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Original Research Paper

Phenotypic and morphometric diversity of Indigenous Turkey (Meleagris Gallopavo) from Wilaya of Tlemcen, Northwest of Algeria

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Abstract

In order to investigate the genetic and phenotypic variability of indigenous turkey in the North West of Algeria, a study was conducted around local poultry farms in the region of Tlemcen and performed on 78 Turkeys (27 males and 51 females) of adult age. Seventeen parameters were measured including 11 quantitative and 6 qualitative which are :body length (BL), wingspan (W), chest width (CW), chest size (CS), tarsal length (TL), thigh length (ThL), neck length (NL), spout length (SL), wing length (WL), width of the dewlap (WD), head length (HL). Taking in consideration plumage coloration, the following phenotypes were observed: Black (17%), White (65%), Red (18%). This work is considered as the first report about the phenotypic differentiation on indigenous turkey in Tlemcen. The measurements performed on these animals showed an important significant difference and a positive correlation between all the mentioned parameters thus the results of the hierarchical classification based on PCA shows three classes, where class 2 and class 3 were balanced with slight differences in (SL), (TL), (ThL), (CS), while class 1 showed remarkable differences which could be under implications of random selection and breeding programs

Keywords: Indigenous Turkey, Characterization, Phenotype , Body measurement, Tlemcen (Algeria).

Introduction

Modern poultry farming is the result of a remarkable progress in feeding, breeding systems and protection against diseases. Genetics plays also an important role in the amelioration of livestock performances which continues to evolve, particularly under aimed selection protocols, as a result, the products are highly varied and diversified. The selection of turkey nowadays is conducted by a few worldwide private firms who organize their schemes from its grandparent's lines to produce by successive crosses the animals of different production stages (Mahammi 2015).

World poultry production has been growing in recent years. It is in second position in the world meat production, accounting for 74 million tons. The United States, China and Brazil occupy the top positions in the most poultry meat producing countries. (FAO, 2007).

Poultry farming in Africa is a complex activity whose importance varies from one country to another, there are two main types of poultry farming: village poultry, based on the breeding of local breeds following an extensive system, and "modern" poultry farming, based on the breeding of imported breeds. (Halbouche, 2009; Mahammi 2015)

In Algeria, the poultry sector is among the successful animal production fields that has experienced the most spectacular growth since the 1980s, thanks to the intervention of the State. This has made it possible to improve the protein intake from a nutritional point of view and currently support the living

of more than two million people (ALLOUI, 2002), however, the Algerian poultry industry still faces a multitude of limiting factors, like the dilapidated buildings, poor control of the production atmosphere as well as poor feeding quality. The latter have a strong impact on growth performance and therefore on Algerian livestock production. (BOUAMRANI , 2017).

Turkey is traditionally present in Algerian family farms under its four phenotypes: Bronzed, Black, Spotted White and Red . The number of local turkeys is estimated by (FAO 2008) at 70,000 head, while the number of imported turkeys carried out in industrial farms is approaching 900,000 head (DSASI 2003). These family farms of local turkeys are conducted in extensive systems, and their reproduction and growth performances are not known (FERRAH et al., 2003), for this reason ;

the main aim of this study consists of two important parts , the first one is the implication of a field survey around local poultry farms in order to investigate the situation of indigenous turkey strains in the region of Tlemcen, Northwestern of Algeria, While the second part depends on studying the genetic diversity of indigenous Turkey and its phenotypic and morphological characteristics by applying a variety of body measurements allowing us to identify the least of genetic funds available in this region.

Materials and methods

Study zone

The study is done in the wilaya of Tlemcen in Four different zones, the first one called Remchi, an old colonial village that was producing fruits and poultry meat in the last decads, the second one called Maghnia, located between the Algerian-Moroccan borders, a pure agricultural town with many farms and flat ground for wheat production, the third one is Ghazaouet, a coastal town over the mediterraneen sea producing fish and seafood in addition to some old isolated agricultural farms, finally the fourth one is Nedroma, a mountainous village very known with its dry fruits such as walnuts and almonds and local poultry farms (Figure 1). Generally, during spring season, the climate is warm and temperate in Tlemcen. In winter, there is much more rainfall than in summer. The average temperature is 16.0 C°.

