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First Study of the Turkey (*Meleagris Gallopavo*) in Cameroon: Assessing Turkey Biodiversity in the Highlands of West-Cameroon

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Abstract: The study was undertaken from November 2015 to January 2016. It had as a general objective to contribute to the knowledge of turkey's biodiversity of the Highlands of West-Cameroon for their safeguard and for their genetic improvement. More specifically, it was aimed at evaluating turkeys' morphobiometric diversity and estimating correlation coefficients between measurements and Live Weight. To achieve these goals, a sample of 236 adult turkeys whose 141 females and 95 males was randomly selected in four Divisions in the zone of study. The principal results show that the turkey's plumage colouring in the Highlands of West-Cameroon is very varied, with a prevalence of bronzed (54.50%). Head colouring is also very variable, but the blue-red (28.94%) and pink (23.86%) are more frequent. Shanks are most often pink (36.85%), but can also be black-red (21.30%) or clear-pink (20.30%). Eyes are black-chestnut (63.13%), chestnut (16.95%) and grey-black (12.18%). In the same way, studied quantitative characters are very variable, with a sexual dimorphism in favour of the males. Thus, the average weight of the studied animals is of 6.11 ± 0.19 Kg with a variation coefficient of 49%. However, males are approximately 23% heavier (7.93 ± 0.19 Kg) than females (4.89 ± 0.25 Kg). In addition, studied body measurements are significantly ($P < 0.05$) higher in tom turkeys, although variable with the considered Divisions. All the correlations are positive, but correlations between Live Weight and the length of the snood ($r = 0.55$) and the thoracic circumference ($r = 0.53$) are the highest ones.

Keywords: Turkey, Biodiversity, Morphobiometry, Correlations, West-Cameroon

1. Introduction

In consequence of the fast and constant growth of the population of many parts of the world under development and particularly in Africa, associated to a fall of the agricultural productivity per capita, it becomes imperative to promote durable agriculture by strengthening capacities [1]. In Livestock Productions, it is especially a question of an intensive production of proteins of animal origin.

The breeding of turkey could contribute effectively to this production, because it is the second greater breeding world, after that of hens [2] [3]. Indeed, the United States produces almost 300 million turkeys every year [4]; Quebec is dissociated in this production with more than 4.7 million turkeys [5]. According to [6], Morocco in 2010 produced 7,700,000 turkey poults for approximately 70,000 tons of meat. The meat of turkey is very appraisal of share its virtues. It has a low fat content and of saturated fatty acids; its consumption supports an improvement of the lipidic profile and contributes to the increase in cholesterol (High Density Lipid).

In Cameroon, there exists little of information on the diversity of the local genetic resources in general and on the breeding of turkey in particular. And yet, the local animal breeds represent an original and single inheritance owing to the fact that they developed particularly useful zoo technical aptitudes, in terms of performances of production and qualities of adaptation [7]. In the absence of a better knowledge of these genetic resources, this sector can be threatened of genetic erosion [8]. It is in this order of ideas that, the line of the recommendations of the Action 21 Program of the Convention on Biodiversity regards identification and characterization of the genetic resources as the basis of the conservation of genetic diversity of domestic animals [9].

Thus, this study was conceived to contribute our share to a better knowledge of turkey biodiversity on the Highlands of West-Cameroon (HW-Cameroon), in order to contribute to its preservation and to the development of its genetic improvement program. More specifically, it was a question of evaluating morpho-biometric diversity of turkeys of HW-Cameroon and of evaluating the coefficients of correlation amongst body measurements and Live Weight.

2. Material and Methods

2.1. Area of Study

The study was undertaken from November 2015 to January 2016 on the Highlands of West-Cameroon with the following Geo climatic characteristics:

- Localization: North Latitude: 05°20` to 07°00' and East Longitude: 10°03` to 12°00`;
- Ground: red or brownish laterite;
- Climate: Sudano-Guinean, modified by the altitude.
- Temperature: 16°C to 27°C.

2.2. Animals

A sample of 236 adult turkeys whose 141 females and 95 males were randomly selected in four Divisions in the zone of study. The age and the origin of the animals were obtained by the interview of the stockbreeders. Table 1 presents the manpower of the animals studied according to the sex and the Divisions.

