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Indigenous Breeding Practices in Guinea Fowl (*Numida meleagris*) as Influenced by Plumage Features in Northern Cameroon

Jean Massawa[1*], Dongmo Djiotsa Francis[1,2], Gustave Simo[3], Alexis Teguia[4]

[1]Biotechnology and Bio Informatics Research Unit, Department of Animal Science, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang, Cameroon
[2]Doctoral Training Unit, Animal Genetic Improvement, Department of Breeding and Biostatistics, University of Ngaoundéré, Ngaoundéré, Cameroon
[3]Molecular Parasitology & Entomology Sub-Unit, Department of Biochemistry, Faculty of Science, University of Dschang, Dschang, Cameroon
[4]Animal Nutrition and Feeding Research Unit, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang, Cameroon
Email: *massawa7jean@gmail.com

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Abstract

The objective of this work was to draw up an inventory of environmental and anthropogenic factors linked to indigenous breeding practices of guinea fowl (*Numida meleagris*) influenced by plumage characteristics. The information was collected using the snowball technique and using a formal questionnaire developed (AU-IBAR, 2015). The dominant plumage is pearl gray with a frequency of 38.89% followed by black (13.85%). In total, 154 adult animals were lost by operators with a frequency of 22.95%. According to plumage, white comes first with a frequency of 51.61% followed by Lavender plumage (36.58%). Predation is the major constraint with a frequency of 35.72%. The guinea fowl most targeted by predators are the white guinea fowl with a frequency of 56.25%, while predation is low for black plumage (25%), royal purple (33.34) and pearl gray (34.69). The pearl gray guinea fowl and the royal purple guinea fowl appear to have a more developed wild instinct, which explains the frequency of recorded escapes. White plumage is perceived as being more docile during breeding and tends to exhibit better resistance to heat stress compared to other phenotypes, making it more valued for traditional rituals. Dark plumage seems more sought after in breeding for its supposed prolificacy, its resistance to infections and its weight. According to breeders, the dominance relationship mainly depends on the number of individuals of the same plumage. Dark plumage in significant numbers in most flocks seems to have dominance in terms of food and choice of sexual partners, which would explain their large numbers.

Keywords

Indigenous Breeding, Guinea Fowl, Plumage Features

1. Introduction

Diversity has largely contributed to the considerable development of the poultry sector, in particular thanks to the biological characteristics of poultry species, which are particularly favorable to selection [1]. The birds are popular for their flamboyant and vibrant colors [2]. This bird plumage provides several functions such as thermoregulation, protection against parasites, locomotion, protection against solar radiation, and communication [3] [4] [5]. Beaumont and Chapuis [1] have shown that man has always looked for animals that are not very sensitive to stress because they are then more efficient and easier to breed. The selection of animals in breeding depends on the favorable characteristics they offer and which arouse the interest of breeders [6]. Traditional poultry farming remains the most widespread in sub-Saharan Africa, where it is practiced by almost all farmers in rural areas [7]-[12]. In this system, the animals are in strict scavenging or in semi-freedom and fed cereal grains, plants, non-toxic termites and kitchen scraps found in nature or occasionally served by breeders [2] [10] [13] [14]. In poultry farming, the plumage greatly influences the choice of individuals because behind each plumage hide real reasons or prejudices that condition the choice of some to the detriment of others [6] [15] [16] [17]. In a context of intra-specific biodiversity where each individual has its place regardless of its characteristics favorable or not to selection, this survey work aims to list on the one hand the most popular plumages in breeding and their assets and on the other hand identify, on the same process, the least requested plumages in order to draw attention to vulnerable resources.

2. Study Area and Data Collection

2.1. Study Area

The study was conducted in the Sudano-Sahelian zone of Cameroon (**Figure 1**). It is an agro-ecological zone between 8˚36" to 12˚54" north latitude, and 12˚30" to 15˚42" east longitude. It stretches from Adamaoua to the shores of Lake Chad over approximately 100,000 km^2, which is more than one-fifth of the area of Cameroon IRAD [18].

