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Prevalence of different pathologies of Girolando dairy cattle reared in the semi-improved breeding system at the Kpinnou breeding farm in Benin

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Abstract

Milk production is struggling to take off in Benin despite the importance of the cattle population and the presence of imported cattle known for their milk production, such as the Girolando. The present study aimed to determine the different pathologies that limit the milk production of Girolando cows at the Kpinnou Breeding Farm as well as the treatments applied in these cases. These cattle are raised in a semi-intensive system, benefit from barns and are fed mainly on natural pasture with a supply of food supplements. During the year 2019 studied, all cattle on the breeding farm were infested with ticks of the species *Rhipicephalus microplus*, with an average of 822 ticks per animal. Every quarter, ticks were searched throughout the body, removed by hand and stored in a container containing 7% formalin.

The other pathologies encountered were lumpy skin disease, trypanosomiasis and dermatophilosis which affected 29%, 7% and 4%, which affected 29%, 7% and 4% of the herd of 107 animals respectively. The diseases that specifically affected the milk production of the 34 lactating cows were mastitis (12%), milk fever (12%) and agalactia (6%). Commercial acaricides are used to control ticks and antibiotics are administered to cattle for lumpy skin disease and mastitis.

The objective of this work is to identify bovine pathologies and diseases in Girolando in the last three years, in order to define action priorities and to implement preventive actions upstream.

Keywords: Milk; Cow; Girolando; Pathologies; Benin

1. Introduction

Sub-Saharan Africa faces many food security challenges. Almost 240 million sub-Saharan people, or one in four people, suffer from undernourishment and achieving food security is therefore a challenge for sub-Saharan countries (Bremner, 2012). According to Tacher and Letenneur (2000), one of the problems that generate this food insecurity is the deficit in proteins of animal origin, despite the importance and genetic wealth of African livestock and while the demand for products of animal origin is increasing each year by 4% in sub-Saharan Africa [1, 2]. This observation is explained by the low production of animal species.

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In 2019, Benin's national livestock population numbered approximately 2,421,000 cattle, 1,755,000 goats, 896,000 sheep, 448,360 pigs, 18,619,000 poultry, 83,470 rabbits and 46,182 aulacodes [1, 3].

However, animal production, such as milk production (106,860 tons), mainly from cattle, remains low [1, 4]. This weakness contrasts with a galloping population (3.5% growth per year) that increased from 9,988,000 inhabitants in 2014 to 11,496,140 inhabitants in 2018 [1]. The quantity of milk consumed per capita is estimated at 11.17 liters / year while the standard recommended by the Food and Agriculture Organization (FAO) is set at 62 liters / capita / year. Local milk production is therefore unable to satisfy the needs of a growing population. Benin has consequently become a major importer of milk and dairy products. Today, these imports largely exceed national production. They therefore increased from 11,879 tons in 2016 to 19,313 tons in 2017, corresponding respectively to 7,775,317,485 f CFA and 12,387,762,671 f CFA [5] and constitute an economic loss for the country.

In order to increase the level of milk production in Benin, Girolando cattle have been introduced into the country since 2003. These animals were imported from Brazil and installed at the Kpinnou breeding farm (FEK) for the adaptation phase to Benin's climatic conditions [6].

In intensive and semi-intensive breeding systems, the most frequent health problems are metabolic diseases (ketosis, acidosis, etc.), infectious and contagious diseases (lumpy skin disease, foot-and-mouth disease) and localized diseases (foot rot and mastitis). All of these diseases are sources of mortality and decrease of productivity. This study, carried out in 2019, focuses on the prevalence of the main pathologies affecting the milk production of Girolando cows at FEK and their treatments for the year 2019 and their comparison with those of the years 2016 and 2017 on the same farm.

2. Material and methods

2.1. Study site

The FEK covers an area of 380 ha and is located between 6°33'22" and 6°33'76" of North latitude and 1°46'36" and 1°47'80" of East longitude.