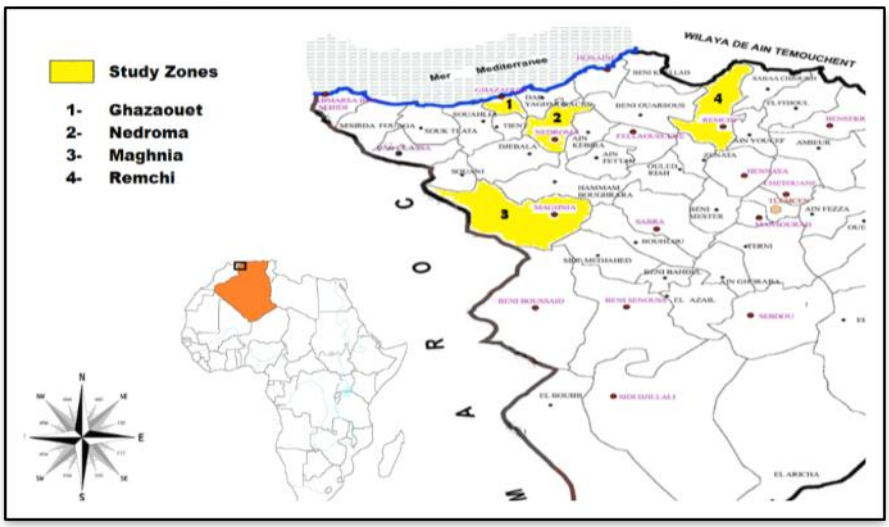


Figure 1: Representation of the study zones in the wilaya of Tlemcen

Choice of animals

Our work was based on the study of the morphological characters of 78 individual distributed in the Wilaya of Tlemcen. The numbers grouped by sex and region are shown in (Table 1).

Table 1. Distribution of the study population by region and sex

Studied Region	Males	Females	Total
Ghazaouet	10	15	25
Nedroma	6	12	18
Maghnia	10	10	20
Remchi	1	14	15

Morphological traits

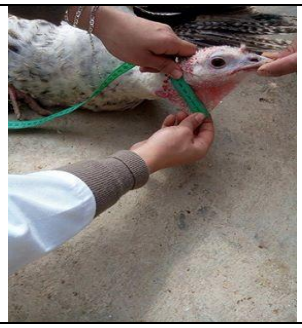
Seventeen measurements including 11 quantitative and 6 qualitative characters have been investigated in our work (Table 2).

Table 2: The different qualitative and quantitative characters of Indigenous Turkey studied

Abbreviation	Quantitative measurement	Abbreviation	Qualitative measurement
BL	Body Length	Sex	Male or Female
W	Wingspan	CPL	Color of Plumage (Black , Red , White)
CW	Chest Width	HC	Head Color (Black , Red , White)
CS	Chest Size	CPA	Color Pattern (Mixed , Unified)
TL	Tarsal Length	S	Snood (Developed , Non Developed)
ThL	Thigh Length	W	Wattle (Developed , Non Developed)
NL	Neck Length		
SL	Spout Length		
WL	Wing Length		
WD	Width of the Dewlap		
HL	Head Length		

Head Length

Wing Length



Width of the Dewlap

Chest Width

Spout Length

Figure 2: Taking some measurements during this work

Statistical analysis:

In this study, the statistical analysis was done Via R software version ‘‘feather spray’’ 3.5.1 using a wide variety of packages and scripts these packages were downloaded from the official R-CRAN data base , the descriptive analysis of body measurements and the one-way analysis of variance (ANOVA) were calculated using PrettyR package, in order to highlight the difference between regions, the application of a Principal Components Analysis (PCA) as a Multivariate analysis model was done using the FactoMineR package in order to groupe the homogeneous individuals with the selected body measurements. finally, an hierarchical analysis (HAC) based on Eucledean distances and centroids method was applied by Factoextra package for classifying the animals and build a correct typology consisting of identifying individuals that are quite similar to each other.