2.2. Data Collection and Statistical Analysis

Data were collected randomly from 61 breeders in 13 localities, including 7 localities in the far north (Guidiguis, Kalfou, Dziguilao, Mokolo, Tchatibali, Doukoula, and Touloum) and 6 localities in the northern region (Nyakira, Bibemi, Mayo -Lopé, Ngong, Guider and Mafa-Tchéboa). This information was collected

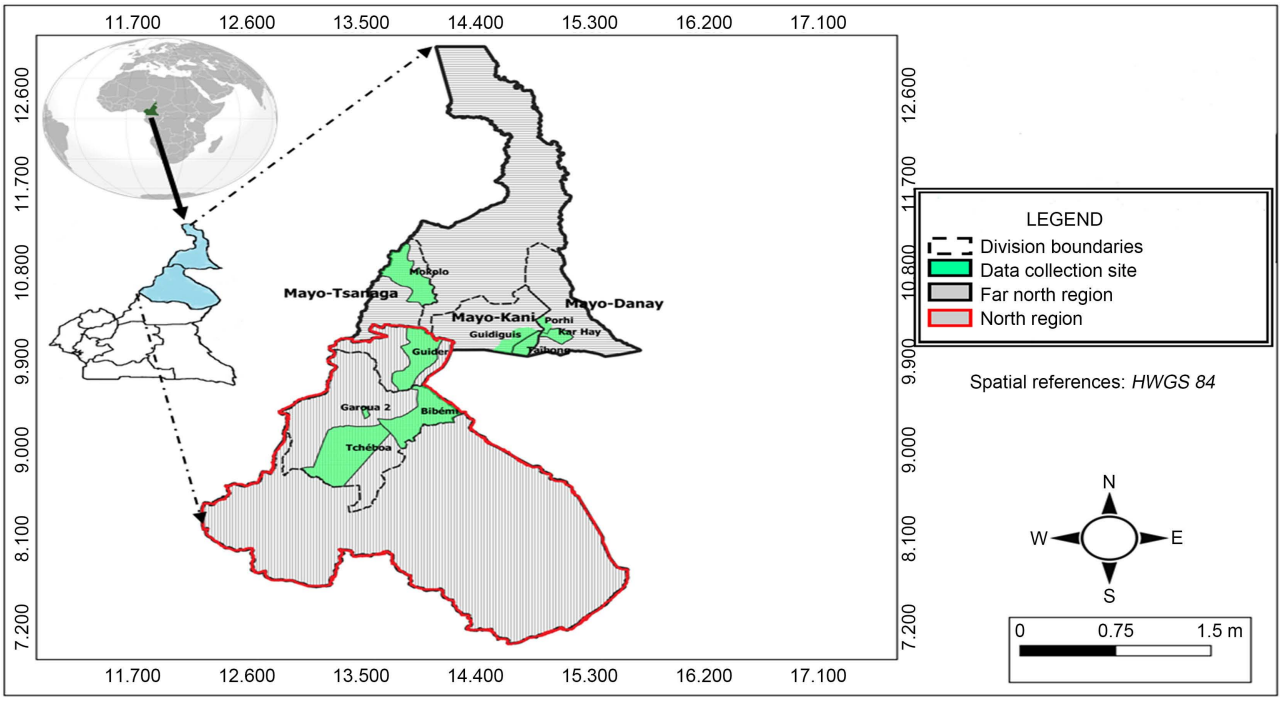


Figure 1. Study area.

using a formal questionnaire developed for this purpose according to the approach established by the African Union Interafrican Bureau For Animal Resources (AU-IBAR [19]). The Chi-square test was used to test the adequacy between the plumage and the different factors listed during the study in order to show the dependence between these random variables.

3. Results and Discussion

3.1. Identification of Producers

Table 1 shows that the activity is dominated by men (73.77%) who in their majority have not crossed the average course. They are farmers (54.10%), retired civil servants (18.04%), traders (14.75%) and teachers (4.91%). The activity is considered incidental and therefore little consideration is given to it. Almost all breeders, because of their level of education, say they know nothing about genetic diversity and nevertheless its importance. As shown by the work of Dongmo *et al.* [20], Massawa *et al.* [12], Teye and Adam [21], the majority of operators in the guinea fowl sector have a very low level of education. Beyond this observation, Teye and Adam [21] reported that the activity is just secondary, which further complicates their interest in animal welfare.

