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Papers:

Gastrointestinal parasites of guinea pigs (*Cavia porcellus*) reared in different breeding systems in Benin

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Abstract

This study was conducted to assess the state of gastrointestinal parasite infestation in guinea pigs raised in traditional and improved traditional farming systems represented by private farms as well as in the controlled farming system represented by the application farm of the Faculty of Agronomic Sciences of the University of Abomey-Calavi. Two methods of faecal sampling were used : the pooled method performed on a population of 125 guinea pigs represented by 25 groups on private farms and the individual collection on 15 guinea pigs at the application farm. Faeces from private farms were analyzed using qualitative coproscopy and those from the application farm were analyzed using qualitative and quantitative coproscopy. A helminthological autopsy on five animals from the application farm was also performed. Eggs of the nematodes *Paraspidodera uncinata* and *Trichuris sp.* had been recorded in the faeces of private farms and the application farm. Infestation rates ranged from 13.33% to 16.6%. At the application farm, quantitative coproscopy revealed an average EPG of 75 ± 35.36. Autopsy results revealed that only one guinea pig housed 3 worms of the nematode *Paraspidodera uncinata* collected in the caecum and one cestode worm collected in the small intestine. Thus, the guinea pigs examined in this study are slightly affected by helminths and those raised in the traditional system are the most affected.

Keywords: *digestive tract, helminths, on-farm*

Introduction

Guinea pig (*Cavia porcellus*) is one of the first caviomorphs domesticated for millennia by the Incan Indians and is a source of protein for Latin American populations (Jori 2002, Quesenberry et al 2012). Its introduction took place in Africa during the colonial period followed by its extension in many areas from 1980s (Blench 2000, Kouakou 2011). The guinea pigs raised are used as a source of animal protein and additional income. In these African countries, cavy culture has a rustic character and is generally practiced in a traditional way inside the rooms and kitchens, which largely explains its very limited knowledge by zootechnicians (Tedonkeng Pamo et al 2005, Faihun et al 2017). This type of livestock faces many challenges such as diseases, inadequate nutrition, poor reproductive management, predation by mice, cats and dogs etc. (Niba et al 2012). Several trials to improve the feeding of guinea pigs under local African conditions have been undertaken for several decades (Tedonkeng Pamo et al 2005, Miegoue et al 2016, Mweugang et al 2016, Faïhun et al 2019). As for the pathologies affecting domestic guinea pigs, very few studies have been carried out. However, guinea pigs can harbour many parasites including arthropods, helminths and protozoa (Coman et al 2009, García et al 2013).

In Benin cavy cultural breeding is found both in the northern and southern regions with a higher concentration of these breeding in the southern part. Within these farms, sometimes a high mortality rate of animals is recorded as a result of pathologies (Faihun et al 2017). Data on pathologies and more precisely on gastrointestinal parasitosis under Beninese conditions are non-existent. Thus, this study was carried out to inventorize gastrointestinal parasites of guinea pigs raised in different farming systems.

Materials and methods

The study was conducted in Benin, a country located in West Africa. Data were collected from twenty-five (25) private farms as well as at the application farm of the Faculty of Agronomic Sciences of the University of Abomey-Calavi. Private farms are located in the sub-humid climate zone (Southern Benin) and the Sudanese climate zone (Northern Benin). These farms were identified using the non-probability method known as the "snowball" method, whereby the first farmers surveyed provide information on other guinea pig farmers and thus in turn become additional informants. The application farm of the Faculty of Agronomy is located in the subhumid climatic zone.

Two livestock systems have been identified on private farms : the traditional system and the improved traditional system. In both these two livestock systems, animal management is rudimentary, with little care given to animals to meet density and hygiene needs. Inbreeding remains important and causes the decrease in litter size. Often the unbalanced diet (energy and low protein) served in these farms, reduces the size of adult animals, increases disease susceptibility and thus reduces production (Picron et al 2012, Faihun et al 2017). The difference between these two systems is the housing of the animals. In the traditional system, guinea pigs are placed inside the houses and somestimes in small partitions made of bar clay, while in the improved traditional system farmers use wooden cages to house the animals. Farmers generally have small numbers of guinea pigs (an average of 21±23 guinea pigs) which are separated from other farmed animals (poultry, small ruminants, rabbits, grasscuters) when they exist. The breeding objectives are self-consumption and marketing to followers of endogenous religions (guinea pig used as a sacrifice animal). Inside these private farms, breeders have never treated guinea pigs against helminthiasis and other parasitic diseases.