Results and discussion

The field prospection in Tlemcen provinces showed three common types of local Turkey, Black, White and Red (Figure3), depending mostly on its color of plumage and head color, there is a significant variation detected between body measurements of these phenotypes and each province .

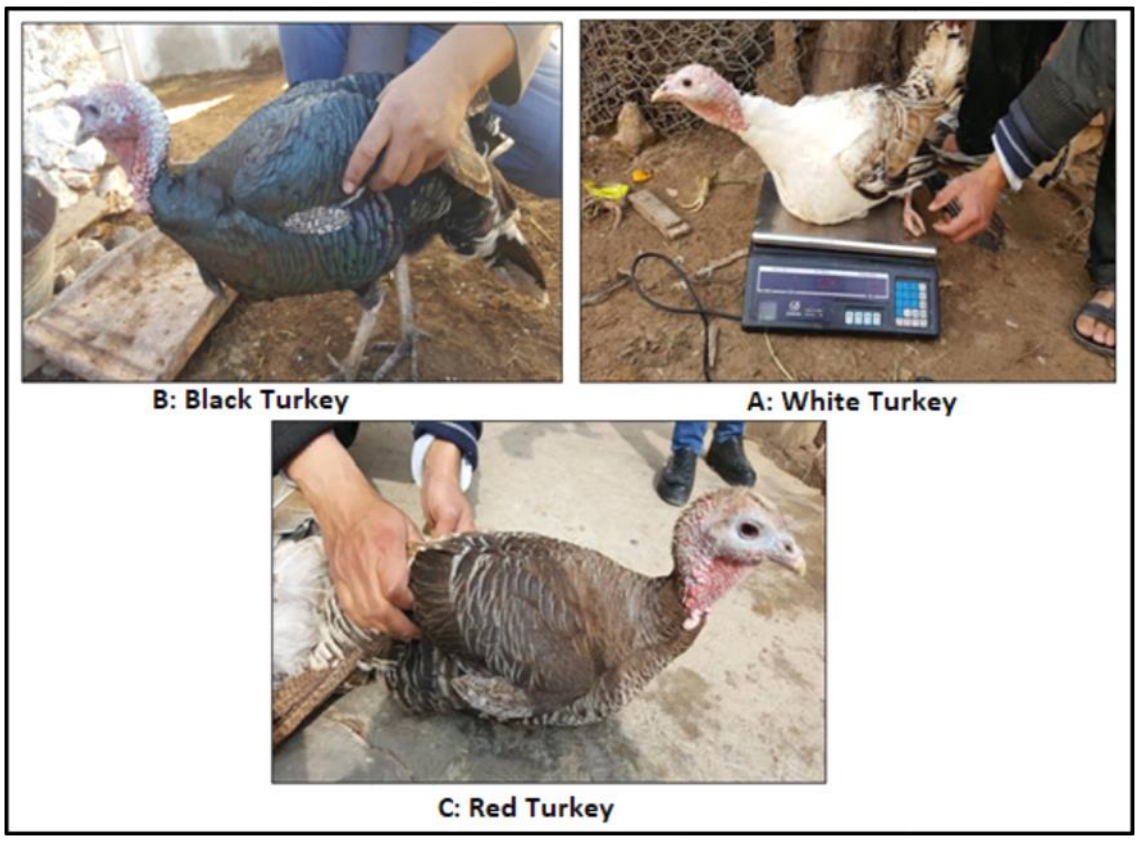


Figure 3: Variationsin Color of Indigenous Turkey in Tlemcen province

It should be mentioned that the farms were in semi-freedom, sheltered only at nights, the provided Shelters are made of local materials: stone, wood, plastic, iron sheet and wire mesh (figure 4).