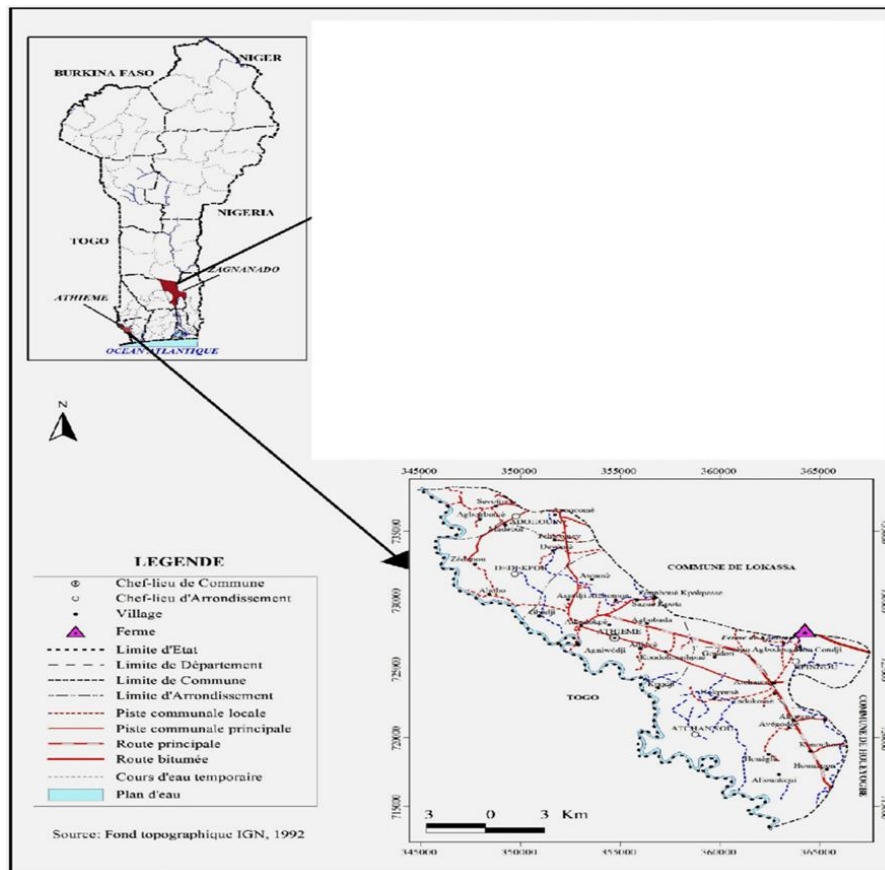


Figure 1 Location map of the Kpinnou breeding farm

The average annual temperature is around 29 °C and the climate of the area is subequatorial. There are four seasons: a long dry season from November to March, a long rainy season from March to July, a short dry season in July and August and a short rainy season from August to November. The average rainfall varies between 900 and 1100 mm per year. The soil of the farm is essentially ferralitic in nature with a clay-gravel texture. This texture limits the penetration of rainwater into the deep layers. However, the lowlands located at the periphery allow sedimentation of enriching soil elements.

2.2. Biological material

Data were collected on 107 Girolando cattle, including 34 cows. The Girolando breed is a cross between the Gir breed of Indian origin and the Holstein breed of Dutch origin. From a zootechnical point of view, it is characterized by a convex profile, a hypermetric size and a prolonged proportion. The coat can be black, spotted, piebald or fawn and the hump is rudimentary. The ears are drooping and the horns are short.

3. Results

3.1. Diagnostic investigation and animals

The pathologies affecting the milk production of Girolando cows at FEK in 2019 were summarized monthly based mainly on clinical records (Fourichon et al., 2001; Miller and Dorn, 1990).

The following criteria are retained

- Lumpy dermatosis: oculo-nasal discharge, conjunctivitis, lymph node hypertrophy, hard nodules located on the head
- Trypanosomiasis: transient hyperthermia, conjunctival petechiae, pricked hair, superficial ganglia hypertrophy, motor incoordination; confirmation by immediate observation under a microscope.
- Dermatophilosis: non-pruritic crusty skin lesions. They were mainly recorded during the rainy season.
- Clinical mastitis: one or more hot, hard, swollen and painful quarters with abnormal milk production. Mastitis was confirmed by the California mastitis test.
- Vitular fever: ample and slowed breathing, hypothermia, cold extremities, cessation of rumination. These signs were noted on cows after calving.
- Agalactia: arthritis, keratitis, mastitis.