At the application farm of the Faculty of Agricultural Sciences, livestock farming is more controlled and improved. The animals are put in boxes containing a bedding made of sawdust, are fed with forage and rabbit concentrates. However, the animals used for the test were not dewormed.

Figure 1. Guinea pigs inside breeder's habitation

Figure 2. Guinea pigs housed in small partitions made of bar clay inside breeder's habitation

Figure 3. Wooden cages used by breeders to house guinea pigs

On private farms, droppings samples were collected from groups of animals (pooled method) representing a population of 125 guinea pigs. Five guinea pigs from the herd in each farm were introduced into a plastic bucket and the faeces were collected immediately after defecation and then packaged in plastic boxes and quickly sent to the laboratory for analysis. The breeding of guinea pigs on the application farm of the Faculty of Agricultural Sciences was recent. The animals were acquired on private farms and had been kept in stations for two months without receiving any anthelmintic treatment. Fifteen animals were introduced into individual boxes and then regularly monitored to collect faeces immediately after defecation. These faecal samples were quickly sent to the laboratory for analysis.

The droppings samples were analyzed using qualitative coproscopy (simple flotation in test tube) and quantitative coproscopy (Mc master method). The flotation method detected helminth eggs and coccidial oocysts that were identified on the basis of their morphology and size. This coproscopic technique was used to analyze droppings samples from private farms and the application farm. The Mc master method was used to estimate the parasitic load of the guinea pig droppings samples from the application farm.

Five guinea pigs from the application farm were killed with chloroform, quickly dissected and the contents of the digestive tract were analyzed portion by portion. The worms of the different species collected were counted and then stored in 70% ethanol.

The data collected were entered into Excel 2010 and then analyzed using descriptive statistics.

The infestation rate of gastrointestinal endoparasites was calculated as follows :

Infestation rate (%)= [(Number of droppings samples containing parasites eggs) / (Total number of droppings samples examined)] x100

The Pearson's Chi-squared test were also made to compare the parasite infestation rate within private farms.

Results

The rate of gastrointestinal endoparasite infestation of guinea pigs on farms with traditional livestock systems was 27.77% while that of animals raised under the improved traditional system was 14.66%. Qualitative coproscopy revealed the presence of eggs of two types of parasites (*Paraspidodera uncinata* and *Trichuris sp.*). *Paraspidodera uncinata* was observed alone in guinea pigs raised under the improved traditional system with an infestation rate of 14.66% (1 positive sample out of 7) and under the traditional or family system with an observation frequency of 16.66% (3 positive samples out of 18). Eggs of*Trichuris sp.* associated with those of *Paraspidodera uncinata* were recorded in the faeces of animals raised according to the traditional or family system; the infestation rate was 11.11% (2 out of 18 positive samples). The Pearson's Chi-squared test showed no difference for these two parasite infestation rate between both livestock systems ($p > 0.05$) (Table 1).

Table 1. Parasitic state of guinea pigs on private farms

Helminths species identified	Livestock systems	Number of farms examined	Number of positive farms	Infestation rate (%)	X-squared	p-value
Paraspidodera uncinata alone	Family or traditional	18	3	15.66	0	1
	Traditional improved	7	1	14.66		
Paraspidodera uncinata + Trichuris sp.	Family or traditional	18	2	11.11	0.001	0.9752
	Traditional improved	7	0	0		

For the guinea pigs of the application farm, Mc Master and flotation methods detected the presence of eggs of the nematode *Paraspidodera uncinata*. The infestation rate was 13.33% (2 out of 15 infested guinea pigs) with an average eggs per gram of feces (EPG) of 75± 35.36 (Table 2).

Table 2. Parasitic load of guinea pigs on the application farm

Methods of analysis or sampling	Helminths species identified	Prevalence (%)	Parasitic load (EPG)
Flotation	*Paraspidodera uncinata*	13.33 (2/15) *	-
Mc master	*Paraspidodera uncinata*	13.33 (2/15) *	75± 35.36
Helminthological autopsy	*Paraspidodera uncinata*	6.67 (1/15) **	5 worms
	Cestode	6.67 (1/15) **	1 worm

**2 infested guinea pigs out of 15 guinea pigs examined ; ** only one guinea pig had helminths in its digestive tract*

The helminthological autopsy performed on five guinea pigs from the application farm revealed the presence of helminths in a single animal. Five worms of *Paraspidodera uncinata* were collected from the caecum and one cestode worm from the small intestine of one guinea pig.