Figure 4: Examples of shelters provided for local turkey (Original photo)

Body measurements Descriptive analysis, the averages, standard deviations, standard errors, variances minima and maxima of body measurements with ANOVA Fvalue and Pvalue are summarized in (Table 3).

Table 3: Descriptive analysis of body measurements of Indigenous Turkey in each studied region

Quantitative traits (cm)	Minimum	Maximum	Mean	Std deviation	Std error	Variance	F value	P value	Signification
BL	43	69	55.36	5.64	0.64	31.77	15.346	0.000	***
W	40	73	55.60	6.98	0.79	48.71	8.7511	0.000	***
CW	13	32	21.06	4.44	0.50	19.67	13.188	0.000	***
CS	38	66	50.95	6.69	0.76	44.72	9.7147	0.000	***
TL	8	17	12.27	1.80	0.20	3.24	8.7352	0.000	***
ThL	13	25	18.85	2.72	0.31	7.38	29.952	0.000	***
NL	10	23	15.83	2.68	0.30	7.21	18.959	0.000	***
SL	3	7	5.10	0.82	0.09	0.66	9.9826	0.000	***
WL	25	41	33.54	3.24	0.37	10.51	3.3057	0.030	*
WD	1	13	4.33	2.21	0.25	4.89	13.149	0.000	***
HL	8	18	12.59	2.16	0.25	4.69	17.359	0.000	***

* Significant (< 0.05), ** very significant (< 0.01), ***highly significant (< 0.001)

Turkey body measurements studied in Tlemcen are shown in (Table3) . The results obtained show that there is a significant difference between the regions in all morphological characters.

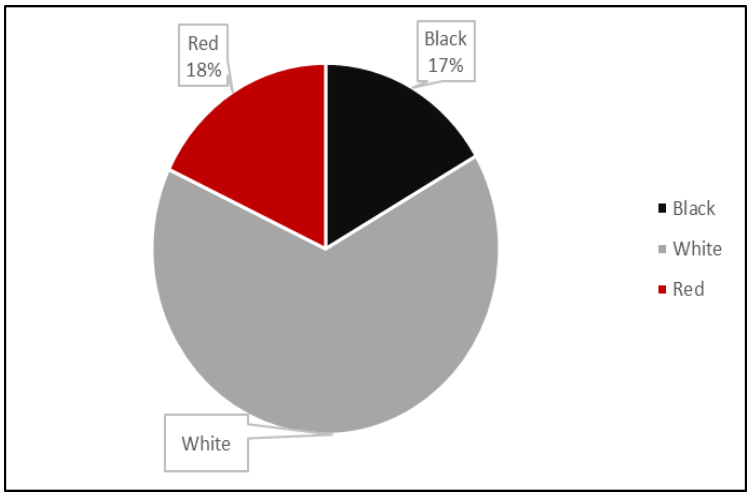


Figure 5: Plumage color of the individuals

The plumage color of the studied local Turkey strains differs between , White , Black , Red (Figure 9), the most dominant is the White with 65%, according to the breeders the size of the individuals is not affected by the coloration , which drive us to believe strongly that the mentioned variations are from the different environmental conditions which change from a farm to another, same results are founded by (M'HAMDI et al., 2014). Therefore, we can say that the differentiation in the plumage is due to the random reproduction systems in local farms and it has no effects on other characters (AMEUR A et al., 2019).