3.2. Knowledge about Reasoned Agriculture

The purpose of the data in Table 2 is to verify whether the guinea fowl breeders surveyed have the required knowledge on sustainable breeding that takes animal welfare into account. The results show that almost all farmers say they have never heard of sustainable agriculture or its merits. The notion of animal welfare,

Table 1. Activities, level of education and gender of producers.

Profession	Size	%	Education level	Size	%	Gender	Size	%
Agricultural agent	5	8.2	Illiterate	31	50.81	♂	45	73.77
Farmers	33	54.1	FSLC	14	22.96			
Traders	9	14.75	F4 and below	12	19.67			
Teachers	3	4.91	GCE OL	3	4.92	♀	16	26.23
Retired people	11	18.04	GCE AL	1	1.64			
Total	**61**	**100**	**Total**	**61**	**100**	**Total**	**61**	**100**
Khi²				*				

♀: Female; ♂: Male; **FSLC**: First School Leaving Certificate; **F4**: Form 4; **GCE**: General Certificate of Education; **OL**: Ordinary Level; **AL**: Advanced Level; *: not significant.

Table 2. Assessment of farmers' knowledge of sustainable agriculture.

Notions of sustainable farming	Yes		No		Abs		Khi²
	Ts	Fr (%)	Ts	Fr (%)	Ts	Fr (%)	
Animal welfare	02	3.27	55	90.17	04	**6.56**	
Adaptability	11	18.03	48	78.70	02	3.27	
Conservation genetics	04	6.56	57	93.44	00	00	
Animal genetic diversity	13	21.31	48	78.69	00	00	
Genetic drift	00	00	59	96.73	02	3.27	*
Selection	07	11.47	54	88.53	00	00	
Ecosystem balance	05	8.20	53	86.89	03	4.91	
Profitability of breeding	15	24.60	46	75.40	00	00	
Climate change	13	21.31	47	77.06	01	1.63	
Environment x Genotype interaction	01	1.63	60	98.37	00	00	
Sustainable agriculture	02	3.27	58	95.10	01	1.63	

Ts: Totals; **Fr**: Frequency; **Abs**: Abstention; **Khi²**: Khi² test; *: not significant.

translated into their respective dialect, made them laugh each time with the same reactions of astonishment. For some, we can at least speak of the well-being of bulls, horses and donkeys that pull the plow for agriculture. These animals, they say, must have chaff and cake frequently to provide them with the energy they need to pull the plow. On the other hand, poultry in general and guinea fowl in particular do not provide any effort in rural activities and could not benefit from any favor.

Despite this reasoning, many recognize that the environment for rearing guinea fowl seems to have changed: More and more guinea fowl are fleeing into the brushwood that punctuates the villages where they seem to find peace, animals that are increasingly becoming more vulnerable to pathologies which once only affected chickens, the temperature which seems to have increased making it difficult to channel and control the animals, the predators which seem to be increasingly present around the concessions, the low agricultural yield which makes it

difficult to distribution of cereals (red millet, sorghum, corn, etc.) to animals, the virtual disappearance of termites which were the main source of protein for guinea fowls. In this regard, they accuse the abusive use of pesticides and fertilizers.

These results confirm those obtained by Teye and Adams [21] who reported in their work on the constraints to guinea fowl production in northern Ghana that the vast majority of guinea fowl breeders do not have knowledge of livestock management breeding. Nevertheless, Ioan *et al.* [16] confirm the remarks of the breeders because they showed that a significant loss of biodiversity occurs, deeply affecting nature and living things, causing changes in the natural habitat. These changes are due to agricultural production systems that overuse chemicals and deforestation that profoundly alter the habitat of poultry.

3.3. Number of Animals Counted by Locality and Plumage

A total of 671 adult guinea fowls were counted according to their plumage among 61 breeders in the 13 localities (Table 3). Eight major plumages have been identified. The dominant color is pearl grey with a frequency of 38.89% followed by Violet (black color) (13.85%), royal purple (12.81%), Pie (9.53%), Bronze (7.30), Buff (6. 85%), Lavender (6.11%) and White (4.61%). The contingency test on the representation of the different colorations according to the localities gives the asymptomatic significance values (p-value) all above the significance threshold of 0.05.

Table 3. Number of animals listed by locality and coloration of guinea fowl aged between five months and more.