Table 1. *Animals studied according to the sex and the Divisions.*

	Divisions				
Sex	**BAMBOUTOS**	**KOUNG-KHI**	**MENOUA**	**MIFI**	**Total**
Male	28	24	16	27	95
Femelle	42	30	25	44	141
Total	70	54	41	71	236

2.3. Data Collection

The qualitative characters were described by the visual observation. The data related to the colours of the plumage, the head, the eyes and the legs.

For the quantitative characters, 13 body measurements were collected with a meter ribbon graduated in centimetre, except the legs whose dimensions were taken using a slide calliper of precision 0.02 mm. For each animal, dimensions of the wattle (length and width), legs (circumference of the rammer, length and diameter of the shank), and the lengths of the body, nozzle, beard and thoracic circumference were measured. The live weight finally was taken using an electronic balance of precision 1 Gram.

2.4. Analysis

The Descriptive Statistics was used to describe the distribution of the characters and to estimate means and standard errors.

The test of Contingency made it possible to test association or independence between the factors (sex and localities) and the qualitative characters.

The Analysis of Variance (ANOVA) was used to test the influence of the factors (age, sex and Division) on various measurements and the live Weight. The factor age not having been significant ($P > 0.05$), the following model was used: $Y_{ijk} = \mu + \alpha_i + \beta_j + e_{ijk}$, where:

Y_{ijk} is the Weight or body measurements on the animal k of the locality j and sex i;

μ is the average of the population;

α_i is the effect of i sex;

β_j is the effect of the j locality;

e_{ijk} is the residual error on the k individual of i sex and of j locality.

To separate the Means when the effects of the sex and the locality were significant, the test of Duncan was used.

The correlations of Pearson were used to evaluate the direction and the degree of association between body measurements and the Live Weight.

3. Results

3.1. Morphologic Characteristics

3.1.1. Plumage Colours

The colouring of the plumage according to the sex and the Divisions is presented in table 2.

Table 2. *Distribution of the colour of plumage in turkey of the Highlands of West-Cameroon according to the sex and the Divisions.*

plumage colouring	**Bronzed**	**black**	**white**	**black-cupper**	**black-white**	**white-frizle**	
	n(%)	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**X²**
Sex							
♂	51(53.68)	25(26.32)	12(12.63)	4(4.21)	2(2.11)	1(1.05)	ns
♀	78(55.32)	43(30.50)	14(09.93)	2(1.42)	3(2.13)	1(0.71)	
♂♀(%)	54.50	28.41	11.28	2.82	2.12	0.88	
Dpts							
BTOS	37 (52.86)	21(30.00)	10(14.28)	2(2.86)	0(0.00)	0(0.00)	*
K-KHI 35 (64.81)		14(25.93)	02(03.70)	0(0.00)	3(5.56)	0(0.00)	

plumage colouring	Bronzed	black	white	black-cupper	black-white	white-frizle	
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	X²
MN	21 (51.22)	10(24.39)	04(09.76)	4(9.76)	0(0.00)	2(4.88)	
MF	36 (50.70)	23(32.39)	00(00.00)	0(0.00)	2(2.82)	0(0.00)	
Mean (%)	54.90	28.18	06.94	3.16	2.10	1.22	

n(%): size (frequence); Dpts: Divisions; BTOS: Bamboutos; K-KHI: Koung-Khi; MN: Menoua; MF: Mifi; ns: non significant; *: P < 0.05

It arises from table 2 that the colouring of the plumage is varied and is statistically (P < 0.05) associated to the Divisions, but not to the sex (P > 0.05). The bronzed colour is statistically more dominant (P < 0.05) in Koung-Khi (64.81%).

3.1.2. Colouring of the Head

The colouring of the head according to the sex and the Divisions is presented in table 3.