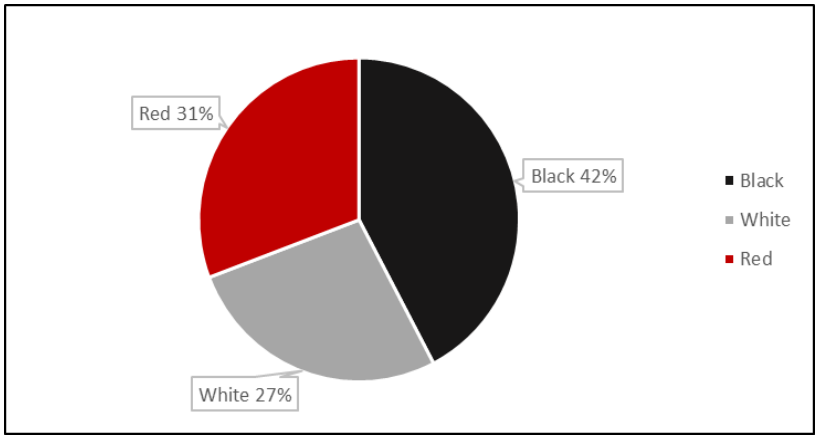


Figure 6: Head color of the individuals

In our study the major Turkey head color is the Black with a percentage of 42% (Figure 10) , this frequency is in disagreement to that of the study of (Savage, 2006) who mentioned that the Black is generally the second most dominating color followed by Red .

Variation of individuals according to body measurements:

Principal component analysis (PCA) was performed on body measurements. The result of this analysis showed that these variables presented 66.52 % of the total inertia on both axes (Dim1 and Dim2), which is relatively average, in addition , the graph shows the formation of two groups of variables correlated positively, the first group contain mostly head characters including (Neck length , Head length , Spout length) meanwhile the second group contain at its majority body characters including (Chest Width , Chest Size , Body length , Wing length , Wingspan) . According to (Figure 5),we can say that some characters of

the first PCA group as (Neck length , Head length) are not very influenced by other characters of the second PCA group as Chest Width.

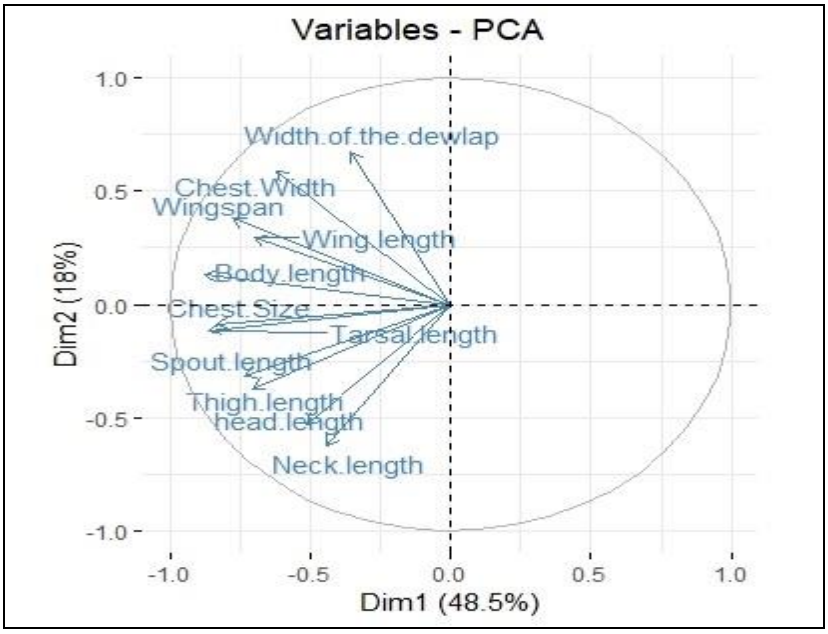


Figure 7: Presentation of IndigenousTurkey's Body measurements using PCA

In this regard, some close results are found in other studies about Indigenous Turkey for example, M'HAMDI et al. (2014) mentioned that the Spout length varies from 2.14 to 2.94 cm and the Body length varies from 28.20 cm to 35 cm which is a little close to our study, (OGAH, 2011) reported that Indigenous Turkey's Wing length varies from 24.57 to 26.85 cm while Head length varies from 6.71 to 9.39 cm and this is confirmed by our results, another study on Mexican backyard Turkeys by VEGA et al (2015) shows that the Body length varies from 36 to 94 cm while the Tarsal length varies from 9 to 17 cm which is considerably superior than our results.

