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Use of *Dysphania ambrosioides* (Taimborotsiloza) as an antiparasitic in traditional poultry farming in the commune of Imerintsiatosika (Analamanga region)

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Abstract

Although an important lever for rural development, village poultry farming faces several challenges that impact its growth in general and poultry performance in particular. Parasitic, viral, and bacterial diseases strongly impact poultry production. Limited access to veterinary drugs, is a real problem in rural areas. This study aims to highlight the effectiveness of *Dysphania ambrosioides* as a dewormer in poultry and a factor in improving weight gain. For this purpose, 30 traditional poultry farms, divided into three batches, with 10 farms per batch, were monitored over 6 months. From 3 batches, we had a control batch (LT) using mineral water as a dewormer, a case batch (LD) using *Dysphania ambrosioides* as a dewormer, and a positive batch (LL) using levamisole as a dewormer. From the results obtained, it appears that *Dysphania ambrosioides* does indeed have an antiparasitic role in general and more specifically on the parasite *Ascaridia galli*. Whose OPG reduction rate is 95% between D0 and D15. Furthermore, a significant difference (p=0.00) was observed for the weight gain of poultry from the different batches over the study period. For an average weight per batch of 34.8g before deworming, four months later, the LD poultry had an average weight of 634.5 g, while that of the LL was 508.2g, and that of the LT, or batch of non-dewormed poultry, was 392.8g.

Keywords: Madagascar; Traditional poultry farming; *Dysphania ambrosioides*; Antiparasitic

1. Introduction

Diseases are one of the main causes of declining production in village poultry farming. Many authors have demonstrated the economic impact of these diseases, regardless of the pathogens involved. [1, 2, 3]. The negative impact of parasitic diseases in general and that of digestive or endoparasitic parasitoses in particular has been reported by several authors, including those of Ghoul and Gagui [2, 4, 5].

Faced with these various reasons, which constitute a major obstacle in the treatment of pathologies in village poultry, some farmers resort to phytotherapy. To this end, they use plants whose active ingredients have a preventive or curative effect against a pathogen. This practice is very old and is observed worldwide in the treatment of several pathologies in humans and animals [6, 7]. It is observed more in less developed countries and rural environments than in developed countries and urban environments [8, 9, 10, 11].

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Among these herbal medicines, garlic (Allium sativum), onion (Allium cepa), and papaya seeds (Carica papaya) are reported by several scientific studies as having important virtues in the treatment of viral, bacterial, and parasitic diseases [12, 13]. The work carried out by Mpoame and his colleagues, on the anthelmintic efficacy of ethanolic extracts of papaya seeds (Carica papaya L.) against avian ascariasis caused by *Ascaridia galli* in broiler chickens points in the same direction. *Dysphania ambrosioides*, also called Taimborotsiloza in Madagascar, is also reported to be effective against several pathologies, including parasitic, viral, and bacterial diseases in humans and animals [10, 14, 15].

Faced with the problems of avian parasitoses in traditional breeding, the absence or rarity of the practice of deworming, the difficulty of access to chemical antiparasitics and the consequences that they could have, two objectives emerge: (i) the importance of highlighting the effectiveness of certain plants such as *Dysphania ambrosioides* in the treatment of diseases due to internal parasites in village poultry and to make a comparison with a chemical antiparasitic widely used in poultry farming, (ii) to put into orbit the negative role that digestive parasitoses play on the performance of poultry in traditional poultry farming.

2. Material and methods

2.1. Study area and period

This study was conducted in the commune of Imerintsiatosika, Arivonimamo district, Itasy region. Located 30km from the capital Antananarivo, the commune has an area of 173 km^2 and has a little over 50,000 inhabitants (Figure 1). With very fertile soil, agriculture and livestock farming occupy crucial places and are widely practiced by the majority of households. The number of poultry in the commune of Imerintsiatosika is approximately 260,000 heads according to the latest agricultural census, with local breed poultry or Akohy gasy in first position [16].

2.2. Sampling

This evaluative, longitudinal, and prospective study was conducted over the period from May to October 2022 (6 months).

In total, 30 poultry farming households, equally distributed in 3 Fokotany (Fonenana, Ambohimanarivo, and Tsenamasoansro) with at least 5 adult poultry, of local breed, including 4 hens and a rooster, were chosen using snowball sampling.