Table 3. *Colouring of the head according to the sex and the Divisions.*

Colours of the head	Pink	Red	Pink-blue	Red-blue	Clair-pink	Purple-pink	Purple	
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	X²
Sex								
♂	13(13.68)	20(21.05)	13(13.68)	44(46.32)	04(4.21)	01(01.05)	0(0.00)	ns
♀	48(34.04)	18(12.77)	11(07.80)	16(11.35)	12(8.51)	34(24.11)	2(1.42)	
♂♀(%)	23.86	16.91	10.74	28.84	6.36	12.58	0.71	
Dpt								
BTOS 15(21.43)		05(07.14)	08(11.43)	16(22.86)	06(8.57)	20(28.57)	0(0.00)	*
K-KHI 12(22.22)		20(37.04)	00(00.00)	11(20.37)	03(5.56)	07(12.96)	1(1.85)	
MN	13(31.71)	09(29.02)	04(09.76)	07(17.07)	02(4.88)	05(12.20)	1(2.44)	
MF	21(29.58)	04(05.63)	12(16.90)	26(36.62)	05(7.04)	03(04.23)	0(0.00)	
Mean (%)	26.24	19.71	09.52	24.23	6.52	14.49	1.07	

n(%): size (frequence); Dpt: Divisions; BTOS: Bamboutos; K-KHI: Koung-Khi; MN: Menoua; MF: Mifi; ns: non significant; *: significant (P < 0,05)

Table 3 shows that the colouring of the head is varied and is statistically (P < 0.05) associated to the Divisions. The pink colour is prevalent in females (34.04%) and in Menoua (31.71%).

3.1.3. Colouring of the Shanks

The colouring of the shanks according to the sex and the Divisions is presented in table 4.

Table 4. *Colouring of the shanks according to the sex and the Divisions.*

Colours of	Black	Pink	Clair-pink	Dark-pink	Purple-pink	Bright-pink	
shanks	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	X²
Sex							
♂	5(5.26)	37(38.95)	17(17.89)	25(26.32)	0(0.00)	11(11.58)	ns
♀	4(2.84)	49(34.75)	32(22.70)	23(16.31)	2(1.42)	31(21.99)	
♂♀(%)	4.05	36.85	20.30	21.32	0.71	16.79	
Dpts							
BTOS	6(8.57)	28(40.00)	16(22.86)	07(10.00)	0(0.00)	13(18.57)	*
K-KHI	0(0.00)	12(22.22)	10(18.52)	14(25.93)	0(0.00)	18(33.33)	
MN	1(2.44)	22(53.66)	05(12.20)	06(14.63)	2(4.88)	05(12.20)	
MF	2(2.82)	24(33.80)	18(25.35)	21(29.58)	0(0.00)	05(07.04)	
Mean(%)	3.46	37.42	19.73	20.04	1.22	17.79	

n(%): size (frequence); Dpts: Divisions; BTOS: Bamboutos; K-KHI: Koung-Khi; MN: Menoua; MF: Mifi; ns: non significant; *: P < 0.05

It comes out from table 4 that the colouring of the shanks is varied and is statistically (P < 0.05) associated with the Divisions. The pink colour is prevalent in the males (38.95%) and statistically dominant (P < 0.05) in Menoua (53.66%).

3.1.4. Colouring of the Eyes

The colouring of the eyes in function of the sex and the Divisions is presented in table 5.

Table 5. *Colouring of the eyes according to the sex and the Divisions.*

Colouring of the eyes	Black-white	Grey-black	Chestnut	Black-chestnut	Black	
	n(%)	n(%)	n(%)	n(%)	n(%)	X²
Sex						
♂	3(3.16)	11(11.58)	14(14.74)	62(65.26)	4(04.21)	ns
♀	2(1.42)	18(12.77)	27(19.15)	86(60.99)	8(05.67)	
♂♀(%)	2.29	12.18	16.95	63.13	04.94	

Colouring of the eyes	Black-white	Grey-black	Chestnut	Black-chestnut	Black	
	n(%)	n(%)	n(%)	n(%)	n(%)	X²
Divisions						
BTOS	0(0.00)	08(11.43)	02(02.86)	58(82.86)	2(02.86)	*
K-KHI	1(1.85)	12(22.22)	13(24.07)	28(51.85)	0(00.00)	
MENOUA	2(4.88)	01(02.44)	20(48.78)	13(31.71)	5(12.20)	
MIFI	2(2.82)	08(11.27)	06(08.45)	50(70.42)	5(07.04)	
Mean(%)	2.39	11.84	21.04	59.21	05.53	

n(%): size (frequence); BTOS: Bamboutos; K-KHI: Koung-Khi; ns: non significant; *: P < 0.05

