



Phenotypic diversity of local chickens (*Gallus gallus domesticus* Hahn, 1898) from Ituri, DRC

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Summary

This study, which involved the phenotypic description of Ituri chickens, included 2,500 chickens (1,109 roosters and 1,391 hens) found in various markets, communes, and along certain roads in the Ituri Territory. The following results were obtained: on average, 12.5% of the chickens possessed the crest gene, which is more common in the Mahagi Territory ; 15.9 % of hens have on average the naked neck gene more represented in Djugu Territory ; 1.6% of hens have on average the feathered leg gene in significant density in Aru Territory and finally; 0.5% of hens have on average the curly plumage gene with a concentration in Aru Territory also .

Abstract:

Keywords : Diversity - Phenotype - Local chicken - Ituri

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I. INTRODUCTION

The African continent in general is home to a significant diversity of animals with some 400 species or varieties of domestic and wild animals, but a large majority of them have been the subject of little investigation (Planchenault *et al.* , 1997) . According to FAO (2007), almost 60% of poultry biodiversity is at risk due to diseases and the introduction of commercial strains into local farms .

However, in West Africa, the efforts of the few studies have shown that chickens are among the species poorly described in the literature and are among the most threatened animal genetic resources in the world, with the risk of losing traits ignored today and potentially useful tomorrow (Fotsa , 2008; Moula *et al.* , 2009; Moula *et al.* , 2012).

The diversification of poultry across several traits with visible effects, such as plumage structure (smooth and frizzle) and other loci occupied by the NA (naked neck), F (frizzle), PO (polydactyly), CR (crested), and PTI (feathered shanks) genes, must be identified and could be considered in genetic improvement programs to produce genotypes adapted to farm poultry production (Fotsa *et al.* , 2001). According to Bessadok *et al.* (2003), local chickens offer a variety of traits that, through selection and controlled crossbreeding, can boost poultry production in the short and long term.

In the Democratic Republic of Congo in general, and in the Ituri Province in particular, the local chicken has hardly been characterized yet except for the work of Moula *et al.* (2012), in Bas-Congo and of Tshishi *et al.* (2021), in the Haut- Katanga plateau . In this regard, a database containing the essential elements must be considered in order to contribute to a recovery in a new approach oriented towards strategies for improving local production given their importance to local communities.

Indeed, it is necessary in Ituri and elsewhere to draw a line of demarcation by characterizing the local diversity of chickens, starting with phenotypic observations and then moving to genotypic data, as this can lead to the preservation of traits neglected today but which may be sought tomorrow.

II. MATERIALS AND METHODS

The survey forms were designed to collect observed data, indelible ink was used to mark the described birds to avoid duplication, normal eyes were used to determine phenotypes, and finally, hens were used as biological material.



Figure 1. Chickens of Ituri

The work was carried out during the periods from August 15, 2024 to January 23, 2025. To achieve this, the Inspectors and their assistants in charge of Animal Production and Health in each Territory served as a source of information.

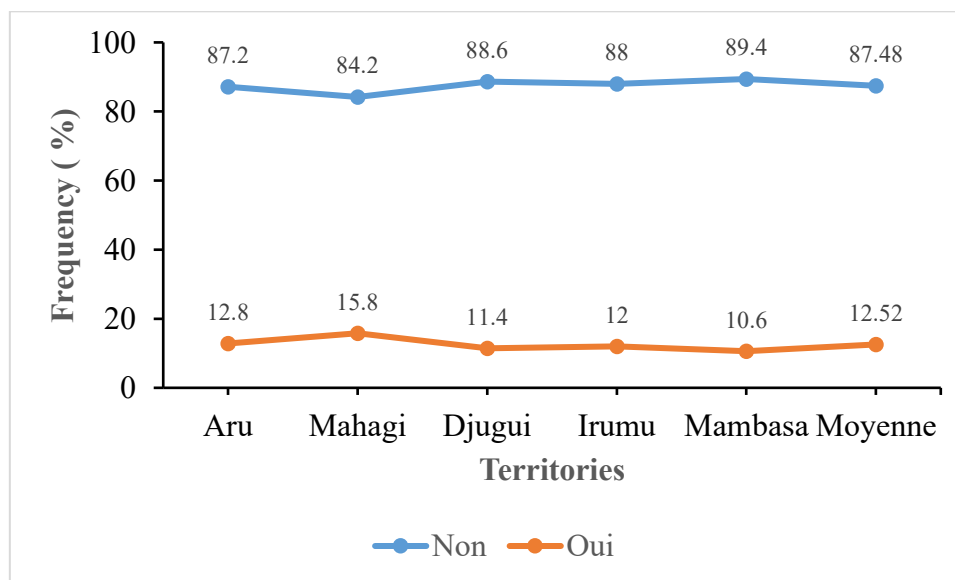
The analytical method allowed for the description of 2,500 local hens of breeding age, including 1,109 males and 1,391 females, with 500 per territory. Each bird was marked with indelible black ink on its legs to avoid duplication.

