International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Management of the Trypanosomal Risk by Livestock Farmers in the Agropastoral Zone of Côte d'Ivoire

K. I. Kouadio[1], M. Koffi[2], D. P. Sokouri[3]

[1]Université Félix Houphouet Boigny, UFR Biosciences, Laboratoire de Biotechnologie, Agriculture et Valorisation des Ressources Biologiques, Abidjan, Côte d'Ivoire.,
Corresponding author, E-mail: *kpandji_2010[at]yahoo.fr*

[2] Université Jean Lorougnon Guédé, UFR Environnement, Unité de Recherche en Génétique et Epidémiologie moléculaire, BP 150 Daloa, Côte d'Ivoire,
m9koffi[at]yahoo.fr

[1]Université Félix Houphouet Boigny, UFR Biosciences, Laboratoire de Biotechnologie, Agriculture et Valorisation des Ressources Biologiques, Abidjan, Côte d'Ivoire
didiersokouri[at]yahoo.fr

Abstract: ***The aim of this study is to analyse trypanosomal risk management practices by cattle breeders in the agropastoral zone of Côte d'Ivoire, where trypanosomal risk remains high. During individual interviews, a semi-open questionnaire was submitted to 36 cattle breeders in the departments of Ferkessédougou and Bouna to gather information on the structure of their various livestock holdings, animal health and trypanosomal risk management practices. None of the farmers surveyed practised tsetse fly control individually or collectively. However, all farmers use trypanocidal molecules (isometamidium chloride and diminazene aceturate) to treat their animals as a preventive or curative measure. These treatments are frequent and are under-dosed in 16.17% of cases, thus running the risk of inducing resistance to trypanocide molecules in livestock farms.***

Keywords: trypanosomal risk, management, trypanocides, breeders, Côte d'Ivoire

1. Introduction

African animal trypanosomosis (AAT) is a disease of veterinary importance caused by flagellate haemoparasites of the genus *Trypanosoma*, mainly transmitted by tsetse or tsetse flies. African Animal Trypanosomiasis occurs in 37 countries in the sub-Saharan zone, where 46 million cattle are exposed to AAT [1]. AAT remain major pathological constraints for the development of livestock farming in sub-Saharan Africa, hindering or preventing livestock production in areas with high fodder and agricultural potential [2], [3].

Control strategies against animal trypanosomiasis consist of acting either on the vector, or on the natural resistance of certain breeds of animals by involving rangeland management in order to avoid contact with tsetse flies, or on the causal agent through the use of trypanocides, the most commonly used of which are isometamidium chloride and diminazene aceturate [4].

In Côte d'Ivoire, the northern Sudanese region (78.3% of the livestock population) appears to be a region with an agro-pastoral vocation. However, the AAT represents a major constraint to livestock production there (Boka *et al.*, 2019). The prevalences of the TAA in this zone are very high and can be over 20% [5], [6].

The trypanosomal risk, which represents the probability that an animal is infected with a trypanosome, depends on vector-related factors, but also on the practices of livestock owners who expose their animals to varying degrees of risk and the different strategies for controlling AAT (trypanotolerant livestock, preventive/curative trypanocides, vector control) [7]. Thus, the objective of this study is to analyse trypanosomal risk management practices in cattle by livestock farmers in two northern departments with an agropastoral vocation in Côte d'Ivoire.

2. Materials and Methods

2.1 Study area

The study was carried out in the departments of Ferkessédougou and Bouna in northern Côte d'Ivoire (Figure 1). These departments are characterised by their large agropastoral capacity. Livestock in Ferkessédougou district are mainly trypanosensitive cattle (Zebu), while in Bouna district trypanotolerant cattle are still found in the farms of local farmers.

The departments of Ferkessédougou and Bouna border on each other. They are located at 9°5 north latitude and -4°75 west longitude and are bordered to the north by Burkina Faso. The department of Ferkessédougou is covered with wooded savannah while the department of Bouna is covered with Sudano-Guinean wooded savannah, wooded savannah and open forests. The climate of these two departments is very hot and very dry (Sudanese type). It has four seasons, including two rainy and two dry seasons. The economic activities of the two departments are essentially agriculture and livestock breeding, which is done in the traditional way. Contagious bovine pleuropneumonia is the main livestock

disease in the two departments. However, foot-and-mouth disease and haemorrhagic septicaemia are prevalent in Bouna department.