From table 5, the colouring of the eyes is varied and is significantly (P < 0.05) affected by the Divisions. The colour chestnut-black is prevalent in the males (65.26%) and statistically dominant (P < 0.05) in Bamboutos (82.86%).

Figure 1. *Morphologic characteristics of turkeys of the Highlands of West-Cameroon.*

3.2. Biometric Characteristics

3.2.1. Length and Diameter of the Shanks

The Analysis Of Variance (ANOVA) shows that the length of shank alone is significantly influenced (P < 0.05) by the sex and the Divisions.

Table 6 presents the average, the standard error and the coefficient of variation of the length and of the diameter of the shank according to the sex and the Divisions.

Table 6. *Mean, standard error and coefficient of variation of the length and of the diameter of the shank according to the sex and the Divisions.*

		Length of shank (cm)		Diameter of the shank (cm)	
Factors	n	$\bar{X} \pm$ E. S	CV (%)	$\bar{X} \pm$ E. S	CV (%)
Sex					
Male	95	$14.57^b \pm 0.12$	8.09	$2.54^a \pm 0.02$	9.84
Female	141	$11.66^a \pm 0.09$	9.69	$2.52^a \pm 0.01$	5.95
Mean		13.12 ± 0.11	8.89	2.53 ± 0.02	7.89
Division					
Bamboutos	70	$13.50^b \pm 0.21$	13.48	$2.54^a \pm 0.03$	9.84
Koung-Khi	54	$12.41^a \pm 0.22$	13.21	$2.51^a \pm 0.02$	6.37
Menoua	41	$12.68^a \pm 0.23$	11.90	$2.51^a \pm 0.02$	6.77
Mifi	71	$12.58^a \pm 0.23$	15.97	$2.55^a \pm 0.02$	6.66
Mean		12.79 ± 0.22	13.64	2.53 ± 0.02	7.41

a and b: the affected means of the same letter in the same column indicate that there is no significant difference (P > 0,05) between the sexes and the Divisions;n= size; x± E. S=mean plus/minus standard error; CV=coefficient of variation;% = percentage.

Table 6 shows that:

a) Length of the shank

Shank is significantly (P < 0.05) longer in males (14.57 cm) and more varied in the females (9.69%). Considering the Divisions, the highest length is recorded in Bamboutos and in Mifi turkeys are more dispersed whereas those of Koung-Khi are more homogeneous.

b) Diameter of the shank

The diameter of the shank is higher in turkeys and in Mifi without being significant (P > 0.05). In addition, in Bamboutos turkeys are more dispersed whereas those of Menoua are more homogeneous.

3.2.2. Circumference of the Rammer and Length of the Nozzle

The ANOVA shows that the circumference of the rammer and the length of the nozzle are significantly influenced by the sex and the Divisions (P < 0.05).

Table 7 presents the average, standard error and coefficient of variation of the circumference of rammer and length of nozzle according to the sex and the Divisions.

Table 7. *Mean, standard error and coefficient of variation of the circumference of rammer and length of nozzle according to the sex and the Divisions.*

		Circumf. of rammer (cm)		Length of nozzle (cm)	
Factors	**n**	**$\bar{X}$ ± E. S**	**CV (%)**	**$\bar{X}$ ± E. S**	**CV (%)**
Sex					
Male	95	$18.12^b \pm 0.17$	12.70	$5.48^b \pm 0.05$	8.94
Female	141	$14.62^a \pm 0.17$	22.37	$4.63^a \pm 0.04$	9.28
Mean		16.03 ± 0.17	17.53	4.97 ± 0.05	9.11
Division					
Bamboutos	70	$16.48^b \pm 0.30$	15.17	$5.16^b \pm 0.06$	10.07
Koung-Khi	54	$16.12^{ab} \pm 0.37$	16.73	$4.83^a \pm 0.07$	11.59
Menoua	41	$15.38^a \pm 0.32$	13.33	$4.79^a \pm 0.09$	12.52
Mifi	71	$15.88^{ab} \pm 0.33$	17.37	$4.99^{ab} \pm 0.08$	14.00
Mean		15.97 ± 0.33	15.65	4.97 ± 0.08	12.05