Aru Territory , 250 roosters and 250 hens were produced, with 100 hens sold to targeted markets. Mahagi, 231 roosters and 269 hens, due to 125 hens being sold at the market, were affected. In Djugu, 266 roosters and 234 hens, representing 250 hens from the markets, were studied. In Irumu, 167 roosters and 333 hens, representing 200 hens from the Bunia central market and 100 hens from the communes, were described, measured, and weighed. Finally, in Mambasa, 195 roosters and 305 hens were included in this study. 200 hens were found in the targeted markets and 300 along the various road axes (Mambasa -Bunia, Mambasa -Kisangani, and Mambasa -Beni).

somatobaric techniques were used to record qualitative data. Descriptions were based on various observed genetic features or mutations (crested, weight on the tarsus, curly plumage, bare neck) . The coded data were entered into Microsoft Excel and then transferred to SPSS (v.20) for analysis.

III. RESULTS AND DISCUSSION

III.1. Crested Gene (CR)



Ituri chicken population

This investigation showed that on average 12.5% of chickens in the aforementioned Province have crests on their heads and these are more represented in Mahagi Territory (15.8%).

This result is higher than that observed by Bemvide *et al.* (2021) in Central African Republic (10.4%) and is almost double that observed by Mboumba *et al.* (2020) in Gabon (6.03%).

According to Hurst (1945) and Davenport (1906), the crest is due to the autosomal CR mutation with incomplete dominance. However, the effect of this mutation on the zootechnical performance of chickens has not been described.

In any case, according to Coquerelle (2000), this mass of feathers makes hens very sensitive to humidity and food contamination, which can promote certain respiratory or fungal diseases. Furthermore, the wattles are very small, or even almost absent, which can limit their adaptation to heat by reducing the unfeathered surface area.

It is therefore recommended that selection be strict or rigorous with regard to this gene which has a much more depressive effect on poultry.

III.2. Naked neck gene (NA)

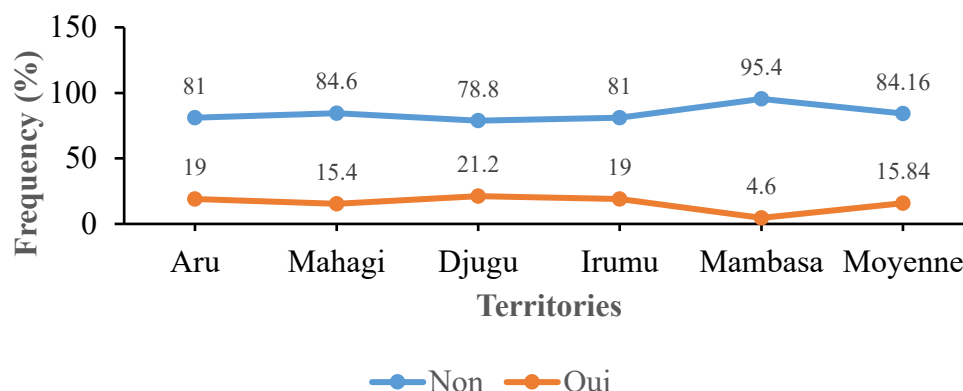


Figure 3. Naked neck gene of Ituri chickens

The results showed that on average 15.84% of the chickens in Ituri have bare necks and are more represented in Djugu Territory (21.2%).