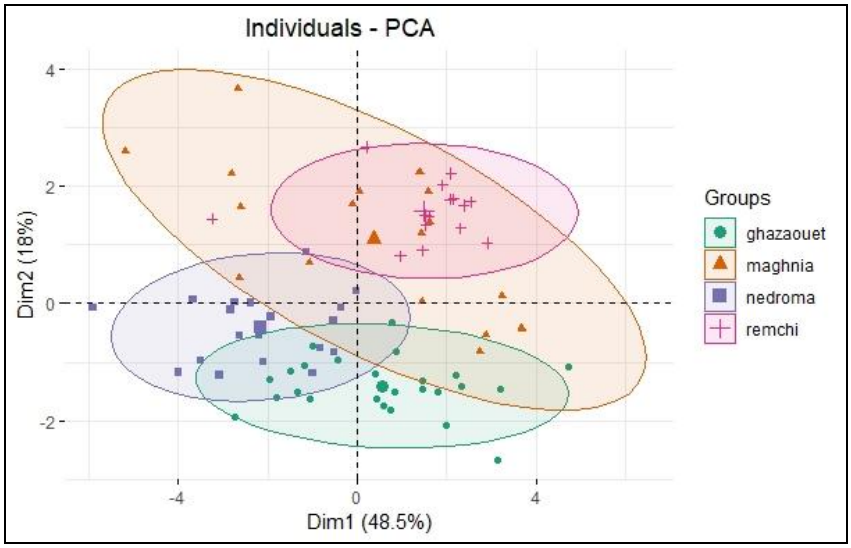


Figure 8: Presentation of Indigenous Turkey's individuals using PCA

The graphical representation of individuals using the PCA (Figure 6), shows 3 strains of Indigenous Turkey across 4 regions that are relatively from a different geography, the first strain represents the regions of Nedroma and Ghazaouet marked in purple and green respectively, this strain is characterized by a fairly large chest and tarsus, a well-developed neck and thigh and a long beak, The second strain is quite independent of the other 2 strains marked in pink and represent the region of Remchi, its less morphometrically developed and positioned near the region of Maghnia which is the third strain, marked in orange and characterized by heterogeneous individuals despite that they are of the same environment and almost the same conditions of breeding this strain is considered as the most diversified on the genetic level.