Localities	Number of animals by plumage									Khi^2
	Pg	Rp	Buf	Wht	Pie	Vio	Brz	Lav	Ts	
Tchatibali	32	8	2	2	8	10	7	4	73	
Bibemi	16	7	4	4	3	6	2	3	45	
Doukoula	27	8	2	4	5	7	4	4	61	
Guider	24	10	5	4	5	5	3	4	60	
Guidiguis	30	9	3	2	7	13	4	7	75	
Mokolo	13	4	7	2	3	6	3	3	41	
Kalfou	12	4	4	2	2	3	2	2	31	*
Mafa-tcheboa	9	7	3	2	3	5	4	0	33	
Mayo-Lope	10	1	4	1	5	7	3	2	33	
Ngong	18	4	2	3	2	5	1	3	38	
Nyakira	9	4	1	0	4	1	1	2	22	
Touloum	28	11	4	2	12	11	7	3	78	
Dziguilao	33	9	5	3	5	14	8	4	81	
Total	**261**	**86**	**46**	**31**	**64**	**93**	**49**	**41**	**671**	
Frequency	38.89%	12.81%	6.85%	4.61%	9.53%	13.85%	7.30%	6.11		

Pg: Pearl grey; **Rp**: Royal purple; **Buf**: Buff; **Wht**: White; **Pie**: Pie; **Vio:** Violet; **Brz**: Bronze; **Lav**: Lavender; **#**: Number of breeder; **Ts**: Totals; **Khi^2**: Khi^2 test; *: not significant; **: Significant.

These plumage colorations encountered are part of the twenty-two variations of colors recognized and reported by the Guinea Fowl International Association (2009). Issoufou [22] in Niger listed nine plumage colors (Brown, White, Lavender, Pearl Grey, Coral Blue, Brown Pied, Pied, Bronze Pie and Bronze). Pearl grey plumage is most common in all localities as observed by Issoufou [22] in two regions of Niger and by Agbolosu *et al.* [23] in Ghana. The GFIA [24] also reported that white albino varieties with pristine plumage are quite rare.

3.4. Animal Losses According to Localities and Plumage Coloration

A total of 154 animals were lost by operators with a frequency of 22.95% (**Table 4**). Depending on the plumage, White comes first with a frequency of 51.61%, followed by Lavender (36.58%), Buff (36.95%), Royal Purple (20.93%), Bronze (20.40%), Pie (20.31%), pearl-grey (18.77%) and Violet (black) (17.20%). The locality of Bibemi comes first with 16 guinea fowl lost out of 45 for a percentage of 35.55% followed by the locality of Guidiguis with 17 guinea fowl lost out of 75 for a percentage of 22.6%.

The Khi^2 test of guinea fowl losses according to plumage and locality gives asymptomatic significance values (p-value) all above the significance level of 0.05. We conclude that there is no significant difference between animal losses and localities at the 5% threshold. The same factors responsible for the loss of guinea fowl are present in all localities. Dao [25] in Burkina Faso also presented in his work on the socioeconomic and phenotypic characterization of local guinea fowl populations in Burkina Faso that guinea fowl mortality is observed in all localities. Dahouda *et al.* [26] in Benin reported the same finding during their work on the constraints related to the breeding of guinea fowl. However, these authors did not show that these losses are more oriented toward guinea fowl with light plumage as evidenced by our results.

3.5. Factors Affecting the Loss of Guinea Fowls

Table 5 shows that in the traditional way of rearing guinea fowl in a village environment where the animals are completely free, the main causes of the loss of animals by farmers are, among other things, predation, theft, flight of animals and pathologies. Predation is the major constraint with a frequency of 35.72%. The predators frequently cited by operators in guinea fowl farms are, among others, dogs, pigs, domestic cats, snakes, monitor lizards, and tiger cats. Furthermore, the results show that the guinea fowl most targeted by the above-mentioned predators are white plumage with a frequency of 56.25% followed by Buff plumage (41.17%) and Lavender plumage (40%). On the other hand, the predation is weak for the black (violet) plumage (25%), the royal purple (33.34) and pearl grey plumage (34.69). These results show that the brightness of the coloration seems to favor predation and therefore seems unfavorable for the genetic resources that carry these characters. Knowing that most predation takes place at night, guinea fowl with dark or barred plumage seem to benefit from the providence of nature.