These results do not appear to corroborate those of Missohou *et al.* (2010), Bembide *et al.* (2013), Mboumba *et al.* (2020) and Moula *et al.* (2012) respectively 1.94% in Senegal, 7% in Central African Republic, 6.63% in Gabon and 1.90% in Bas-Congo.

Furthermore, Fotsa *et al.* (2001) showed that the presence of this mutation within the local chicken population could improve adaptive character to enhance productive potential in rural areas.

Furthermore, Greenwood (1927) stipulates that these genes modifying feather repair on the body are autosomal with incomplete dominance.

As for Merat (1990), the homozygous NA*NA/NA*NA subject is more featherless than the heterozygous NA*NA/NA*N at the neck but also at the belly.

This reduction in plumage also has a positive influence on the bird's performance when the ambient temperature is high. At around 30°C and above, homozygous and heterozygous bare-necked birds are heavier than normal, and their feeding efficiency is as good, if not better.

Naked-neck hens maintain their laying rate better, and the average egg weight is higher (up to 3–4 g) than that of their normal counterparts. This advantage is also noted for slaughter yield (2% higher due to reduced feathering) and meat yield, particularly with their well-developed breasts. (Op. Cit.).

According to Safalaoh (2001), local 'naked neck' chickens have shown superior meat yield compared to local bantam chickens. Given the aforementioned facts, selecting these individuals would significantly increase poultry production.

Djugu Territory, which hosts this gene, could have the hens with the highest average weight but is destabilized by the conflict which reduces its potential in food resources that could materialize the expression of this gene.

III.3. Feathered leg gene (PTI)

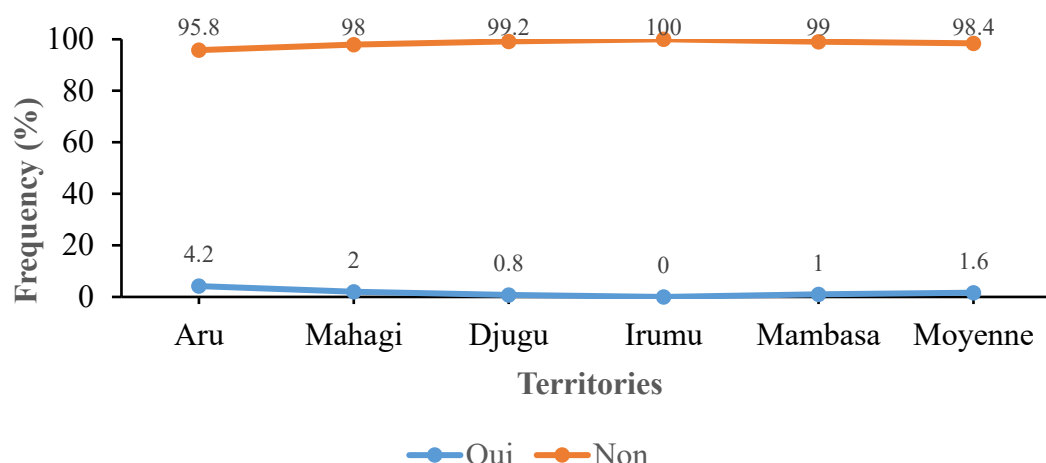


Figure 4. Feathered leg gene of Ituri chickens

The result indicates that on average 1.6% of Ituri chickens have feathered legs and this gene is found to be significantly represented in the Territory of Aru (4.2%). According to Bemvide *et al.* (2013), a study in the Central African Republic showed that 5.9% of chickens have feathered legs, and Mboumba *et al.* (2020) in Gabon found that 4.54% had feathered tarsi. These studies show that the average obtained in this study is lower than those of others. The works of (Hurst, 1905; Punnett *et al.*, 1918; Serebrovsky, 1926 cited by Somes, 1990; Dunn *et al.*, 1927) agreed that the trait is governed by three alleles PTI-1, PTI-2 and PTI-3 on the PTI locus and that this mutation would be associated with better growth of local chickens in Nigeria (Ikeobi *et al.*, 2000). It is also present in local chickens in Cameroon (Fotsa *et al.*, 2010). The relatively high average weight of roosters in Aru would be partially justified by the presence of these genes, thus promoting the growth of local hens, according to the statement by Ikeobi *et al.* (Op. Cit.).

