Biometric characterization of local chicken "*Gallus gallus domesticus*" according to the sex and phenotype from traditional breedings of Dabakala (Côte d'Ivoire)

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Abstract— *A study having for objective the biometric characterization of the local chicken according to the sex and the type of feathering was conducted in the department of Dabakala. A sample of 116 local reared chickens (39 cocks and 77 hens) from traditional breeding was the object of a description by observation, weighing and physical measurement. This study has shown a sexual dimorphism between the cock and the hen. Thus cock's average weight was 1571.79 ± 60.69 g against 1120.78 ± 29.70 g for the hen. The whole population of chicken weight average was 1272.41 ± 34. 51 g. The eight (8) biometric traits studied were distributed in five (5) phenotypes and three (3) subgroups according to the number of common traits. The biometric parameter that could best serve the determination of body weight of a chicken without actually weighing it, was thoracic perimeter with better correlation with weight.*

Keywords— Dabakala, biometric characterization, traditional breeding, local chickens.

I. INTRODUCTION

Essential sources of animal's protein undoubtedly remain the local production of poultry in Côte d'Ivoire (Fofana, 2010). Traditional poultry farming produced about 22 million chickens, which represents 70 % of national poultry production (FAO, 2008). In general, over 89 % of small rural farmers raise chickens and the average number per household is 6.8 chickens (Fattah, 1999).

Despite this important average, the national poultry production remains in deficit. Thus the country has imported frozen poultry meat from African countries and from Europe. These imports of animal's products caused significant output of currency. In Côte d'Ivoire, these imports amounted to over 120 billion CFA in 2013 (MPARH, 2013). This short production could be explained by a poor productivity of traditional poultry farms compared to modern one. Indeed, African indigenous chickens are in majority reared without food supplement, no vaccine and treatments. These rambling birds feed on residual grains in the course and surrounding houses, kitchen waste, insects and earthworms.

This low productivity could explain why this village farming could not benefit from the support programs put in place by the authority in the agricultural sector. The few programs that have involved the breeding of local species were the used of improved stump of poultry in crossbreeding, especially for meat production (Sonaiya and Swan, 2004). Most of these programs have failed due to the lack of monitoring in improving the management of livestock (FAO, 2004). Moreover, crossbreeding with exotic breeds is a source of "erosion" of local breeds genetic leaving in place hybrid whose breeding conditions, are not always accessible to the breeder in rural areas (Batimsoga and Lombo, 2009). It is necessary to preserve the genetic "erosion" by improving the genetic selection for the satisfaction of farmers and consumers. This cannot be done without a good knowledge of livestock genetics parameters.

The objectives of this work are to contribute to the knowledge of animal genetic resources of the local chicken population in Cote d'Ivoire. Specifically, we proposed to describe the morphometric characteristics by type of feathering of local chicken come from traditional farms Dabakala northern region of Côte d'Ivoire.

II. MATERIAL AND METHODS

2.1 Study area

The study was conducted in the North-Central region of Côte d'Ivoire at Dabakala (Figure 1) within coordinates 8° 22'0''N and 4°25′60″W. Located at 87 kilometers from Katiola which is the capital of the region, Dabakala is a major town of the

region measuring about 9 670 km2 area, near the Comoé National Park. From the north to the south, the vegetation is savannah type woodland. It's severely degraded due to bush fires during the dry season.

During the investigation, five villages were visited. This is N'Gorla, M'Borla-Bambarasso, Ouasségbogo, Djédaganan and N'Gala respectively located at 9 km west, 10 km north, 14 km north, 12 km Northeast and 7 km east of the city of Dabakala. Of the five villages visited, only three villages were able to lend us chickens for our study. It is N'Gorla, M'Borla-Bambarasso and Ouasségbogo. M'Borla-Bambarasso and Ouasségbogo are located respectively (on the same axis) at 11 km and 15 km north of N'Gorla.