Table 4. Evaluation of animal losses according to localities and plumage.

Localities	#	Animal losses									Khi²
		 Pg	 Rp	 Buf	 Wht	 Pie	 Vio	 Brz	 Lav	Ts	
Tchatibali	6	6	2	2	2	1	1	0	1	**15**	
Bibemi	4	5	0	2	4	3	1	1	0	**16**	
Doukoula	6	4	1	0	2	0	0	2	2	**11**	
Guider	5	3	3	1	2	0	1	1	2	**13**	
Guidiguis	7	8	1	2	1	1	2	0	2	**17**	*
Mokolo	4	2	2	1	1	2	2	2	1	**13**	
Kalfou	3	4	0	2	0	2	0	1	1	**10**	
Mafa-Tcheboa	3	2	3	1	0	1	1	1	0	**9**	
Mayo-Lope	3	2	0	1	0	0	2	0	2	**7**	
Ngong	4	6	1	1	0	1	2	1	0	**12**	
Nyakira	2	2	1	2	0	1	1	1	1	**9**	
Touloum	7	0	3	0	2	1	1	0	2	**9**	
Dziguilao	7	5	1	2	2	0	2	0	1	**13**	
Total	**61**	**49**	**18**	**17**	**16**	**13**	**16**	**10**	**15**	**154**	
Loss freqency		18.77	20.93	36.95	51.61	20.31	17.20	20.40	36.58		

Pg: Pearl grey; **Rp**: Royal purple; **Buf**: Buff; **Wht**: White; **Pie:** Pie; **Vio**: Violet; **Brz**: Brown; **Lav**: Lavender; **#**: Number of breeder; **Ts**: Totals; **Khi²**: Khi² test; *: not significant; **: Significant.

Table 5. Evaluation of the factors affecting the loss of guinea fowls.

Cause of losses.	 Pg	 Rp	 Buf	 Wht	 Pie	 Vio	 Brz	 Lav	Ts	Freq	Khi²
Predation	17	6	7	9	4	4	2	6	55	35.72	
Frequency	34.69	33.34	41.17	56.25	30.7	25.00	20.00	40.00			**
Theft	10	4	3	2	3	5	3	2	32	20.77	
Frequency	20.41	22.30	17.65	12.50	23.07	31.25	30.00	13.34			*
Leak	13	5	3	3	4	4	3	3	39	25.33	
Frequency	26.54	27.70	17.65	18.75	30.76	25.00	30.00	20.00			*
Diseases	9	3	4	2	2	3	2	4	28	18.18	
Frequency	18.36	16.66	23.53	12.50	15.38	18.75	20.00	26.66			*
T	**49**	**18**	**17**	**16**	**13**	**16**	**10**	**15**	**154**	**100**	

Pg: Pearl grey; **Rp**: Royal purple; **Buf**: Buff; **Wht**: White; **Pie**: Pie; **Vio**: Violet; **Brz**: Brown; **Lav**: Lavender; **Ts**: Totals; **Khi²**: Khi² test; *: not significant; **: Significant.

In addition, pearl grey guinea fowl qualified as wild type, royal purple, black and bronze guinea fowl seem to have a more developed wild instinct, which is evidenced by the frequency of recorded escapes. According to breeders, the escape of animals is favored by several factors such as:

- The number of livestock: it has a stabilizing effect on guinea fowl. The greater the number of livestock, the less there are guinea fowl escapes. As a result, small holders regularly lose animals to large numbers.

- The presence of a dog in the house: regardless of their plumage, guinea fowls are frightened by the sounds of dogs and tend to flee the house.

- The age of the guinea fowls: The oldest guinea fowls tend to be less frequent in the concessions.

- The stress generated by the brutal capture of one of theirs for sale or consumption.

The Khi^2 test shows that there is a significant difference between predation and bright plumage.

These results confirm those obtained by Gluckman and Mundy [27] who showed that the striped feather pattern helps birds blend into the environment. For Hill and McGraw [28], the dark plumage facilitates camouflage. McAinsh *et al.* [29] reported in Zimbabwe that losses due to predation are the main constraint to guinea fowl rearing. In descending order, the predators reported by breeders are snakes, hawks, shrews, dogs, pigs, ducks, cats and lizards. Dahouda *et al.* [26] presented the same predators in Benin and Burkina Faso. However, none of his studies show a difference in predation between different animal colorations.