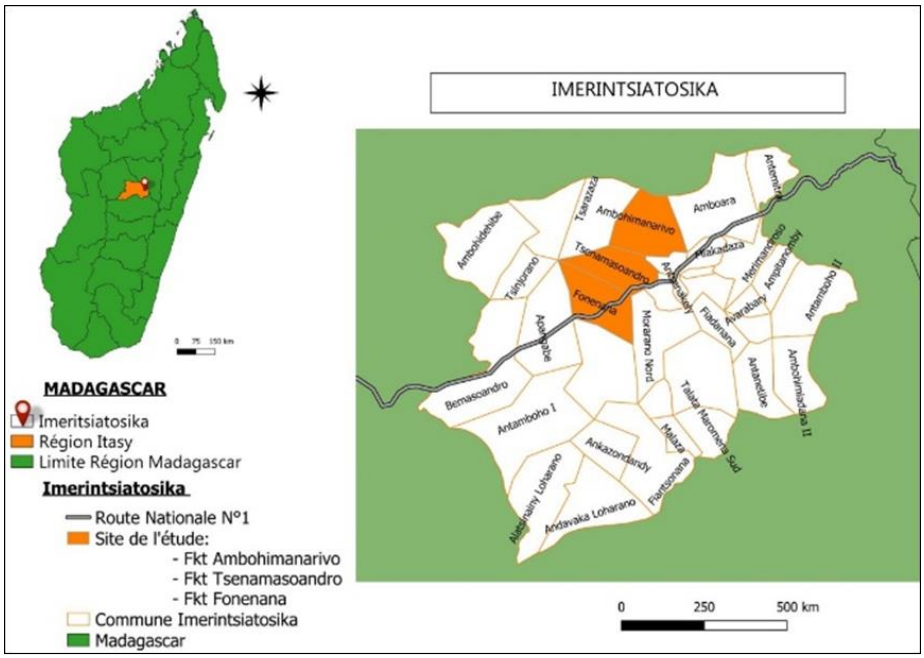


Figure 1 Study area, Municipality of Imerintsiatosika

The 30 livestock-raising households were then divided into three groups using a blind draw. The table below shows the distribution of livestock by group and by type of dewormer used during the experiment.

Table 1 Distribution of farms by batch and by type of dewormer used

Lots	Dewormer use	Number of breeding
Witness Batch (LT)	Mineral water	10
Batch case (LD) o	*Dysphania ambrosioides*	10
Positive control batch (LL)	Levamisole	10

Levamisole is a chemical derivative of imidazothiazole, primarily used in veterinary medicine as an anthelmintic. It is relatively inexpensive among veterinary parasiticides. It is also easy to use, as it can be administered in drinking water or poultry feed.

2.3. Carrying out deworming

Regardless of the age of the poultry, they were all dewormed and monitored during the study period.

For LT, administration consisted of giving mineral water to all poultry. For LD, preparation was done by weighing with a precision balance, grinding in a mortar, then filtering through a sieve 25g of fresh Taimborotsiloza leaves. The addition of 125 ml of distilled or boiled water was necessary. The well-mixed preparation was then left to stand for one hour before filtering and administering to the poultry, at a rate of 1 ml per adult poultry and 0.25 ml for chicks. This dosage was observed in the work of Mpoame and Essomba, then those of Amoussou et al in Dégouè, Benin [17, 18]

For LL, levamisole is administered in drinking water at a rate of 30 mg/kg body weight.