Data for previous years was analyzed from FEK's annual activity reports for the years 2017 and 2018. On the sanitary plans, scrupulous respect for hygiene rules is observed (permanent and daily cleaning of water troughs and feeders, daily sweeping of the stabling yards, presence of roto-tanks and foot baths.). With the support of the national laboratory, located in the city of Bohicon, a medical prophylaxis program is in place. Its main features are: vaccination against pasteurellosis at the beginning and end of the rainy seasons; trypanoprevention every two to three months; tick control (external deworming) every week; internal deworming against gastrointestinal parasitosis every three months; vitamin therapy when the animals are weak. In addition, there are specific interventions for particular pathologies.

Table 1 Pathologies affecting Girolando cattle at the Kpinnou breeding farm for the years 2017, 2018, 2019

Types of pathologies	Pathologies	Prevalence					
		2017(n=301)		2018 (n=150)		2019 (n=107)	
		abs	%	abs	%	abs	%
General Pathologies of cattles	Ticks	301	100	150	100	107	100
	Lumpy dermatosis	82	27.24	62	41.33	31	28.97
	Trypanosomiasis	6	1.99	7	4.66	4	3.73
	Dermatophilosis	10	3.32	6	4.00	8	7.47

Note: The intra-class percentages of the same column, assigned different letters, differ significantly at the 5% threshold.

Table 2 Specific pathologies of Girolando lactating cows at the Kpinnou breeding farm for the years 2017, 2018, 2019

Types of pathologies	Pathologies	Prevalence					
		2017 (n=158)		2018 (n=69)		2019 (n=34)	
		abs	%	abs	%	abs	%
Specific pathologies to the lactating cows	Mastitis	19	12.02	12	17.39	4	11.76
	Vitular fever	10	6.32	3	4.34	2	5.88
	Agalactia	22	13.92	8	11.59	4	11.76

Note: The intra-class percentages of the same column, assigned different letters, differ significantly at the 5% threshold.

During these three successive years, all the Girolando cattle were infested by ticks, particularly by the species *Rhipicephalus microplus*. This species is very invasive. The average infestation in 2019 was 822 ticks per animal, with a fortnightly count of all the animals. Among the other pathologies encountered, lumpy skin disease, characterized by the appearance of nodules on the skin (29%), was the most diagnosed, 3.9 and 7.7 times more frequent than trypanosomiasis and dermatophilosis with respective frequencies 7.48% and 3.74% of the herd made up of 107 animals.

The pathologies that specifically affected the 34 lactating cows were mastitis, characterized by visible inflammation of the udder (11.76%), milk fever (5.88%) and agalactia (11.76%). No significant difference was therefore observed between the frequencies of these three pathologies observed only in the cows.

3.2. Treatment of pathologies of the Girolando dairy cows at Kpinnou breeding farm

Table 3 Treatment of pathologies affecting Girolando cows at the Kpinnou breeding farm

Pathologies	Treatments	Posologies
Ticks	Grassland burning of Panicum C1 and grassland sanitation	
	Pulverization	
	cypermethrin	
Lumpy skin disease	Benzylicillin	1 to 2 vials per cow
	Zamectin ND	1 ml/50 kg
	Oxytetracycline 20%	1 ml/10 kg
	Dexamethasone and phenylbutazone	20 to 30 ml (1st et 2nd days), 10 ml from the 3rd day
	Motor oil + cypermethrin and chlorpyrifos	20 ml of Cypertop per 16 liters of water
Mastitis	Dexamethasone and phenylbutazone	20-30 ml (1st et 2nd days), 10 ml from the 3rd day
	Benzylicillin	1 to 2 vials per cow
Streptothricosis	Streptomycin sulphate	10 ml/cow
	Oxytetracycline 20%	1 ml/10 kg
	Benzylicillin	1 to 2 vials per cow
Trypanosomiasis	Diminazene diacetate	1 sachet of 125 mg /250 (300 kg)
Agalactia	Ocytocin	3 - 5 ml/cow
	Oxytetracycline 20%	1 ml/10 kg
Fièvre vitulaire	Dexamethasone and phenylbutazone	20 - 30 ml (1st et 2nd days), 10 ml from the 3rd day