3.6. Plumage and Breeding Traits Sought

Table 6 shows that the choice of guinea fowl color for breeding depends on the criteria accepted by public opinion and which seem to find justification. Of all the guinea fowl breeders interviewed, 27.87% choose the color according to the docility of the animals in breeding and their resistance to infections. In addition, 24.6% say they choose animals according to their thermal resistance and for the remaining 19.67% of breeders, their choice of plumage is mainly guided by the prolificacy of laying. Thus, on the basis of these four criteria, we find that white, Buff and lavender guinea fowl seem more docile in breeding. Similarly, white and buff guinea fowl seem to resist heat stress better than other phenotypes. Since color plays a role in the absorption and reflection of incident solar radiation, birds with black phenotypic characteristics may be more susceptible to heat stress under intense solar radiation from the Sudano-Sahelian zone. Birds with light plumage (White, Buff and Lavender) on the other hand, may be more tolerant in the same conditions. This absorption and reflection of light rays by the plumage could also condition the docility of light-coloured animals which feel less threatened by thermal stress or, on the other hand, reinforce the wild instinct of animals with dark plumage which seem to escape for less stressful horizons.

Table 6. Evaluation of the breeding traits according to the plumage.

Breeding traits	Number of animals by plumage								Ts	Freq	Khi²
	 Pg	 Rp	 Buf	 Wht	 Pie	 Vio	 Brz	 Lav			
Docility	2	1	4	5	0	1	2	3	17	**27.87**	**
Frequency	22.2	12.5	50.0	50.0	0	12.5	33.3	50.0			
Laying	3	2	1	0	2	3	1	0	12	**19.67**	*
Frequency	33.3	25	12.5	0	33.3	37.5	16.7	0			
Disease resistance	3	4	1	0	3	3	2	2	17	**27.87**	*
Frequency	33.3	50.0	12.5	0	50.0	37.5	33.3	33.3			
Heat stress resistance	1	1	2	5	1	1	1	1	15	**24.60**	**
Frequency	**11.2**	**12.5**	**25**	**50.0**	**16.7**	**12.5**	**16.7**	**16.7**			
Ts	**9**	**8**	**8**	**10**	**6**	**8**	**6**	**6**	**61**	**100**	

Pg: Pearl grey; **Rp**: Royal purple; **Buf**: Buff; **Wht:** White; **Pie**: Pie; **Vio**: Violet; **Brz**: Brown; **Lav**: Lavender; **Ts**: Totals; **Khi²**: Khi² test; *: not significant; **: Significant.

On the other side, guinea fowls with dark plumage seem to be more sought after in breeding for their supposed prolificacy in laying eggs and their resistance to infections. Paradoxically, resistance to heat stress seems to have developed in guinea fowls with dark plumage, an ability to resist certain infections compared to light coloured guinea fowls. The Khi² test shows that there is a significant difference between the plumage and the docility of the animals on the one hand and the resistance to heat stress on the other hand.

These results confirm those obtained by Ayorinde *et al.* [30] who showed that plumage coloration and genetic variations seem to affect the performance of birds, in particular their productivity and their capacity for resistance under traditional agricultural conditions. They showed a significant difference in feed intake and conversion between white, grey, black and ash varieties. Beaumont and Chapuis [23] have also shown that man has always looked for animals that are not very sensitive to stress, because they are then more efficient and easier to raise. Conversely, Boko *et al.* [31] in the study on the actogram of local keets subjected to heat stress in Benin showed that temperature and humidity affect the performance of keets despite their resistance and thus, independently of their coloration. Although Boko *et al.* [32] and Sanfo *et al.* [33] showed that guinea fowl are in general less susceptible to infections, these authors did not show a correlation between guinea fowl plumage and their susceptibility to infections. If the resistance of guinea fowls with light plumage to heat seems logical because of the reflection of light by their plumage, other factors such as the docility of the animals, the laying ability and the resistance to infections such as expect our results must be the subject of in-depth studies to confirm or refute these results.