a and b: the affected means of the same letter in the same column indicate that there is no significant difference (P > 0,05) between the sexes and the Divisions; n= size; x± E. S=mean plus/minus standard error; CV=coefficient of variation;% = percentage.

It appears in table 7 that:

a) Circumference of the rammer

The circumference of the rammer is significantly higher (P < 0.05) in the males (18.12 cm) and the coefficient of variation is higher in the females (22.37%). Comparing the Divisions, the value most significantly high (P < 0.05) is recorded in Bamboutos. In Mifi, the turkeys are more dispersed, whereas those of Menoua are more homogeneous.

b) Length of the nozzle

The nozzle is statistically longer (P < 0.05) in males (5.48 cm) but the coefficient of variation is higher in females. Comparing the Divisions, the length most significantly high (P < 0.05) is observed in Bamboutos. In addition, in Mifi turkeys are more dispersed whereas those of Bamboutos are more homogeneous.

3.2.3. Length and Width of the Wattle

The ANOVA shows that the length and the width of the wattle are significantly influenced (P < 0.05) by the sex and the width of the wattle alone is influenced (P < 0.05) by the Divisions.

Table 8 presents the mean, standard error and coefficient of variation of the length and of the width of the wattle in function of sex and Divisions.

Table 8. *Mean, standard error and coefficient of variation of the length and of the width of the wattle in function of sex and Divisions.*

		Wattle length (cm)		Wattle width (cm)	
Factors	**n**	**$\bar{X}$ ± E. S**	**CV (%)**	**$\bar{X}$ ± E. S**	**CV (%)**
Sex					
Male	95	$5.48^b \pm 0.05$	12.78	$7.51^b \pm 0.17$	21.97
Female	141	$4.63^a \pm 0.04$	22.37	$3.66^a \pm 0.13$	43.16
Mean		5.05 ± 0.05	17.58	5.59 ± 0.15	32.57
Division					
Bamboutos	70	$12.73^a \pm 0.47$	30.87	$6.13^b \pm 0.34$	46.00
Koung-Khi	54	$12.79^a \pm 0.55$	31.59	$4.90^a \pm 0.34$	50.61
Menoua	41	$12.61^a \pm 0.58$	29.66	$2.39^a \pm 0.37$	47.80
Mifi	71	$11.71^a \pm 0.47$	19.83	$1.91^a \pm 0.23$	41.16
Mean		12.46 ± 0.52	27.99	3.83 ± 0.32	46.39

a and b: the affected means of the same letter in the same column indicate that there is no significant difference (P > 0,05) between the sexes and the Divisions; n = size; x± E. S=mean plus/minus standard error; CV=coefficient of variation;% = percentage.

It rises from table 8 that:

a) Length of the wattle

The dimorphism is significantly (P < 0.05) in favour of the males (5.48 cm), however with more variability in the females. As regards with the Divisions, Koung-Khi has the most raised value (P > 0.05), however in Mifi, turkeys are more heterogeneous.

b) Width of the wattle

The dimorphism is statistically (P < 0.05) still in favour of the males (7.51 cm), but the greatest variation is recorded in the females. The width most significantly (P < 0.05) high is recorded in the locality of Bamboutos.

3.2.4. Length of the Body and Circumference of the Thorax

The ANOVA shows that the length of the body and the circumference of the thorax are significantly influenced (P < 0.05) by the sex and the Divisions.

Table 9 presents the mean, standard error and coefficient of variation of the length of the body and the circumference of the thorax according to the sex and the Divisions.