Figure 1: Agro-ecological zones of Côte d'Ivoire and framework of the study

2.2 Methods

Breeders' selection

The choice of farmers was made according to the sites selected for the cross-sectional and longitudinal parasitological study carried out within the framework of the same research work in the northern zone with an agro-pastoral vocation [5], [6]. Thus, the choice of sites was made taking into account the different geographical axes of each department to ensure total geographical coverage of the department. However, in each department, farms with a low number of cattle (< 60 head) or those with very difficult access were excluded.

Interview with breeders

The interview with the cattle breeders was individual. It took place in July and August 2012 for the Ferkessédougou department and in March and April 2013 for the Bouna department. The interview consisted of filling in a semi-open questionnaire aimed at collecting information on the practices of trypanosomal risk management by the breeders, focused on the structure of the different farms, the health of the animals and the use of trypanocidal products.

Statistical analysis of data

The frequencies of qualitative variables relating to the sanitary situation of the animals (clinical signs observed, disease control) and to the specific management of AAT (knowledge of AAT, tsetse fly control, treatment of AAT, use of trypanocides) were calculated. The mean and standard deviation of the quantitative variables relating to herd structure (size of herds, composition of cattle breeds) were also calculated and followed by an analysis of variance. These tests were carried out using STATA 9.2, STATISTICA version 7.1 and R version 2.8.0.

3. Results

3.1 Structure of livestock farms

The farm structure could only be established for the Ferkessédougou farms (Table 1). The average number of cattle on the sampled farms in the department is 145. However, significant differences in numbers were observed between these farms. The Ouangolo Corridor and Doulovogo farms, located in the north, with less than 100 head, had the smallest numbers, while Tièkpè, located in the north-west, and Sourougoutogo, located in the south-east, with around 200 head, had the largest numbers.

Table 1: Size and cattle breed composition of the farms surveyed in the department of Ferkessédougou

Locality/ village	*Animal numbers*	*Zebu breed*	*Méré Breed*	*Trypanosensitive cattle*
		Number (Percentage)	*Number (Percentage)*	*Number (Percentage)*
Ferké 1-SUCAF	167	167(100%)	0(0)	167(100%)
Tièkpè	199	199(100%)	0(0)	199(100%)
Corridor Ouangolo	69	68(98.55%)	1(1.45%)	68(98.55%)
Doulovogo	92	89(96.74%)	3(3.26%)	89(96.74%)
Sourougoutogo	203	203(100%)	0(0)	203(100%)
Sangori/ Dabla	142	142(100%)	0(0)	142(100%)
Total	872			868(99.54%)
Nombre Moyen	145,33	144,67	0,67	144,67
Ecart-type	55,42	56,28	1,21	56,28

A breakdown by breed shows that the livestock in Ferkessédougou district is composed mainly (99.54%) of trypanosensitive animals (Zebu), i.e. vulnerable to animal trypanosomosis. Only the farms of the Ouangolo and Doulovogo Corridor, located in the north, included animals of the Méré breed (a cross between a zebu and a baoulé) with respective proportions of 1.45% and 3.26%. No animals of the Baoule or N'dama breeds were registered in the sampled farms.

The age structure of Ferkessédougou's animals revealed that young cattle (1 to 4 years old) were the most numerous on the farms (56.42%). They were followed by adults (more than 4 years old) and calves (less than 1 year old) which represented 23.97% and 19.61% of the animals respectively. In addition, the farms are characterised by a large number of females. In fact, cows made up more than three-quarters (79.01%) of all cattle counted (Table 2).

3.2 Animal health and disease control

Data on the general health of the animals could be obtained from the farms in Bouna Department. A total of 30 cattle farm owners filled in the survey forms.

Clinical signs (diarrhea, skin diseases, breathing difficulties, fevers and deaths) and the presence of ticks sought in animals were reported by the majority of the 30 herders interviewed (Table 3). Diarrhea, fever and ticks were highly observed in the farms with a percentage of 93.33% for each

of the first two clinical signs and 100% for the third clinical sign. Fever, taste depravation and abortions, which are signs of suspected AAT, were recorded in more than 50% of the farms.