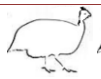
3.7. Plumage and Market Demand

Table 7 shows that plumage influences the choice of guinea fowl. Among the selection criteria related to the plumage, we have the traditional rites, the color of the meat, the weight of the animals in adulthood and the offerings. It emerges from this table that 14.76% choose the color of the plumage for the traditional rites, 31.14% make the choice for the color of the meat, 27.87% for the weight and 26.23% for the offerings in sacred places or for important people.

Thus, White and Buff guinea fowl are preferentially requested for traditional rites with 30.7% and 25% respectively and for offerings. In addition, light guinea fowls (White, Buff and Lavender) urged them as their choice of meat, which is similar to that of chicken. Nevertheless, according to the breeders, the white guinea fowl have a reduced size compared to the others, which would partly explain their low frequency in the herds. On the other hand, dark guinea fowl seem to be more in demand for their weight: Pearl grey (42.5%), Royal purple (50%), Piebald (40%), Black (50%), and Bronze (25%).

While the choice of animals for criteria such as weight and meat quality seems objective and justifiable, the choice of colors for traditional rites and offerings is more subjective. The white color associated with purity and innocence seems to be more in demand for rites. Among the Mafa people of the far north of Cameroon, for example, a pair of white guinea fowl is sacrificed on the wedding night if, after verification, the young bride is still a virgin. This rite, long perpetrated and today in the process of disappearing, is a symbol of blessing, prolificacy and above all a recognition towards the young bride who is considered to have no defilement and therefore deserves the confidence of her husband for a life of happy couple. Among the Dagombas and Gonjas in northern Ghana, Teye and Adam [21] also reported that pure white guinea fowl is used for religious sacrifices and to perform certain funeral rites.

Table 7. Evaluation of demand on the market according to plumage.

Market demand traits	Number of animals per plumage								Ts	Freq	Khi²
	 Pg	 Rp	 Buf	 Wht	 Pie	 Vio	 Brz	 Lav			
Ritual	1	0	3	4	1	1	1	0	09	**14.76**	**
Frequency	14.3	0.0	25.0	30.7	20.0	16.7	25.0	0.0			
Meat color	2	2	4	6	1	1	1	3	19	**31.14**	*
Frequency	28.6	25.0	33.4	46.2	20.0	16.7	25.0	42.8			
Weight	3	4	1	0	2	3	1	2	17	**27.87**	**
Frequency	42.8	50.0	8.32	0.0	40.0	50.0	25.0	28.6			
Offerings	1	2	3	3	1	1	1	2	16	**26.23**	*
Frequency	**14.3**	**25.0**	**33.4**	**23.1**	**20.0**	**16.7**	**25.0**	**28.6**			
Ts	**7**	**8**	**11**	**13**	**5**	**6**	**4**	**7**	**61**	**100**	
Frequency	100	100	100	100	100	100	100	100			

Pg: Pearl grey; **Rp**: Royal purple; **Buf**: Buff; **Wht**: White; **Pie**: Pie; **Vio**: Violet; **Brz**: Brown; **Lav**: Lavender; **Ts**: Totals; **Khi²**: Khi² test; *: not significant; **: Significant.

Contrary to the ancestral ritual among the Mafa people and the Dagombas and the Gonjas who have a preferential choice for the white guinea fowl, Anthony [34] mentioned that in the Afro-Brazilian community descending from the Yoruba (Nigeria and Benin), the sacrifice of any guinea fowl carries the transformative energy of destiny. This sacrifice of the guinea fowl in the ancestral tradition of this people appears to be decisive for the dynamic balance of the cults, the reproduction of the religious system based on initiation.

Moreover, these results confirm the work of Kgakole *et al.* [35]. These authors recently showed in their work on the growth performance of lavender, pearl grey, royal purple and white guinea fowl in Botswana that royal purple and pearl grey guinea fowl had the highest weights in adulthood, unlike white guinea fowl. Sanfo *et al.* [17] showed that native guinea fowl varieties have different asymptotic weights depending on the phenotype. Black and pearl grey guinea fowl weigh more than lilac and white guinea fowl. Although Khan *et al.* [36] showed that the nutritional and organoleptic qualities of guinea fowl meat can vary according to genetics, gender, age and rearing conditions, they did not specify that these organoleptic qualities are in favor of the white guinea fowl as evidenced by our results. Furthermore, Houndonougbo *et al.* [37] showed that guinea fowls of different colorations and of the same age reared under the same conditions showed a variation in weight. This observed weight difference could be explained by genetic differences between the ecotype.