III. 4. Curly feather

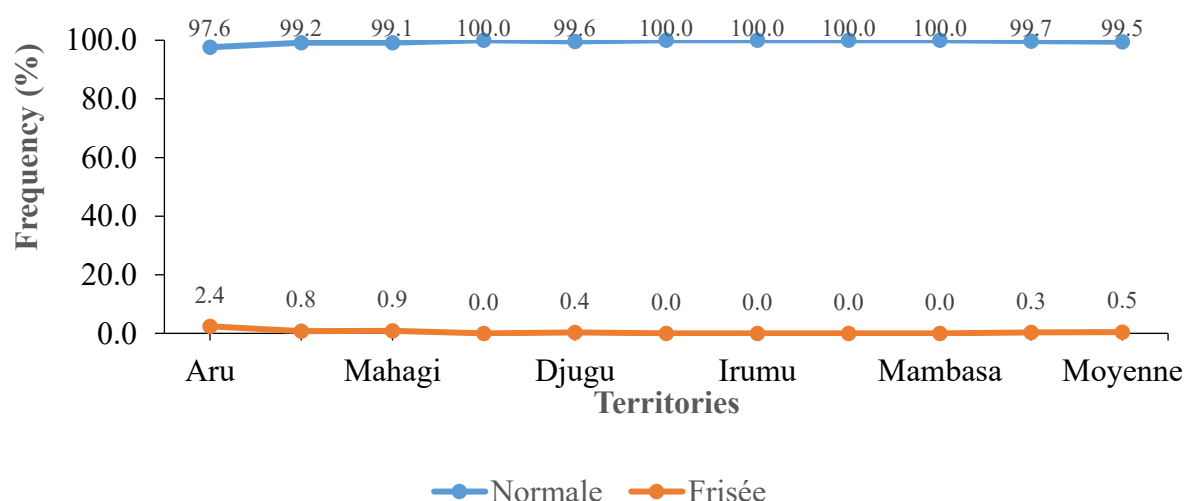


Figure 5. Percentage of the curly feather gene in Ituri chickens

The results obtained indicate that the curly feather gene represents 0.5 % in the breeding of Ituri chickens with a very high acuity in the Territory of Aru 2.5% and concerns more roosters according to our observations.

According to studies conducted by Bemvide *et al.* (2013) in the Central African Republic, 2.3% of birds had curly plumage. This result is higher than that obtained in Ituri Province, and we believe this difference could be explained by the genetic resources of chickens used in each region.

According to Horst (1987) and Haanren -Kiso et al . (1988), feathered legs are due to the presence of the F mutation, which influences performance in hot environments, potentially providing an adaptive advantage for local chickens in tropical climates. The F gene in the heterozygous state F*/F*N, and when combined with the naked neck gene (NA), would increase the number and mass of eggs and decrease mortality in moderately growing chickens under heat stress, according to Horst (Op. Cit) and Haanren -Kiso et al. (Op. Cit).

On the other hand, Yunis et al. (1999) believe that in broiler chickens raised at 32°C, the F-curly mutation would increase weight gain from 4 to 7 weeks of age and body weight at 7 weeks (in the absence of the Naked Neck gene), but has no effect on carcass yield.

Applying the bivariate and non-parametric Spearman Rho correlation, $p < 0.01$. That is , the correlation is significant between bare neck and feather shape.

IV. CONCLUSION AND SUGGESTIONS

The overall objective of this study was to describe the phenotypes of 2,500 hens (1,109 roosters and 1,391 local birds) from Ituri in order to identify traits related to poultry production. The goal was to acquire new knowledge to revitalize poultry farming activities in Ituri Province. The following results were obtained:

- 12.5% of Ituri chickens have on average the crested gene;
- 15.9% of Ituri chickens have on average the naked neck gene;
- 1.6% of Ituri chickens have on average the feathered leg gene;
- On average, 0.5% of Ituri chickens have curly plumage.

In light of these results, the following suggestions were made:

- Researchers should invest in this sector, addressing constraints and improving them in order to increase poultry production, which is a guarantee of sustainable development;
- Humanitarian actors working for food security should group the breeders of these birds into a Cooperative for effective intervention.

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