Table 9. *Mean, standard error and coefficient of variation of the length of the body and the circumference of the thorax according to the sex and the Divisions*

		Body length (cm)		Thorax circumf. (cm)	
Factors	**n**	**$\bar{X}$ ± E. S**	**CV (%)**	**$\bar{X}$ ± E. S**	**CV (%)**
Sex					
Male	95	$62.83^b \pm 0.55$	8.46	$62.02^b \pm 1.02$	16.02
Female	141	$53.65^a \pm 0.45$	9.91	$48.70^a \pm 0.47$	20.21
Mean		58.24 ± 0.50	9.19	55.36 ± 0.75	18.12
Division					
Bamboutos	70	$57.38^{ab} \pm 0.83$	12.04	$56.69^b \pm 1.05$	15.54
Koung-Khi	54	$57.48^{ab} \pm 0.78$	9.93	$51.18^a \pm 1.51$	21.61
Menoua	41	$59.77^b \pm 0.98$	10.47	$53.94^{ab} \pm 1.54$	18.26
Mifi	71	$55.80^a \pm 0.94$	14.23	$53.75^{ab} \pm 1.20$	18.77
Mean		57.61 ± 0.88	11.67	53.89 ± 1.33	18.55

a and b: the affected means of the same letter in the same column indicate that there is no significant difference (P > 0,05) between the sexes and the Divisions; n = size; x± E. S=mean plus/minus standard error; CV=coefficient of variation;% = percentage.

Table 9 shows that:

a) Length of the body

The body of the males is significantly (P < 0.05) longer (62.83 cm) than that of the females (53.65 cm). Considering the Divisions, turkeys are significantly longer (P < 0.05) in Menoua and are more dispersed in Mifi.

b) Thoracic circumference

The circumference of the thorax is statistically (P < 0.05) higher in the males (62.02 cm) but females have the greatest variation. Comparing the Divisions, turkeys have the longest circumference in Bamboutos and they are more dispersed in Koung-Khi.

3.2.5. Length of the Beard and Live Weight

The ANOVA indicates that the length of the beard is significantly influenced (P < 0.05) by the Divisions alone and the Live Weight is influenced (P < 0.05) by the sex alone.

Table 10 presents the mean, standard error and coefficient of variation the length of the beard and the live Weight according to the sex and the Divisions.

Table 10. *Mean, standard error and coefficient of variation the length of the beard and the Live Weight according to the sex and the Divisions.*

		Beard length (cm)		Live Weight (Kg)	
Factors	**n**	$\bar{X}$ **± E. S**	**CV (%)**	$\bar{X}$ **± E. S**	**CV (%)**
Sex					
Male	95	$10.35^{a} \pm 0.56$	52.17	$7.93^{b} \pm 0.19$	23.20
Female	141	$6.96^{a} \pm 1.04$	42.38	$4.89^{a} \pm 0.25$	60.74
Mean		8.66 ± 0.80	47.28	6.41 ± 0.22	41.97
Division					
Bamboutos	70	$5.29^{a} \pm 0.96$	56.30	$6.13^{a} \pm 0.29$	39.15
Koung-Khi	54	$12.68^{b} \pm 1.02$	40.93	$5.82^{a} \pm 0.25$	32.13
Menoua	41	$10.93^{ab} \pm 1.66$	59.01	$6.50^{a} \pm 0.81$	79.85
Mifi	71	$8.27^{a} \pm 0.3$	49.46	$6.10^{a} \pm 0.29$	39.51
Mean		9.29 ± 0.99	51.43	6.14 ± 0.41	47.66

a and b: the affected means of the same letter in the same column indicate that there is no significant difference (P > 0,05) between the sexes and the Divisions; n = size; x± E. S=mean plus/minus standard error; CV=coefficient of variation;% = percentage.

It appears in table 10 that:

a) Length of the beard

Comparing the Divisions, the value significantly (P < 0.05) high is recorded in Koung-Khi and the greatest variation is observed in Menoua.

b) Live weight

The Live Weight statistically (P < 0.05) high is observed in the males (7.93 kg), with a greater dispersion observed in females.

3.3. Correlation Coefficients Amongst Body Measurements

Table 11 summarizes the coefficients of correlation between Live Weight and various body measurements.