3.8. Intra-Specific Conflicts

Table 8 shows that the dominant/dominated relationship in poultry in general and in particular in guinea fowl depends above all on the number of intra-specific individuals. The number of guinea fowl with the same plumage coloration seems to have a group effect on the other plumage on the one hand and on all poultry on the other hand. The pearly grey, royal purple, black and pied guinea fowls in large numbers in most of the flocks seem to have a dominance in terms of food, mating or strategic positions in the henhouse or on the tree branches. This

Table 8. Evaluation of intra-specific conflicts.

	 Pg		 Rp		 Buf		 Wht		 Pie		 Vio		 Brz		 Lav		Khi²
Causes of conflicts	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	
Watering	+	+	+	+	-	+	-	-	±	±	+	+	+	±	±	-	
Grain pecking	+	+	+	+	-	-	-	-	±	-	+	+	+	+	-	-	
Place of choice	+	+	+	+	+	±	-	-	+	-	+	+	+	+	+	±	*
Chasing insects	+	+	+	+	-	+	±	-	+	±	+	+	+	+	-	-	
Mating	+	/	+	/	-	/	-	/	+	/	+	/	+	/	-	/	

Pg: Pearl grey; **Rp**: Royal purple; **Buf**: Buff; **Wht**: White; **Pie**: Pie; **Vio**: Violet; **Brz**: Brown; **Lav**: Lavender; **Ts**: Totals; **Khi²**: Khi² test; *: not significant; **: Significant; +: dominant; -: dominated; ±: more and less dominant; /: not observed; ♂: male; ♀: female.

dominant-dominated relationship is even more visible when food resources are even more limited. In addition to the group effect, the stay of the animal in the environment is essential to assert itself. Thus, according to breeders, new animals are easily dominated regardless of their plumage. These results could partly explain the flight of animals for livestock with large numbers because animals with small numbers according to their plumage seem to seek refuge in livestock where they are well represented. Our results are in line with those of the work of Jens *et al.* [38] who showed in their manual on the technique of poultry production in a village setting that dominance relationships are frequently observed within animals. For Julien [39], long-term dominance relationships have a negative impact on the well-being of the animal genetic resource, hence the need to improve the framework of animal genetic resources. Although no work has been carried out on the dominance relationship between guinea fowl on farm, these results obtained based on the observations and experience of guinea fowl breeders must be studied in other studies with new approaches to confirm or invalidate these results because dominance relationships are a constraints to breeding.

4. Conclusion

The objective of this work was to make an inventory of the traits that influence the choice of breeders according to the plumage on the one hand and the constraints related to the plumage that handicap this breeding and cause the loss of animal genetic resources. Docility, egg laying, thermal and pathological resistance, meat quality, weight, and market demand are some factors that guide breeders to choose a type of plumage in native guinea fowl breeding. In this study, we can easily make a link between the very small number of white guinea fowl on the farms and the following reasons: their exclusion by the farmers because of their size which seems small and their supposed low capacity to lay eggs compared to wild types, their almost easy predation favored by the brilliance of their plumage in the moonlight without however neglecting their preferential use in certain ritual events. Added to these constraints are the dominance relationships that are unfavorable to pale guinea fowl in general and white guinea fowl in particular. In traditional farming where food is already a major constraint for the survival of animals, the lack of knowledge required to conduct farming that respects animal welfare with a view to its development in its environment and the relegation of Activity in the background are all factors that make it particularly difficult for certain plumages such as the white to adapt, which could explain their low numbers on farms. Conversely, dark guinea fowls in general and the wild type in particular seem more suitable for traditional breeding because not only do they have a great capacity for camouflage to escape predators but also seem to have a great conformation and seem to be more resistant to attacks pests and heat stress. These traits would be at the origin of the choices of breeders for these plumages. These preferences of producers driven by socio-economic factors could in the long term be the cause of genetic erosion

and therefore have serious consequences for the genetic diversity within the local guinea fowl population. This work is a preliminary to functional genomics, which aims to identify genes whose expression is linked to a function or a trait.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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