anecdotal evidence. The results of measurements (mean and standard deviations) of animals are presented in Table 1. The values of body measurements by region and sex are summarized in Table 2.

The average live weight of the population studied was 57.94 ± 16 kg with the highest coefficient of variation (27.61), which explains the remarkable diversity of the weight between the animals studied. This difference is significantly related to the sex of animals; males were heavier than the female counterparts. Turries (1976) and Chellig (1992) reported similar weight in males and higher in females, while Feliachi *et al.* (2003) found higher weights in males and lower in females.

The influence of sex is significant ($P < 0.001$); males are longer, higher and wider with a well developed heart girth, a fairly large chest depth, greater paunch girth, a larger cannon perimeter and relatively long legs than females (Table 2).

While ewes have a relatively short head, narrow with long ears similar to the width of rams. In addition, they have a short pelvis, narrow than rams. The corporal length (BDL) and the withers height of males is higher than that presented by Turries (1976) and Chellig (1992). While rams have an almost similar CD to that cited by Chellig (1992) and higher than that reported by Turries (1976). Ewes also exhibited similar CD to that reported by Chellig (1992).

Rembi sheep of Ksar Chellala have a wide lumbar region (HW), a long pastern (CL), short and wide head with short and wide ears ($P < 0.001$). Those of Mahdia and Medroussa areas have a narrow lumbar region, short pastern, and medium head with medium and larger ears ($P < 0.001$).

In addition, the studied breed has the same length (BDL) than Ouled Djellal breed (Chellig, 1992); but more slender and taller (WH) than Ouled Djellal breed (Dekhili and Aggoun 2013) and other breeds, viz. Hamra, Berber, Barbarine (Chellig 1992) and Ripollesa (Esquivelzeta

Table 3. Calculated zootechnical indexes

	Indices %	Mean	Min	Max	SD	CV	SD
Céphalic	hW/hL $\times$ 100	47	33	79	12	26.12	0.02
Thoracic	SW/CD $\times$ 100	57	41	75	5	8.34	0.01
Pelvic	HW/PL $\times$ 100	74	54	95	8	10.71	0.01
Corporal	SIL/HG $\times$ 100	84	74	105	6	6.99	0.01
Relative depth of thorax	CD/WH $\times$ 100	45	38	53	3	5.94	0.00
Length	SIL/WH $\times$ 100	102	91	117	5	5.27	0.01

hW, head width; hL, head length; SW, shoulder width; CD, chest depth; HW, hip width; PL, pelvis length; SIL, scapular-ischial length; HG, heart girth; WH, withers height.

classify the Rembi sheep breed (Table 3). The hW/hL ratio indicated a head of oblong shape with a width equal to half the length. The cephalic index showed that the animal's head is dolichocephalic (Esquivelzeta *et al.* 2011).

Thoracic index (SW/CD) and length index (SIL/HG) indicated that the body shape is almost square, as the ratio between the back height and the scapulo-ischial length is $102 \pm 5\%$.

The cephalic, thoracic, pelvic index and length were lower than those reported by Esquivelzeta *et al.* (2011), in the Ripollesa breed; while corporal index and relative depth of thorax were similar to those of this breed.

According to Esquivelzeta *et al.* (2011), zootechnical indices (ethnological and functional) is sufficient to classify a breed and provided information about aptitude of the animal. These zootechnical indexes are indications that the Rembi breed is a brevilineal breed near to the ground. This proportion is supporting the Rembi as a sheep breed for meat production because of low values of relative depth of thorax (CD/WH) (Aparicio 1944). This is in agreement with the results found by Esquivelzeta *et al.* (2011) in Ripollesa breed, a meat breed having 44.2cm CD/WH, which is similar to reported values. These zootechnical indexes cannot be compared with those of other authors due to the absence of studies on the ethnology of this breed or other Algerian breeds. On these criteria and the absence of local data, the results could not be compared.

Qualitative traits: The factor analysis revealed 36.85 and 18.63 % phenotypic variance (Fig. 5). The F1 axis could be linked to the variables related to color of neck (white and brown), neck (tawny and tawny with white spot), face (tawny), legs (tawny and white) and sex (male and female); whereas the F2 axis gave a major relevance to horns, color of face (tawny and slightly brown) and neck (slightly with white spots and slightly brown). The cluster analysis defined 5 sheep groups (Fig. 6), each represented mainly by the following flocks (percentage of matching): group 1 (9.26% of the sample), 100 % males characterized by a tawny head, neck and legs; group 2 (5.56% of the sample), these males have a white neck and tawny neck; group 3 (5.56% of the sample), these males are characterized by a slightly brown face and neck; group 4 (3.7% of the sample), these males have a tawny face; group 5 (75.93% of the sample), it consists of females that have a tawny neck with white spot, a white face, neck and legs.

Data available or accessible on Rembi breed indicated that the Rembi sheep has a red or brownish head and tawny legs with chamois fleece; it is leggy, with spiral and massive horns, drooping middle ears, aquiline profile and thin and medium tail (Chellig 1992, Feliachi *et al.* 2003).

The studied animals have white semi-invasive wool and head, neck and legs free of wool; 28% horned animals (including 77% males have long, spiral and massive horns of 53.6 cm in length, while only 12% of females have short horns 16.25 cm inclined towards rear). Rembi ewes have a wide neck with white spot and white face and legs; while rams are classified into 4 groups: male with tawny head, neck and legs; male with white nape and tawny neck; male with brown face and neck and male with tawny face.

Though there is lack of data on the morphological characterization of this breed, data are available only from Chellig (1992) and previous work (Trouette 1929, Jores D'Arces 1947, Magneville 1959), yet it should be noted that the herds in the country has greatly evolved. In fact, sheep earlier having fixed racial characteristics due to inbreeding have probably been altered due to the changes in farming methods (mainly extensive), the free movement of animals across the country and uncontrolled reproduction. If conclusions could be drawn from this study, it is due to the fact that animals used are from well structured environment (Experimental Farm for the preservation of the pure breed). However, the sheep number remains statistically still insufficient; it has to be multiplied to ensure the sustainability of the Rembi breed.

It may be concluded that the study of quantitative and qualitative traits allowed defining Rembi breed in the region of Tiaret as a semi invasive and white fleece breed characterized by a medium-sized body and slightly brevilineal near earth. It is known with a marked orientation to meat production and with signs of adaptation to the environment. These animals have a short head with medium and wide ears varying according to the study areas. Males have tawny head and legs, and massive and spiral corms, while females are white with a tawny neck with white spot. In addition, males are more developed than females with significant variations in all parameters studied.

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