It appears in table 11 that all biometric measurements in turkey of the Highlands of West-Cameroun are correlated positively between them and with the Live Weight, with the threshold of 5% or 1%. Table 11 also shows that the coefficients of correlation positive most significantly high are observed between the length of the shank and the length of the wattle (R = 0.83), between the length of the shank and the length of the nozzle (R = 0.80), between the length of the wattle and the length of the snood (R = 0.83) and between the length of the neck and the length of the beard (R = 0.89).

Table 11. *Correlations between the live weight and measurements of turkey of the Highlands of West-Cameroon.*

Variables	PV	LT	DT	PP	LB	lB	LBc	LSn	LCp	LC	PTh	LA	LPA	LBb
PV	1													
LT	0.48**	1												
DT	0.09	0.15*	1											
PP	0.50**	0.78**	0.14**	1										
LB	0.45**	0.83**	0.11	0.77**	1									
lB	0.45**	0.74**	0.03	0.66**	0.78**	1								
LBc	0.49**	0.80**	0.20**	0.71**	0.73**	0.64**	1							
LSn	0.55**	0.77**	0.07	0.69**	0.83**	0.78**	0.71**	1						
LCp	0.33**	0.69**	0.19**	0.60**	0.73**	0.60**	0.65**	0.68**	1					
LC	0.48**	0.74**	0.20**	0.73**	0.78**	0.62**	0.64**	0.65**	0.63**	1				
PTh	0.53**	0.71**	0.15*	0.72**	0.68**	0.65**	0.67**	0.69**	0.59**	0.65**	1			
LA	0.30**	0.49**	0.05	0.49**	0.50**	0.44**	0.43**	0.44**	0.27**	0.49**	0.18**	1		
LPA	0.04	0.16*	0.03	0.18**	0.26**	0.15*	0.23**	0.27**	0.21**	0.22**	0.21**	0.15*	1	
LBb	0.34**	0.01	0.04	0.22*	0.17	0.12	0.19	0.29**	0.05	0.89	0.24*	0.05	0.03	1

* The correlation is significant on level 0,05; ** the correlation is significant on level 0,01

PV = Live Weight; LT = Length of the shank; DT = Diameter of the shank; PP = Circumference of the rammer; LB = Length of the wattle; lB = Width of the wattle; LBc = Length of the nozzle; LSn = Length of Snood; LCp = Length of the body; LC = Length of the neck; PTh = Thoracic Circumference; LA= Length of the wing; LPA = Length of the back feather; LBb = Length of the beard.

4. Discussion

From the preceding results, it arises that the bronzed plumage is dominating over the Highlands of West-Cameroon. These results corroborate with others [10], which found that bronzed is raised the most, but do not corroborate with some [11] which had described the popularity of the white plumage in the United States. However, this bronzed plumage corresponds to their description [10] [11] [12]. Thus, the high percentage of the bronzed plumage can be explained by the action of the stockbreeders in the selection and breeding of turkeys corresponding to their needs. According to the information collected from these actors, the beauty of this animal and its adult weight are its assets of production. In addition the small percentages of the plumages black-coppered, black-white and white-curly according to stockbreeders, do not owe their causes in the morphology of the animal, but in their generally weak adult weights.

The colouring red-blue of the head was the most frequent colour, the least frequent being the pink. The red colour was defined as standard in the turkey [10] [11] [12]. The head turns to red-blue when the animal is excited. The other variations of the colour would be due to *random* methods of reproduction, in particular uncontrolled crossings. Moreover, the multiplicity of decorative details on the head testifies the variability of turkey genetic resources in the Highlands of West-Cameroon. However, the more marked colours of these decorative details prevail in the males where they would play a significant role at the time of bridal parade. This was deferred at the local hen populations. Pale colourings of the appendices in the females would be rather related to the physiological phenomena during the reproduction cycle [13].