Note that, in chicks, weight gain was previously achieved before deworming

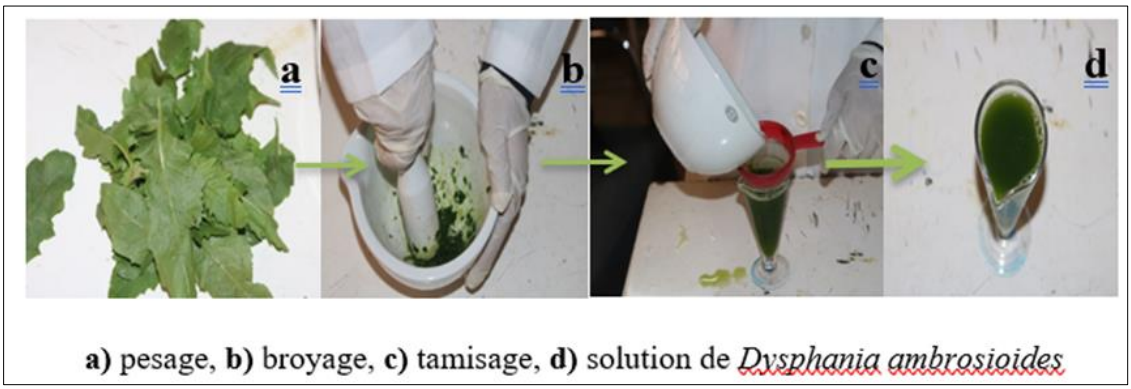


Figure 2 Steps for preparing the *Dysphania ambrosioides* solution

2.4. Collection of samples and data

It took place periodically from day zero (D0) and before the administration of dewormers then on days: D15, D45, D75, D105 and D135. Note that before the administration of the dewormer in each batch, a survey questionnaire had previously been completed with the breeder and focused on the practice of village poultry farming. The sample consisted of fresh droppings at a rate of two samples per farm (in the shelters where the poultry sleep), packaged in bottles, labeled, kept cold and analyzed as quickly as possible at the coprology laboratory of the Department of Zootechnical, Veterinary and Pisciculture Research of Antananarivo (DRZVP).

Furthermore, during the various periodic descents (the first four months), the weights of the chicks in the different farms were collected.

2.5. Coprology examination

Qualitative coproscopy by flotation, the principle of which is based on the difference in density between the eggs or parasitic cysts and the flotation liquid (here the saline solution), was carried out initially. As a methodology, first, 5g of feces are mixed and solubilized in 20 mL of saline solution. Then, the mixture is filtered with a sieve and placed in a test tube and covered with a slide for 15 to 20 minutes. Finally, the microscope reading is done between slide and coverslip

with a ×10 then ×40 objective. In a second step, quantitative coproscopy was carried out with the aim of counting the number of parasite eggs per gram of feces or OPG in 0.3ml of a suspension of fecal matter diluted 1/15th. As a step, once the mixture of 5g of feces in 70ml of dense saline solution is filtered, the solution is poured into the Mac master slide and observed under a microscope objective×10. Note that the dense solution is obtained by diluting 300g of table salt in 100ml of water.

2.6. Processing, analysis of data and variables

To evaluate the effectiveness of the dewormer on poultry in different batches, the Faecal Egg Count Reduction Test (FECRT), evaluated as a percentage, was used. The FECRT is obtained by taking the difference between the value 1 and the ratio of two OPG averages obtained over two consecutive periods, i.e., "n" and "n+1".

$$\text{FECR } (\%) = (1 - \frac{T2}{T1})$$

Where T1 is the average OPG of the batch treated at period “n” and T2 is the average OPG of the same batch at period “n+1” [19, 20].

Furthermore, different statistical tests were carried out, such as the Student test for the comparison of two means, the Chi-square test, which allows to highlight the interdependence between two samples or the Anova test which allows us to highlight the existence of a possible significance between deworming and weight gain of poultry during the experiment. The data were compiled and cleaned in Excel, while the statistical analyses were carried out on the RStudio software version 4.1.1.

This study focused on two response variables: the presence or absence of a genus or species of internal parasite, the number of parasite eggs per gram of feces (OPG), and the weight of the chicks. They were explained by the batch variable including the control batch (LT), batch treated with levamisole (LL) and the batch treated with *Dysphania ambrosioides* (LD).

3. Results

3.1. Poultry farming practice in our farms

This study involved 659 local breed poultry belonging to 30 breeders, divided into 3 batches, and with an average population of 22 poultry per farm. Of our breeders, 73% have a henhouse that serves as a shelter for the poultry and 13% do not. The poultry sleep in trees or in the owners' homes. Half (50%) of the breeding households in our study, distributed across the 3 batches, distribute feed supplements to the poultry. These are mainly kitchen and harvest leftovers (vegetables, rice, corn, cassava and rice bran). Some poultry breeders (40%) let their poultry roam and do not give any feed supplement. While others (10%) give, in addition to agricultural and kitchen leftovers, feed (complete feed manufactured by industrial companies).

3.2. Knowledge and use of *Dysphania ambrosioides* in our farms

When asked if *Dysphania ambrosioides* is known to our breeders, 73.3% answered yes. However, only 26.7% of our breeders have ever used this plant either on their farms or personally. The survey revealed that 88.8% of poultry-farming households use the fresh leaves and 50% consume them in their raw form (as leaves). Respectively, 14% and 10% consume them in crushed form, and in vaporized form (inhalation).

Of our farmers, 47% have already had to deworm their poultry with chemical antiparasitics. Only 33.3% of our households have ever had to use antiparasitic plants such as *Dysphania ambrosioides* or Allium sativum (garlic) as a dewormer in poultry. From our surveys, various reasons justify the use by our farmers of *Dysphania ambrosioides* in poultry, namely: anorexia (72%), cachexia (14%), the beginning of laying (7%), and apathy and ruffled plumage (7%).