	Oxytetracycline 20%, 10%	1 ml/10 kg
	anti- stress Vitamins (Stress vitam)	10 ml/cow for 3 days
	Iron, cyanocobalamin, nicotinamide (Fercobsang)	20 ml/cow
	Gluconate and glucoheptonate (Theracalcium)	40 - 50 ml/500 kg

Table 3 summarizes the different treatments used to control the pathologies that affect dairy cows. To control the ticks, grassland burning of *Panicum C1* and grassland sanitation are practice. Different products based on cypermethrin are also used. As far as the use of acaricides is concerned, FEK uses acaricide products based on ivermectin and fluzuron. However, it must be noted that the tick *Rhipicephalus Boophilus microplus* has defied all acaricides in Benin.

For Lumpy skin disease, supportive treatments are implemented to treat hyperthermia, inflammation, or bacterial superinfections with anti-inflammatory drugs and antibiotic treatment.

Mastitis and dermatophilosis are treated with antibiotics. Trypanosomiasis was treated with TrypadimND or TrypamidiumND. Agalactia is treated by administration of oxytocin to stimulate milk production and oxytetracycline 20% to avoid possible infections. Several drugs are used in the treatment of milk fever.

4. Discussion

This study revealed several pathologies in Girolando cows at the Kpinnou breeding farm. These pathologies include general pathologies of livestock (ticks, lumpy skin disease, trypanosomosis and dermatophilosis) and pathologies specific to lactating cows (mastitis, agalactia and milk fever). Ticks remain the real threat on this farm, followed by other general livestock pathologies. Research conducted fifteen years ago showed that *Rhipicephalus geigy* was the most abundant and widespread tick in Benin [7, 8]. Nowadays, *Rhipicephalus microplus* (68.12%) has become the most abundant in the south of the country [9,10]. According to Madder et al. [11], this species was introduced to the FEK in 2004 following the importation of Girolando cattle from Brazil [12, 13]. The expansion of this tick in Mono has been proven by Amoussou [14] from this point of introduction. The rapid reproduction and massive infestation of *Rhipicephalus microplus* have completely changed the situation in Benin [15], characterized by a regression of other tick species.

A study carried by Dotché in 2013 [16] showed the importance of pathologies that limit milk production on farms in the departments of Borgou, Alibori, Collines and Mono, where FEK is located. Foot and mouth disease (42.11% - 100%) and trypanosomiasis (44.74% - 74.36%) were the most frequent diseases in the departments surveyed. Couacy-Hymann et al [17] agree with Dotché [16] in estimating the prevalence rate of Foot and mouth diseases at 50% in Benin. Specifically, the rate of *Trypanosoma congolense* infestation is 28% in Benin [18]. In Burkina Faso, more precisely in the intra-urban cattle farms of Hamdallaye (Ouagadougou), Traoré et al [19] prove the presence of brucellosis and tuberculosis in addition to mastitis, with overall prevalences of 13.2% and 27.7% respectively. The extent of these diseases in the herds is therefore a handicap to milk production. In the same vein, Belhadi and Traoré [19, 20] also found clinical mastitis (31.7%) in Algerian dairy farms at a higher frequency than that reported in our study. In addition to this pathology, digestive disorders (12.3%) and placental retention (9.6%) also represent significant limitations to milk production in Algeria [20]. Regarding FEK, apart from the ticks that are present and continue to be severe, lumpy skin disease should hold the attention more seriously, because its prevalence is becoming high in recent years (27.24% in 2017, 41.33% in 2018 and 28.97% in 2019). In dairy cows of the FEK, agalactia and mastitis are registered more and more.