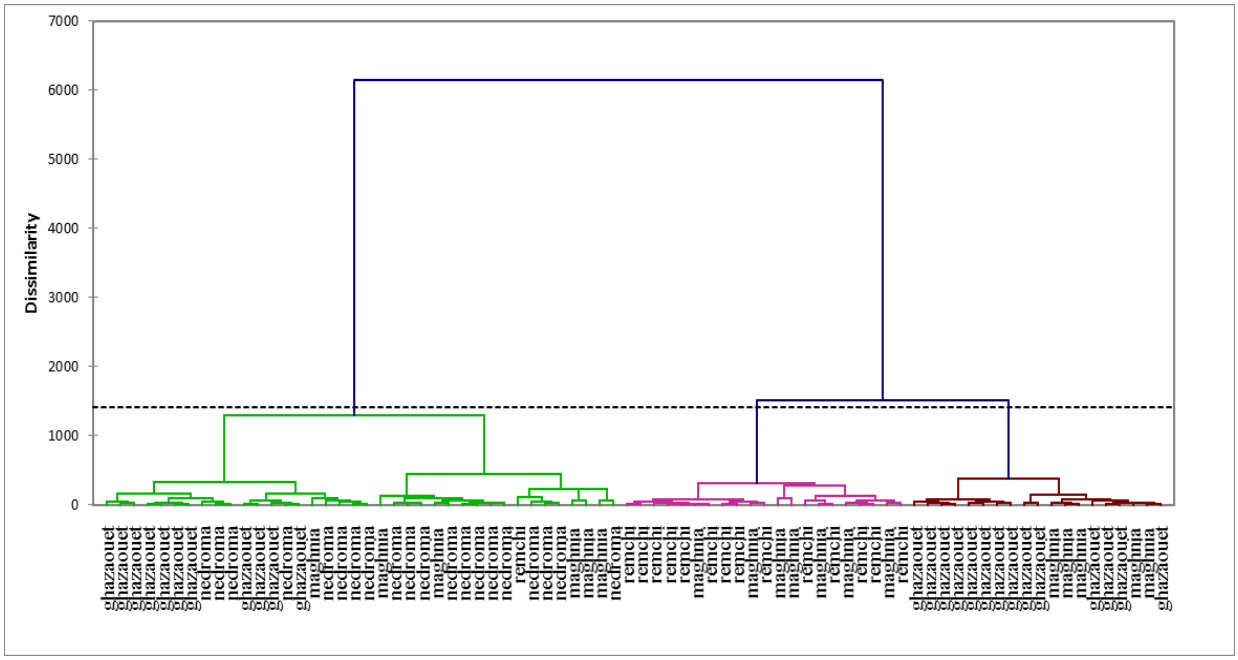


Figure 9: Hierarchical tree using average distance (between classes) among the population

Table 4: Important variations between clusters of the Hierarchical classification

				Class centroids									
	Number of Sample	**Within-class variance**	**Average distance class**	**BL**	**W**	**CW**	**CS**	**TL**	**ThL**	**NL**	**SL**	**WL**	**WD**
Class 1	38	112,62	9,9	59,50	59,71	23,08	56,71	13,61	20,87	16,79	5,61	35,37	4,50
Class 2	21	64,25	7,26	52,38	55,67	22,38	45,14	11,10	16,29	13,33	4,52	33,00	5,26
Class 3	19	56,84	6,92	50,37	47,32	15,58	45,84	10,89	17,63	16,68	4,74	30,47	2,95

The hierarchical classification according to the 11 morphological parameters of Turkey populations in the wilaya of Tlemcen shows three groups (figure 9) in a total of 78 individuals studied in four visited regions, the three classes are divided according to the number of individuals and regions. The affiliation of the individuals shows that class 1 holds the majority of individuals with 6 individuals from the Maghnia region, 1 from Remchi, 20 from Nedroma and 11 from Ghazaouet. According to the morphological characteristics, the centriod data of the classes shows that the class 1 is more developed than the other classes, on the other hand, it shows a very strong morphological characteristics, the exception was only in the parameter Width of

the Dewlap value (WD = 4.50) which is considerably inferior. In the other part, class 2 represents 21 Turkey, it is mainly dominated by 14 individuals from Remchi and 7 from Maghnia, this class had some of the lowest values in this study in terms of Chest Size (CS = 45.14), Thigh Length (Thl = 16.29), Neck length (NL = 13.33), Spout Length (SL= 4.52). Finally, class 3 which represents 19 individuals most of them from ghazaouet and only 4 from maghnia, carried the lowest values in terms of Width of the Dewlap (WD = 2.95), Wing Length (WL = 30.47), Tarsal Length (TL = 10.89), Chest Width (CW = 15.58). It is remarkable indeed that this classification of Turkey population in Tlemcen shows a very varied genetic diversity according to the study regions, this classification deserves to be confirmed by molecular markers.