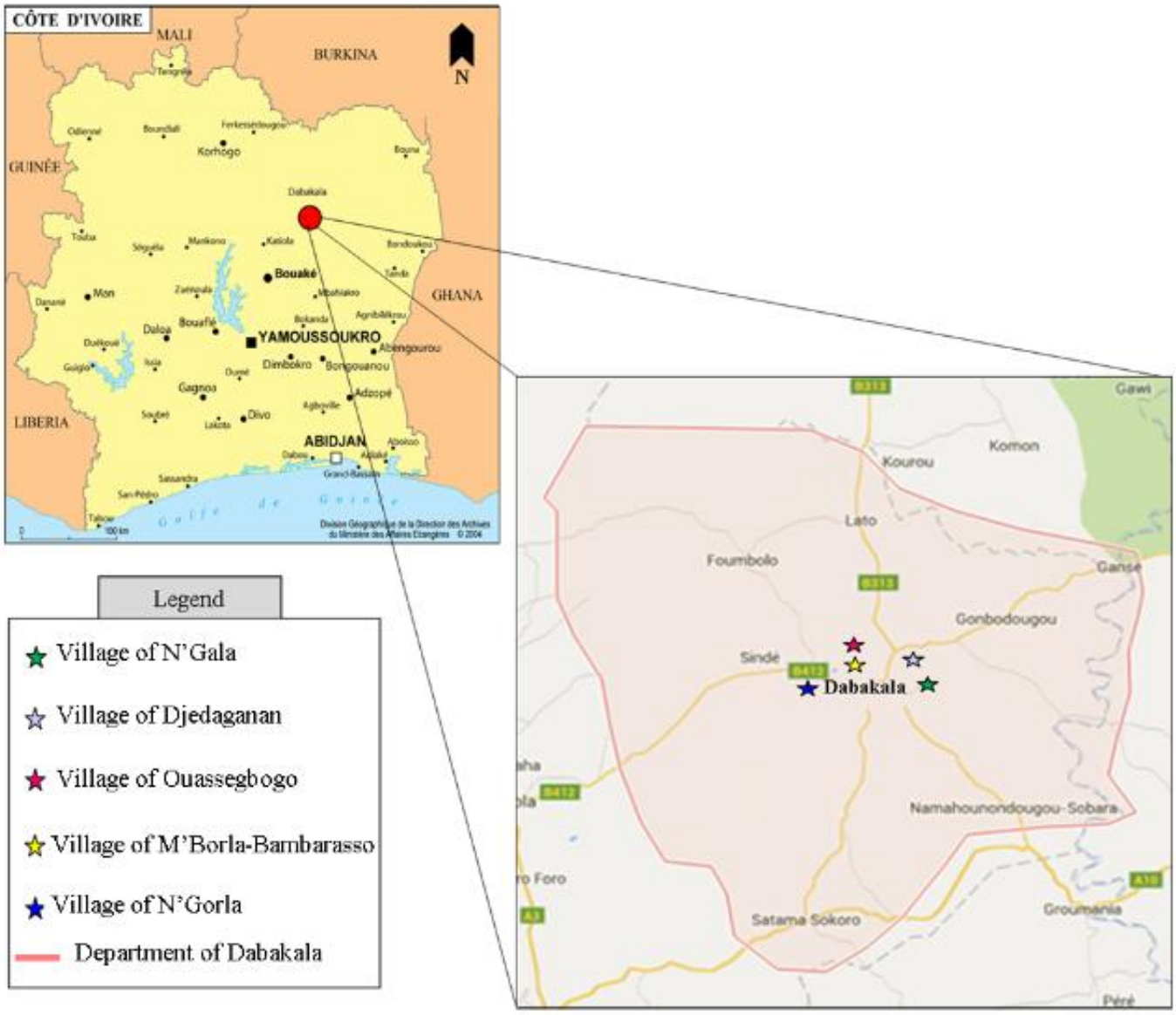

FIGURE 1: LOCATION OF DIFFERENT AREAS OF SURVEYS AND BIRDS SAMPLING IN CÔTE D'IVOIRE (IN AFRICA).

2.2 Animal and data collection material

A sample of 116 traditional chickens (39 cocks and 77 hens) commonly called "running chickens "has been considered for the study. The weight of animals has been determined by a balance with accuracy 0.05 kg. Biometric data has been collected within a digital slide foot precision 0.1 mm and a millimeter ribbon. A digital camera was used for photographic snap.