Several treatment methods are adopted in this study. Acaricides (based on amitraz and ivermectin) are generally used to control ticks. FEK uses trypanocides, such as Trypamidium and Trypadim, to control trypanosomosis. Other specific treatments are used in particular clinical cases. Despite the use of acaricides, our study reported the presence of ticks. The effectiveness of these acaricides would be in question. According to Rosado-Aguilar et al. [21] the permanent use of the main classes of available acaricides leads to the resistance of certain species of ticks, due to possible mutations. To overcome the continuous increase in resistance to chemical acaricides, products of plant origin have been tested. Adinci (2012) tested in vitro and obtained the larvicidal activity of ethanolic extracts from the leaves of *Mitracarpus villosus* and *Thevetiane reiifolia* [22]. He specifies that these two extracts are active on the larvae of *Rhipicephalus microplus*.

Mastitis also persists at FEK. Antibiotics are used extensively for their treatment. These antibiotics can be contaminants (milk residues). In case of clinical mastitis, Descôteaux [23] advises the use of isotonic and saline (hypertonic) fluids and electrolytes by oral, intraruminal or intravenous routes, especially when the pathology is in the acute form. In cases of severe acute mastitis, anti-inflammatory drugs such as glucocorticoids and non-steroidal anti-inflammatory drugs (KetoprofenND and Aspirin) are administered to cows [23].

The treatments indicated in the control of the lumpy skin disease are options to prevent possible microbial superinfection that can occur during this disease. Because lumpy skin disease is a viral pathology, caused by a virus of the family Poxviridae and the genus Capripoxvirus [24, 25]. It is a vector-borne disease. It is therefore without etiological treatment and the only precaution to take is to avoid it by rigorously observing the sanitary rules of breeding: cleaning, clearing, disinfection etc. It causes little damage. Since 2016 that it is present in Eastern Europe, the management of this contagious disease listed on list A of the World Organization for Animal Health (OIE), involves an emergency health intervention plan, specifying the immediate management of any suspicion and control measures in case of confirmation (slaughter, zoning around the infected site and restriction of animal movements). The vaccination strategy comes in addition to the health measures described above, after agreement from the European Commission [24, 25].

In addition, for the treatment of diseases, the FEK buys veterinary products, which are generally expensive. Sarda et al [26] report the high cost of veterinary products and propose an alternative of plant origin. Veterinary ethnomedicine can therefore represent an alternative for the control of the different pathologies mentioned and other bovine pathologies. For example, *Gossypium arboreum* associated with bird's nest, *Mitragyna inermis* associated with *Sorghum vulgare*, *Terminalia glauscens* and cow urine, *Tamarindus indica* associated with *Sorghum* sp and *Balanites aegyptiaca* associated with *vitellaria paradoxa* in addition to salt, are respectively used with effectiveness in the treatment of mastitis, nodular dermatitis, foot-and-mouth disease and trypanosomiasis in Benin [27]. Other plants such as *Dioscorea* sp and *Parkia biglobosa* are used to cure animals suffering from scabies and brucellosis respectively [27]. In Burkina Faso, a study by Tamboura et al. shows the usefulness of *Bombax costatum* in the treatment of retained placenta and *Khaya senegalensis* for internal deworming (intestinal worms) in cattle [28].

5. Conclusion

The analysis of the data shows that several pathologies, both general and specific to Girolando dairy cows, persist in the Kpinnou breeding farm. The presence of ticks testifies to the low effectiveness of the acaricide use plan. This failure could be due to the permanent use of these products to which the pathogens are beginning to adapt and which effectiveness would become doubtful. For other diseases (milk fever, trypanosomiasis), the infection rates are lower than those reported by other authors. However, veterinary products are used for their treatment. These are generally expensive drugs with risks of contamination of the milk by their residues.

In the light of these results, it is interesting to adopt veterinary ethnomedicine as an alternative solution in the treatment of livestock pathologies and to establish a permanent and effective veterinary control.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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