Table 2: Number and percentage of animals in the different farms surveyed according to age and sex in the department of Ferkessédougou

Locality/village	*Animal numbers*	*0-1 year*	*1-4 year*	*4 years and more*	*Females*
		Number (%)	*Number (%)*	*Number (%)*	*Number (%)*
Ferké 1-SUCAF	167	11 (6.59)	112 (67.07)	44 (26.35)	118 (70.66)
Tièkpè	199	52 (26.13)	90 (45.23)	57 (28.64)	163 (81.91)
Corridor Ouangolo	69	13 (18.84)	39 (56.52)	17 (24.64)	58 (84.06)
Doulovogo	92	31 (33.70)	58 (63.04)	3 (3.26)	78 (84.78)
Sourougoutogo	203	23 (11.33)	113 (55.66)	67 (33.00)	153 (75.37)
Sangori/ Dabla	142	41 (28.87)	80 (56.34)	21 (14.79)	119 (83.80)
Total	872	171 (19.61)	432 (56.42)	209 (23.97)	689 (79.01)
Nombre Moyen	145.33	28.50	82	34.83	114.83
Ecart-type	55.42	16.07	29.51	25.03	40.96

Table 3: Clinical signs and mortalities in Bouna's farms

Animal health status	*Farms concerned Number (Percentage)*	*Farms not concerned Number (Percentage)*	*Total*
Signes cliniques			
Diarrhea	28(93.33%)	2(6.67%)	60
Skin diseases	19(63.33%)	11(36.67%)	60
Breathing difficulties	23(76.67%)	7(23.33%)	60
Fever	28(93.33%)	2(6.67%)	60
Other signs (taste depravation, joint problems, cough)	19(63.33%)	11(36.67%)	60
Ticks	30(100%)	0(0)	60
Ages of Mortality			
young animals	25(83.33%)	5(16.67%)	60
Adults	13(43.33%)	17(56.67)	60
Abortions	21(70%)	9(30%)	60

Livestock disease control is based on a variety of uses, including traditional methods. Vaccination against infectious diseases (pasteurellosis, asymptomatic anthrax and CBPP) and de-worming of animals are practiced annually by 90% and 100% of livestock owners respectively. Lack of financial resources is the reason put forward by some farmers to explain the absence of vaccination of their animals. In general, livestock owners opt for external and internal de-worming of their animals. The association of traditional methods to the treatment of animals is practiced by a quarter (26.67%) of the people surveyed. Traditional methods consist essentially of the use of decoctions or potions made from roots or leaves of trees supposed to have medicinal virtues. The combination of salt and the leaves of different trees is often used to treat AAT.

Furthermore, the surveys revealed that visits by livestock managers and veterinarians are mostly very rare for the former and mostly regular for the latter. Only 3.33% of livestock owners said they were visited by supervisory staff, and 70% of them said they were visited regularly by veterinarians.

3.3 Trypanosomal risk management

Ability of farmers to recognise the symptoms and the vector of AAT

The results of the surveys reveal that the majority of the Bouna herders recognise at least three of the clinical signs of AAT. Indeed, 76.67% of these herders know that fever, depravation of taste (pica) that leads animals to eat the soil, and significant weight loss are signs that lead to the suspicion of AAT. The presence of these symptoms in the farms was reported by 70% of the farmers. In addition, 90% of breeders are able to identify tsetse flies, the vector of AAT, by size or shape and colour. Thus, 80% of them have noted the presence of these flies in their farms.

Tsetse control and treatment of AAT

The fight against tsetse is not practised by all the breeders of Bouna. Only 43.33% of them use various methods including the use of veterinary products and traditional methods to keep flies away from animals or to kill them. BAYTICOL and DOMINEX are the veterinary products used for the body treatment of animals. Traditional methods consist of chasing flies away by the smoke from the burnt leaves of a tree that has properties for this purpose.

As far as the treatment of AAT is concerned, all the breeders in the Bouna department interviewed stated that they use trypanocidal products (Typamidium® and Berenil®) as a preventive or curative measure. In addition, 3.33% of these farmers claim to combine decoctions made from the roots and leaves of trees supposed to have medicinal virtues.

Reason for trypanocidal drugs use

Throughout the study area, trypanocidal drugs have been used by farmers for a variety of reasons. Prophylactic treatment of animals justified the use of trypanocides by 83.33% of farmers in Ferkessédougou and 53.33% of farmers in Bouna.