The multiplicity of the details on the shanks also testifies the variability of turkey genetic resources on the Highlands of West-Cameroon. These results corroborate with those of our authors [11] [12], which gave a report on the colours: red, black and clear for the shank. Multiple uncontrolled crossings for several decades, between animals having various colours have probably given rise to other combinations notably those existing in small proportions [14]. Pink prevalence of the colours (36.40%), pink-clear (20.80%), red-black (20.30%) and pink-purple (17.80%) for the shanks make believe that one could find turkey in the native state. However, the clear colours, very low (4.60%) in the total population may suggest a relatively low dilution level of original genes, through the introduction of commercial stocks.

The presence of the colours chestnut-black, chestnut and black of the eyes corroborates with the results of many authors [10] [11] [12], which gave a report on the colours chestnut, yellow-chestnut, chestnut-black and black. Moreover, we obtained other colours with small percentages: grey-black (12.30%) and white-black (2.10%). This would be due to multiple uncontrolled crossings since several decades between animals having various colours, which gave rise to other combinations, probably those existing in small proportions [14].

For the biometric diversity, the higher values of the length and diameter of the shanks in males (14.57 ± 0.12 cm and 2.54 ± 0.02 cm) are in disagreement with some results [15] which brought back 17.78 cm; this situation may be due to geo-climatic conditions which lead to poor performances in the Tropics, as well as production systems. In fact, our result for the shank length is greater than that of 12.52 ± 0.35 cm obtained in Nigeria [16]. But the obtained a higher coefficient of variation (12.78%) compared to ours (8.09%), showing greater diversity among their turkey population, compared to ours. The same trend was obtained for the circumference of the rammer and the length of the nozzle, as well as for the length of the neck, the thoracic circumference. Concerning the Live Weight, male turkeys also take the lead on the females. They obtained weaker results in Nigeria [16]; but their population was more homogeneous for this character. Moreover, our values are higher than those proposed by other authors concerning the *White of Beltsville* and *white Turkeys* with broad breast [17] [18]. On the other hand, our values are weak compared to those of other authors [19] [20]. In a general way, the dimorphism is very marked and is in favour of the males for all the studied quantitative characters but the relatively low values of the Live Weight of turkeys on the Highlands of West-Cameroun, compared to those of the Temperate zones would be due to environmental conditions such as temperature, nutrition and the absence of selection of characters of interest of genetic resources in the Tropical zones [16].

With all the measurements, the Live Weight was correlated the most with the length of snood and the thoracic circumference, but all the correlations were positive. Others brought back similar values between the weight and principal measurements [21]. However this result does not corroborate with those in Nigeria [16]. Indeed, they found correlations positive and strong between the Live Weight and various measurements except with the circumference of the thorax which was negative and weak. Significant correlations ($P < 0.05$ and $P < 0.01$) and positive, though not very strong suggest a prediction among the features of the two sexes. Thus, selection for Live Weight will enable an increase in the proportions of other characters. In other words, the majority of the genes which influence the weight of turkey as well as body measurements have a common action. The implication of this concept is that body weight can be estimated starting from biometric measurements, even if correlations were not sufficiently strong [16].

5. Conclusion

This study was conceived and aimed at contributing to a better knowledge of turkey biodiversity in the Highlands of West-Cameroon. This turkey presents a great diversity in its morphology as well as in its biometric characters.

In the studied turkey population, the colours bronzed and black of the plumage were prevalent and the various colours of the plumage made it possible to bring turkeys of the Highlands of West-Cameroon closer to the varieties originating in America. The presence of small colour percentages of the plumage, shanks, eyes and head makes think of a significant influence of *random crossings* on those turkeys. Sexual dimorphism was noted for some colourings and for all the considered quantitative characters. It was besides in favour of the males. The results of morphology as well as the values of measurements of the characters vary with the localities. Among the studied quantitative variables, the length of the snood and the thoracic circumference were shown most reliable for the determination of the Live Weight of our turkeys.

This great biodiversity can be used as a basis for the installation of the rustic and more powerful genetic types by the means of selection and the crossings. A concomitant improvement of breeding conditions should make it possible to effectively increase the productivity of turkey to make some, particularly in traditional medium, a source of high quality and less expensive proteins. However, the information obtained on the degree of similarity of the various phenotypes offers the possibilities for the preservation and genetic improvement of turkeys on the Highlands of West-Cameroon.

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