Discussion

The number of guinea pigs in private farms has been low as a result of the Beninese population's low interest for cavyculture. Indeed this type of production system is unknown by general public, the difficulty of breeders to sell the animals is real. This study is a first in the inventory of gastrointestinal parasitic fauna of guinea pigs in Benin. The prevalence of Gastro Intestinal Tract endoparasites was not determined for guinea pigs from private farms because the droppings samples were taken from groups of animals. Also the Mc master method was not used for the analysis of animal faeces on private farms for the same reason mentioned above, a quantitative analysis will not provide useful information on the actual parasite load of animals. *Paraspidodera uncinata* was identified in animals bred according to the three breeding systems while *Trichuris sp.* was identified only in guinea pigs bred according traditional or family system. A complete identification of the species has not been made but it would probably be *Trichuris gracilis* widely found in guinea pigs. The inventory of the nematode *Paraspidodera uncinata* in the parasitic fauna of guinea pigs bred according to the three breeding systems confirms its ubiquitous nature. This parasite species has been observed in guinea pigs from Cameroon, Congo, Italy, Peru and Bolivia from different breeding systems and conditions (Paterson et al 2001, Ditmar et al 2002, d'Ovidio et al 2015, Kouam et al 2015, Payne et al 2016). *Paraspidodera uncinata* is a helminth of the caecum that can be present in large numbers without producing significant lesions or pathology. Nevertheless, a massive infestation by this parasite can lead to diarrhea and weight loss in animals (Baker 2007). The infestation rates and prevalence of endoparasites in guinea pigs obtained from this study were low. These values are lower than those reported by Payne et al (2016) (79%) and higher than those reported by Kouam et al (2015) (12.9%) in Cameroon. Elsewhere outside sub-Saharan Africa, d'Ovidio et al (2015) in Italy reported an endoparasite prevalence of 31.7% for guinea pigs from laboratory animal sales stores. The variations observed in prevalence values are related to the breeding conditions of animals. In Cameroon, for example, Payne et al (2016) justified the high prevalence of endoparasitosis in guinea pigs by the fact that they were raised in a traditional breeding system and together with other animal species with whom they share the same bedding and food, a situation that favours infestation. The relatively low percentage of private farms that were endoparasitic positive in this study could be explained by the fact that in both the traditional and improved traditional farming system, guinea pigs did not share bedding or feed with other animal species and farmers made the effort to clean up the area where the animals were kept quite frequently. In cavyculture farms, the infestation of animals with endoparasites can be avoided by taking regular disinfection precautions, a guarantee of hygiene of the breeding infrastructures, a diet based on dried and not fresh fodder (Audebert et al 2003). On the application farm where the breeding is controlled, the infestation rate was not zero, although the lowest infestation rate was obtained. This situation can be explained by the fact that the breeding of guinea pigs on the application farm of the Faculty of Agricultural Sciences was recent. The animals were acquired on private farms and had been kept in stations for two months without receiving any anthelmintic treatment. Like all captive animals, laboratory animals become a primary target for parasite infection if appropriate preventive measures are not applied (Baker 2007, Tanideh et al 2010). *Paraspidodera uncinata* egg parasite load in guinea pigs raised at the FSA application farm was low according to the grid defined by Gressler et al (2010). In Cameroon, the parasite load of animals for this type of parasite is moderate, but in elderly subjects the infestation can be massive (sometimes reaching 450 OPG).

Trichuris gracilis was found at the end of this study only in one private farm with traditional guinea pig farming system A low prevalence for this parasitosis has been observed in Cameroon (3.3%) (Payne et al 2016). It is a parasitic species frequently found in wild guinea pigs and those used as laboratory animals but is considered non-clinical (Ballweber and Harkness 2007). The species of cestodes harvested from the small intestine of the autopsied guinea pig could not be identified, but according to its location in the digestive tract it could be the species *Monoecocestus parcitesticulatus* (Haverkost and Gardner 2010).

Conclusion

The results of this study indicate that domestic guinea pigs raised in three farming systems (traditional, traditional improved and controlled) are infected with parasitic helminths of the Gastro Intestinal Tract. Although the parasites recovered in the present study are not zoonotic, guinea pigs should always be considered as potential vectors of zoonoses. More studies are needed to have an exhaustive list of the parasitic fauna of these caviomorphs in order to correctly define the preventive and curative treatments of the pathologies related to them.

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