Diagnosis of AAT by veterinary agents and suspicions of AAT by livestock owners were secondary reasons for the use of trypanocides. In Bouna, 6.67% of herders treated their animals with trypanocides on the advice of other herders.

Whatever the reason for the use of trypanocides by farmers, the treatment of animals always begins with the administration of a diminazene-based product (Berenil®, Verben®), followed 2 weeks to a month later by the administration of an isometamidium-based product (Typamidium®).

Animal treatments

Responses from the survey show that most herders treat their animals for AAT in the rainy season. In Ferkessédougou, 100% of the herders interviewed claimed to treat their animals at the beginning of the rainy season, compared with

90% in Bouna (Figure 2). Treatment against AAT concerns all breeds of cattle on the farms, except in Bouna, where 3% of herders claimed to treat animals of the trypanosensitive Zebu breed.

During treatment, in general, herders do not apply the same dose to all animals in the herd. Treatments are done according to the age and/or weight of the animals. In Ferkessédougou, 66.67% of herders said they administer the remedy to animals according to their age and 16.67% according to their weight. In Bouna, 73.33% of herders reported treating their animals according to their weight and age (Figure 3). The weight of the animals is determined by estimation by the person treating them. In Bouna, 16.67% of herders treated their animals without taking into account their age or weight.

Although the majority of farmers claimed to treat their animals according to weight or age, 16.17% of them were unable to apply the correct dose. They applied lower rates than were required for the ages and weights of the animals (Figure 4).

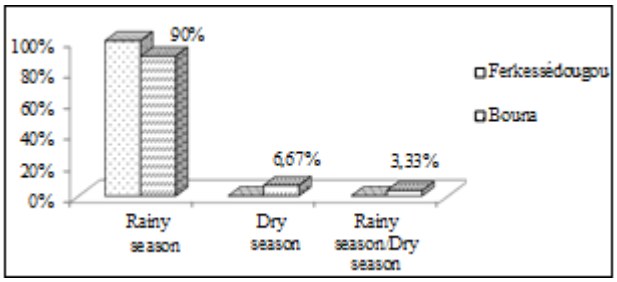

Figure 2: Season of trypanocidal treatments of animals in Ferkessédougou and Bouna

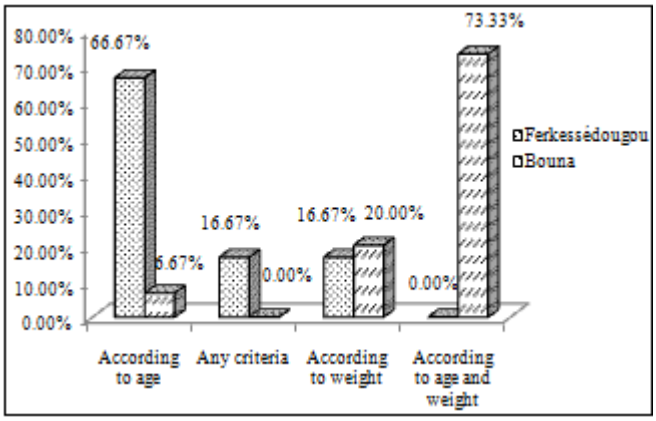

Figure 3: Criteria for the treatment of animals in the departments of Ferkessédougou and Bouna

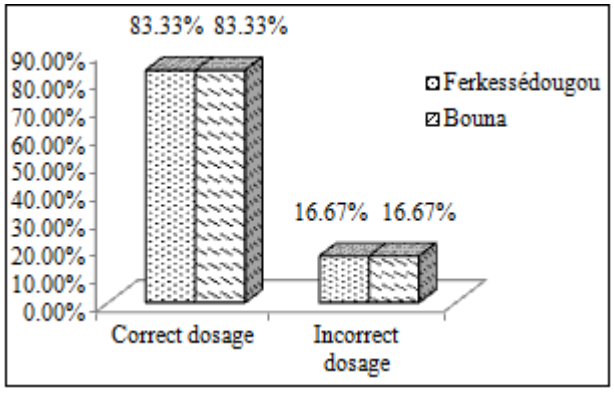

Figure 4: Quality of the dosage of trypanocidal treatments administered to animals in the departments of Ferkessédougou and Bouna

4. Discussion

Surveys on the structure of the farms in the present study revealed that the farms in the study area, particularly those in Ferkessédougou district, were mainly composed of Zebu trypanosensitive animals. A similar result was obtained in the herds of Boromo and Douroula, two localities in the Mouhoun river basin in Burkina Faso where half of the herds were composed of more than 70% trypanosensitive animals [7]. Although vulnerable to animal trypanosomosis, this breed is preferred to the others mainly for its milk yield, size, fertility, weight gain and ability to move and pull [8], [9].