2.3 Data collection

Visual observation has permitted the collection of qualitative data (type of feathering) from chickens. These data has been recorded following FAO's (1981) recommendations. According to these recommendations, body length is the distance

between the top of the upper mandible and the tail (without feathers). The thoracic perimeter is the chest circumference taken under the wings at the prominent region of sternum. Wing length is the length of the flange extended from the junction of the humerus to the spine to the tip of the wing. Beak length is distance between the top of the upper mandible and their corners. Tarsus length is the distance between the calcaneus and ankle.

2.4 Parameters studied

The study focused on the phenotypic parameters of the feathering and biometrics (weight, beak length, number of fingers, tarsus length and diameter, drumstick diameter, thoracic perimeter, length of the wing and body).

The biometric parameters are expressed by sex and chickens feathering.

2.5 Statistical analyses

Descriptive statistics has concerned the average, its standard error, frequencies, analysis of correlation, linear regression, main component (PCA) and hierarchical clustering (HAC). These statistical analyses has been made by using Microsoft office software (EXCEL, 2007), XL STAT version 2015.4.06 and STATISTICA 7.1.

III. RESULTS

3.1 Classification by the type of feathering

The classifications of chickens by the type and the distribution of plumage are recorded in table 1 and figure 2. The study has shown that 99 of the 116 subjects have a plumage normally distributed on the body. The rest of the chickens has a crested (10), silky (05), frizzle (01), naked neck (01).

TABLE: 1
NUMBER OF ANIMALS BY TYPE AND DISTRIBUTION OF FEARTHERING BY SEX

	Normal		Silky		Naked neck		Crested		Frizzle		Total Population	
	Male	Femal	Male	Femal	Male	Femal	Male	Femal	Male	Femal	Male	Femal
Number	38	61	00	05	00	01	00	10	01	00	39	77
Total number	99		05		01		10		01		116	
Rate (%)	85,35		04,31		0,86		08,62		0,86			