Conclusion:

This study was conducted in the fields of several provinces (Maghnia , Nedroma , Remchi and Ghazaouet), which are different from each other in terms of environmental and breeding conditions. we have investigated Seventeen Morphological characters and many of these proves conformational discrimination, this drive us to believe that further analyses are required to improve the situation of Indigenous Turkey and developing more efficient selection strategies in poultry farming , this study is a first step for identifying local Turkey in the West of Algeria, regarding this, molecular analysis using genetic markers like simple sequence repeats (SSR's) or single nucleotide polymorphisms (SNP) are highly recommended for obtaining better results and understanding the genetic diversity of Indigenous Turkey in Algeria. Finally, we can say that the traditional poultry farming in Algeria is in prosperity and more progress is expected in this important socio-economic domain, unless the Algerian Government and the scientific community does not remove its support to breeders.

References:

Alloui N 2002 Effets de la ventilation sur les paramètres de l'ambiance des poulaillers et les résultats zootechniques en été. Magvet nº42 – mars 2002 p 27.

Benabdeljelil k. Arfaoui T 2001. Characterization of Beldi chicken and turkeys in rural poultry flocks of Morocco. Current state and future outlook. Anim. *Genet. Resour. Inform*., 31: 87–95

Berrezoug L. Bouchiba I. Hedeili N. Ameur Ameur A. Gaouar SBS 2019. Phenotypic and morphometric diversity of local chickens (BRAHMA) from wilaya of Tlemcen, Northwestern of Algeria, Gen. Biodiv. J: 3(2), 70-79

Bouamrani A. Hadj Moussa I 2017. Situation de l'aviculture type chair. Dans la zone nord et dans la wilaya de Ain défla ,. Master Sciences et Techniques de Production Animale Université Khemis Miliana http://www.secheresse.info/spip.php?Article79784

DSASI, 2003. Ministère de l'Agriculture et du Développement Rural (2003). Recensement général de l'agriculture 2001 : rapport général des résultats définitifs. Alger (Algérie) : Ministère de l'Agriculture et du Développement Rural. 125 p.

Eliezer VV. Utrera AR. Roman SI 2016. Analysis of morphological variables in Mexican backyard turkeys (*Meleagris gallopavo gallopavo*) Rev Mex Cienc Pecu 2016;7(3):377-389

FAO 2007. Global plan of action for animal genetic resources and the Interlaken Declaration. Plan d'action mondial pour les ressources zoogénétiques et la Déclaration D'Interlaken. International Technical Conference on Animal Genetic Resources for Food and Agriculture. Interlaken (Suiza). 3-7 Set 2007.

FAO 2008. Organisation des Nations unies pour l'alimentation et l'agriculture, L'ÉTAT DES ressources zoogénétiques pour l'alimentation et l'agriculturedans le monde, 66p

Ferrah A 2003. Aides publiques et développement de l'élevage en Algérie. Contribution à une analyse d'impact (2000- 2005). 10p. Www.Greddal.com.

Halbouche M. Dahloum L. Mouats A. Didi M. Ghali S. Boudjenah W. Fellahi A 2009. Inventaire phénotypique des populations avicoles locales dans le Nord-Ouest algérien, caractérisation morphologique des animaux et des œufs. Actes des 1ères JE-RG. 7-12

M'hamdi. N. Haddad I. Chriki A. Djebbi A 2014. Phenotypic characterization of the indigenous turkey (Meleagris Gallopavo) In The North West Regions Of Tunisia, Sci. Agri. 2 (1), 2014: 51-56

Mahammif Z 2015. Caractérisation phénotypique et moléculaire des populations de poules locales (Gallus gallusdomesticus) de l'Ouest Algérien. Thèse Doctorat en Génétique moléculaire et cellulaire. pp120

OGAH, 2011 : assessing size and conformation of the body of nigerian indigenous turkey , Department of Animal Science, College of Agriculture pmb 33, Lafia, Nasarawa State, Nigeria , Slovak J. Anim. Sci., 44, 2011 (1):21-27

Savage T. EI Zakrzewszka F 2006. Single Gene Traits of the Turkey. Http://oregonstate.edu/ dept/animal-sciences/poultry/tc.html>. Oregon stateuniversity. Corvallis, Oregon, 2006