In several regions of Afique, since the restructuring of veterinary services, more and more farmers are treating their sick animals themselves. This practice has serious drawbacks, as most livestock owners do not have adequate knowledge about the diagnosis and use of trypanocides, especially in cases of high prevalence of AAT [10], [7]. The present study confirms this inability of herders to diagnose AAT perfectly, as it reveals that nearly a quarter of the herders (23.33%) in Bouna do not know that fever, depravation of taste (pica) that leads animals to eat the soil, and significant weight loss are signs that lead to suspicion of AAT. A similar result was reported in Sikasso in Mali where 77.9% of the animals declared sick with AAT by pastoralists had been confirmed, suggesting that a large number of clinically ill animals had received unnecessary treatment with trypanocides [11]. In addition, this work showed that some livestock farmers misjudged the weight of their animals and/or under-treated them, thus running the risk of inducing resistance in their herds. Indeed, underdosing of therapeutic products is one of the major causes of the development of drug resistance [12], [13], [14], [15].

Tsetse control is practised by a small proportion of the Bouna breeders. However, all the breeders interviewed in this department claim to use trypanocidal products (Typamidium® and Berenil®) as a preventive or curative measure. This option for controlling AAT could be explained by the fact that the benefit of using trypanocides largely accrues to the user and their effectiveness does not depend on the participation of other livestock owners [16]. However, there is a risk that this drug practice may lead to the emergence of resistance for the following reasons: (i) the

frequent use of preventive trypanocides (isometamidium) would be likely to favour the development of chemoresistance, since in the case of treatment with isometamidium, the parasites remain in contact for a long time (more than three months) with subcurative doses, (ii) the exposure of the entire parasite population to trypanocides through systematic treatment of all animals puts strong selective pressure on the trypanosome population. Thus, the percentage of the total parasite population exposed to trypanocide at the time of treatment would be able to have an impact on the development of resistance [17].

The use of traditional methods based on the use of tree roots or leaves to treat animals with AAT or to kill or remove tsetse flies from animals has been reported by this work. This practice is also observed in Kénédougou province in Burkina Faso where some cattle herders often use a combination of salt and leaves from different trees to treat AAT [18], [7]. In addition, it has been shown by in vitro and in vivo tests that aqueous extracts of medicinal plants have trypanocidal effects [19]. The formulation of veterinary drugs from these plants with medicinal virtues against AAT could be an alternative of choice against the multiple phenomena of resistance to the currently used trypanocides.

5. Conclusion

Throughout the study area, animal disease control and animal care is generally provided by livestock owners or their herdsmen. As part of the management of trypanosomal risk, these herders and their herdsmen generally use trypanocides as a means of control, although most of them do not have adequate knowledge of AAT diagnosis and the use of trypanocides. Thus, some aspects of their practices may be conducive to the development of resistance to trypanocides.