FIGURE 2: TYPE AND DISTRIBUTION OF PLUMAGE ON THE BODY

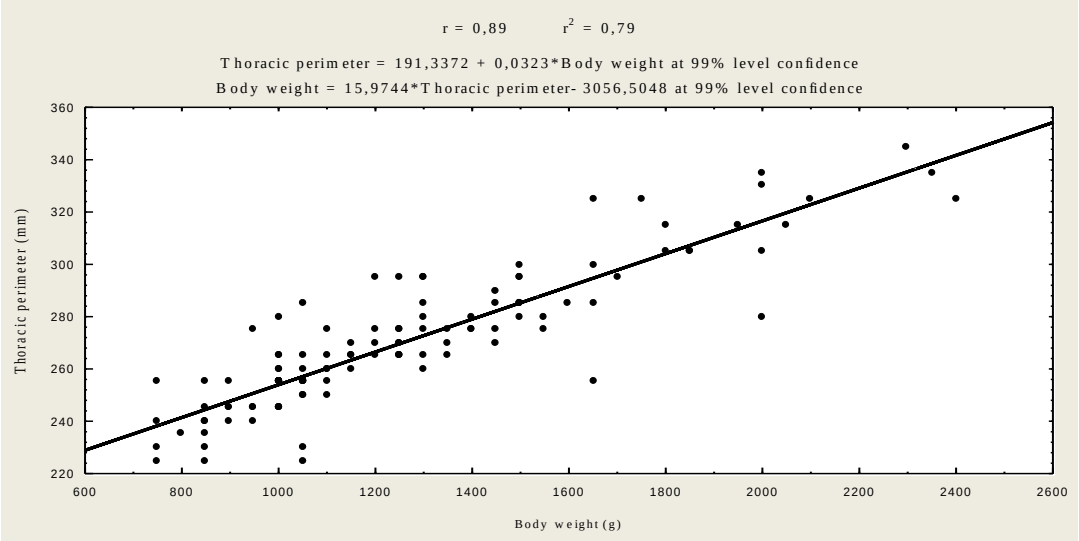

FIGURE 3: LINEAR REGRESSION FOR BODY WEIGHT USING THORACIC PERIMETER AS PREDICTOR FOR LOCAL CHICKEN

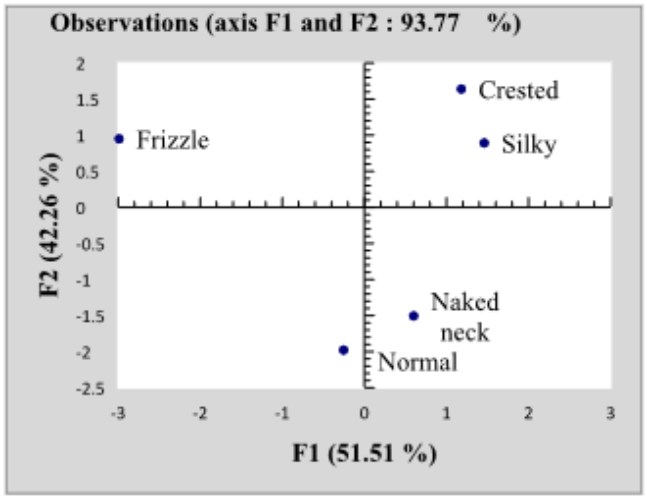

FIGURE 4A: PRINCIPAL COMPONENT ANALYSIS (PCA)

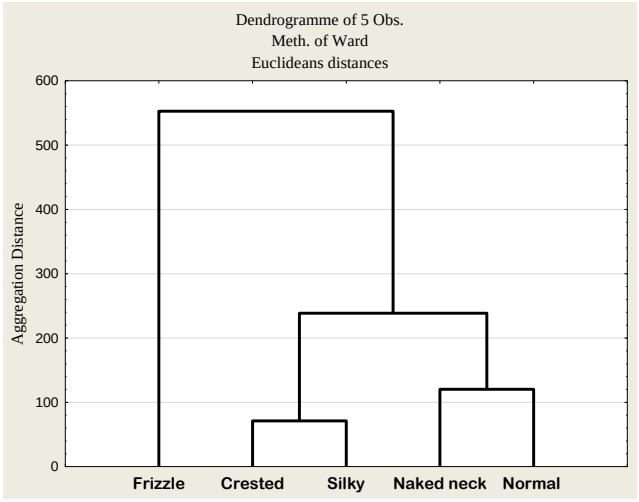

FIGURE 4B: HIERARCHICAL ASCENDING CLASSIFICATION (HAC)

3.2 Weight and body measurements following the sex

The means of quantitative traits by sex are given in table 2. Chickens average weight was 1272.41 ± 34.5 g. specifically, cocks and hens weighted respectively 1571.79 ± 60. 69 g and 1120.78 ± 29.70 g with a significant difference ($p < 0.01$) at 99

% level confidence. In addition, excess weight between the weight of the cock and the hen is 40.24% the weight of the hen. Similarly, the ratio of the weight of the cock by the hen is 1.40 according to equations (E1) and (E2) below:

3.3 Correlations between bodyweight and other measurements

The correlations between body weight and other measurements are recorded in table 3. A high correlation has been observed between body weight and other measurements ($0.66 < r < 0.89$). Thoracic perimeter had the best correlation with body weight ($r = 0.89$) followed by tarsal diameter ($r = 0.81$). Drumstick diameter was the less correlated ($r = 0.66$) parameter. According to figure 3, an equation that estimated the bodyweight from its thoracic perimeter was:

With *Bw (g) = Bodyweight, Pth (mm) = Thoracic perimeter.*

3.4 Relations between bodyweight, body measurements and phenotype of chicken

The evaluated quantitative parameters are linked to the phenotypic traits observed (Table 4). Significant differences ($p < 0.01$) were observed for parameters of same traits, but fingers were not included. Thus no significant differences ($p \geq 0.01$) are observed between normal and silky types. However, the weight differs between the two types ($p< 0.01$) and the crested, the frizzle and the naked neck. For these, weights are different between them. Also, is it noted the high value of all the characters concerning the frizzle type.

A principal component analysis (PCA) and hierarchical ascending classification (HAC) (Figures 4a and 4b) allow noting that the eight analyzed characters discriminate frizzle phenotype of all others. The phenotypes crested and silky relatively closer to the characters share more than normal phenotypes and naked neck that segregate anyway other phenotypes.