References

[1] M. Alsan, “The effect of the TseTse Fly on African Development,” American Economic review 105: 382-410, 2015
[2] A. Sow, I. Sidibe, Z. Bengaly, J. Bouyer, B. Bauer, P. Van den Bossche, “Fifty years of research and fight against tsetse flies and animal trypanosomosis in Burkina Faso. An overview,” Bulletin of Animal Health and Production in Africa 58: 95-118, 2010.
[3] M.J.B. Vreysen, M.T. Seck, B. Sall, J. Bouyer, “Tsetse flies: their biology and control using area-wide integrated pest management approaches,” J. Invertebr. Pathol. 112: S15-S25, 2013.
[4] D. Cuisance, J. Itard, P. Solano, M. Desquesnes, J.-L. Frézil, E. Authié, "Trypanosomes. Méthodes de lutte, pp. 1695-1724. In P.-C. Lefèvre, J. Blancou and R. Chermette (eds.), Principales maladies infectieuses et parasitaires du bétail. Europe et régions chaudes, vol. 2. Lavoisier, Londres-Paris-New York.
[5] Kouadio I.K., Sokouri D., Koffi M., Konaté I., Ahouty B., Koffi A. and N’Guetta, S.P., 2014. Molecular Characterization and Prevalence of Trypanosoma Species in Cattle from a Northern Livestock Area in Côte d’Ivoire. Open Journal of Veterinary Medicine, 4,314-321. http://dx.doi.org/10.4236/ojvm.2014.412038
[6] Koffi M., Kouadio I.K., Sokouri D., Wognin M.T. and N’Guetta, S.P.J., 2014. Molecular characterization of trypanosomes isolated from naturally infected cattle in the "Pays Lobi" of Côte d’Ivoire. Journal of Applied Biosciences 83:7570– 7578.
[7] Koné N, Bouyer F, Vitouley HS, Sidibé I, N'Goran EK, Vial L, Balenghien T, and Bouyer J, 2012. Perceptions des éleveurs et stratégies de gestion du risque trypanosomien dans le bassin du fleuve Mouhoun (Burkina Faso). Cah Agric 21 : 404-16. doi : 10.1684/agr.2012.0599.
[8] Tano K., 1998. Genetic Preferences of Smallholders and Trypanotolerant Cattle in Sourthen Burkina Faso,PhD Dissertation, University of Manitoba, Winnipeg, 203 p.
[9] Toure A., 2020. Analyse des typologies d’élevage et des performances des bovins en vue d’évaluer des stratégies de développement des ressources génétiques bovines au Mali. Thèse de médecine vétérinaire. Université de Liège, Faculté de médecine vétérinaire 148 p.
[10] Mungube E.O., 2010. Management of trypanocidal drug resistance in cattle in identified chemoresistance hot spots in the administrative District of Sikasso, South-East Mali.Thesis of doctoral degree in Veterinary Medicine. Journal-Nr.: 3419 Freie Universität Berlin.
[11] Grace D., 2005. The epidemiology and control of trypanosomosis in areas of high risk of trypanocide resistance in West Africa. PhD Thesis, the Freie Universität Berlin, pp 195.
[12] Whiteside E.F., 1960. Proceedings of the 8th ISCTRC Meeting, p. 141-154. Jos, Nigeria.
[13] Whiteside E.F., 1962. Interactions between drugs, trypanosomes and cattle in the field.In : Goodwin, L.G and Nimmo-Smith, R.H (eds) Drugs, Parasites and Hosts. J and A. Churchill, London, pp. 116-141.
[14] Boyt W.P., 1986. Guide pratique pour le diagnostic, le traitement et la prévention de la trypanosomiase animale africaine. FAO.Rome, 281 p.
[15] Onono J.O., Wieland B. and Rushton J., 2013. Factors influencing choice of veterinary service provider by pastoralist in Kenya.Trop Anim Health Prod.
[16] Shaw P.M.A., 2004.Economics of African trypanosomosis. In: The Trypanosomiases. Maulidn, I., Holmes, P.H., Miles M.A. CABI International Wallingford, UK. pp 369- 402.
[17] Geerts S. and Holmes P.H., 1998. Drug management and parasite resistance in bovine trypanosomiasis in Africa.PAAT Technical Sciences Series, N° 1 FAO, Rome, 31 p.
[18] Ouédraogo D., 2002. Analyse socio-economique des pratiques de gestion de la trypanosomose animale et les facteurs associés au developpement de la chimioresistance dans la province du kenedougou (Burkina Faso). Thèse de Doctorat Unique ès Sciences Economiques. Université de Ouagadougou, Burkina Faso.
[19] Talaki E., Sidibe I., Diall O., Grace D., Barry A.M., Diarra B., Djiteye A., Bocoum Z., Clausen P-H., Randolph T., Affognon H., Hendrickx G., Pangui L.J. and Belem A.M.G., 2006.Répartition spatiale des trypanosomoses animales en relation avec la

chimiorésistance dans la zone cotonnière de l'Afrique de l'Ouest (Mali et Guinée). RASPA, 4 (1 -2): 45-50.

Author Profile

Kpandji Isidore Kouadioi received the Ph.D. in Genetics and Animal Improvement from the University Félix Houphöet-Boigny in Abidjan (Côte d'Ivoire) in 2016. Lecturer-researcher at the Laboratory of Biotechnology, Agriculture and Valorization of Biological Resources at the UFR Biosciences of the University Félix Houphöet-Boigny of Abidjan.