IV. DISCUSSION

The study has revealed a biometric and phenotypic variability of the traditional chicken. In fact five types of feathering were noted: normal, crested, silky, naked neck and frizzle. The investigation has revealed that 85 % of the population has a normally distributed plumage on the body of the subjects. Moreover, the crested phenotype, naked neck and silky are for females while the frizzle phenotype has been carried only by males in our sampling.

As for the recorded quantitative traits (weight, beak length, tarsus length, diameter of tarsus, diameter of drumstick, body length, wing length, thoracic perimeter), there emerges a dimorphism between the cock and hen, according to Keambou et al. (2007), Fotsa et al. (2010) and Akouango et al. (2010). The weights of the cock and hen (1571.79 ± 60.69 g and 1120.78 ± 29.70 g) recorded are similar to those obtained by Keambou et al. (2007). The extra weight of the cock over the hen is 40.24% of the weight of the hen. These 40.24% that reflect the ratio weight between the cock and the hen dimorphism. This value was similar to 38.5 % recorded by Yapi-Gnaore et al. (2010).

The correlation coefficient (r) between weight and thoracic perimeter measured 0.89 for all sexes. That showed a high correlation between these two variables. This result has demonstrated that the measurement of thoracic perimeter could advice about the weight of traditional chickens following an equation. The poor appearance of frizzled for the studied traits is the fact that this phenotype has concerned only male. In the other side, the mean values of the recorded measurements are significantly different from those of the other phenotypes whose populations are either mixed (normal) or only composed of females (crested, naked neck, silky).

V. CONCLUSION

It appears from this study that Gallus gallus domesticus from traditional farms present a biometric dimorphism between cock and hen. Chicken's bodyweight could be straight obtained by the thoracic perimeter which has a strong correlation with weight. The biometric information noticed could allow the establishment of national genetic map. This genetic map could be used for the selection of a more rustic local strain than the industrial one actually reared and more productive than the local chicken.

REFERENCES

[1] Akouango F., Bandtaba P. et Ngokaka C., 2010. Croissance pondérale et productivité de la poule locale Gallus domesticus en élevage fermier au Congo, Animal Genetic Resources. 46 : 61–65.

[2] Batimsoga B. B. et Lombo Y., 2009. Caractérisation des populations locales de poules dans la région de la Kara, Rapport d'activité, p. 8.

[3] FAO, 1981. Descripteurs des espèces avicoles. In : Banque de données des ressources génétiques animales. Rome, Italie. Pp. 13 – 15.

[4] FAO, 2004. Production en aviculture villageoise. 134 p.

[5] FAO, 2008. Revue du secteur avicole ivoirien. 67p.

[6] Fofana N., 2010. Prospection pour l'amélioration de l'aviculture semi-intensive périurbaine. Mémoire de maîtrise, Université d'Abobo-Adjamé, UFR des Sciences de la Nature, filière Production Animale. 25p.

[7] Fotsa J.C., Rognon X., Tixier-Boichard M., Coquerelle G., Poné Kamdem D., Ngou Ngoupayou J.D., Manjeli Y. et Bordas A., 2010. Caractérisation phénotypique des populations de poules locales (Gallus Gallus) de la zone forestière dense humide à pluviométrie bimodale du Cameroun, Animal Genetic Resources, 46 : 49–59.

[8] Keambou T. C., Manjeli Y., Tchoumboue J., Teguia A. et Iroume R. N., 2007. Caractérisation morphobiométrique des ressources génétiques de poules locales des hautes terres de l'ouest Cameroun, Livestock Research for Rural Development 19 (8) 2007 http://www.lrrd.org/lrrd19/8/cont1908.htm

[9] MPARH (Ministère de la Production Animale et des Ressources Halieutiques), 2007. Annuaire provisoire des statistiques de la Direction de la planification et des programmes, 57p.

[10] Yapi-Gnaoré C. V., Loukou N. E., Kayang B., Rognon X., Tixier-Boichard M., Touré G., Coulibaly Y., N'Guetta A. S. P. et Youssao Y., 2010. Diversités phénotypique et morphométrique des poulets locaux (Gallus gallus) de deux zones agroécologiques de Côte d'Ivoire. Cah Agric 2010, 19 : 439-45 ; doi : 10.1684/agr.2010.0436