3.3. Parasitoses and digestive parasites observed in our farms.

Coprological analyses (qualitative and quantitative) allowed the identification of 6 parasitic species during the experimental period. According to their infestation rate on D0 and before deworming, we have: *Capillaria spp*. (49.3%), *Ascaridia galli* (26.6%), *Heterakis gallinarum* (17%), *Syngamus trachea* (4.2%), *Eimeria* (1.5%) and *Railietinia cesticulus* (1.2%). Figure 3 shows the different parasite eggs observed.

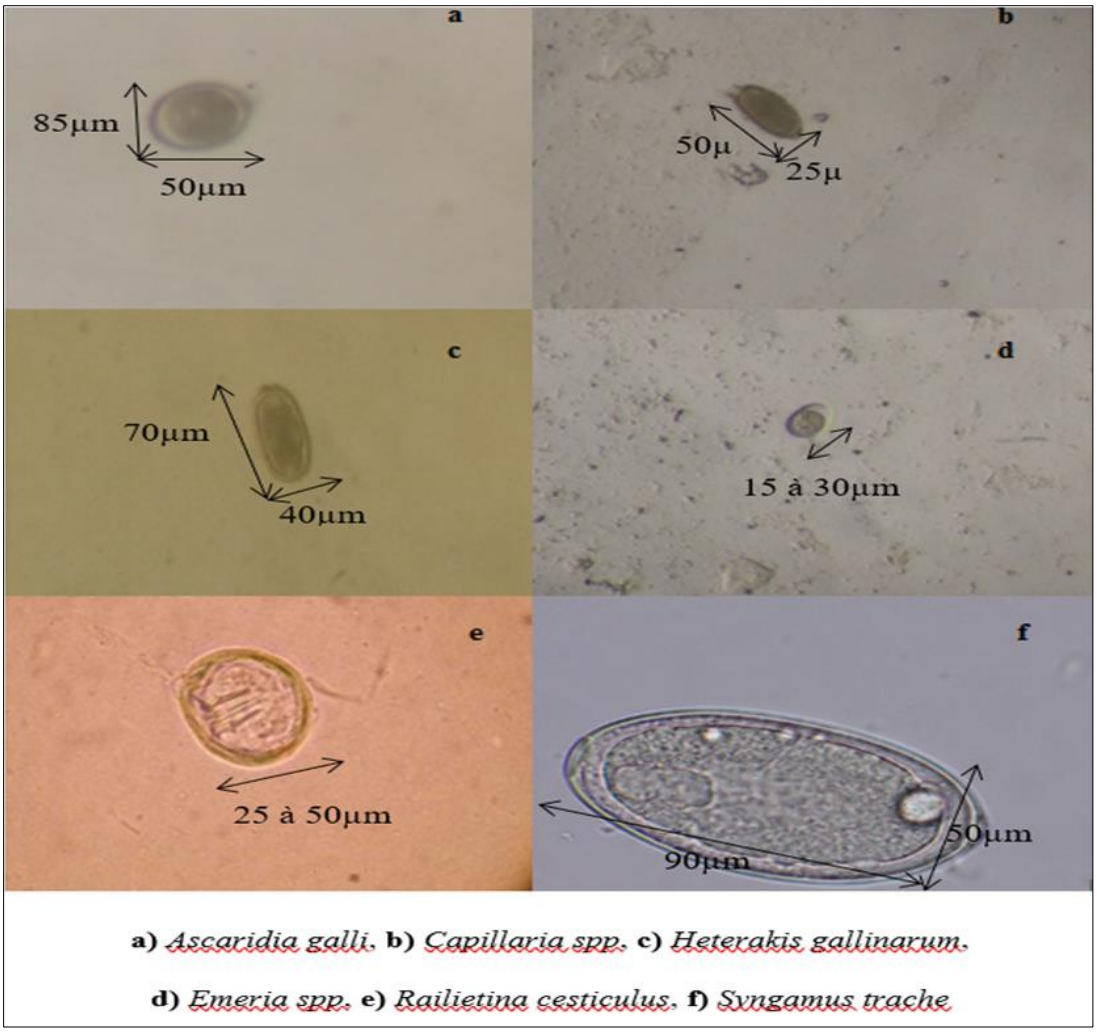


Figure 3 Different parasite eggs observed in farms

3.4. Comparative effectiveness of antiparasitics used

Periodic collection of poultry fecal samples and their laboratory analysis made it possible to obtain periodic infestation rates.

3.4.1. Evolution of parasite infestation rates for the three batches

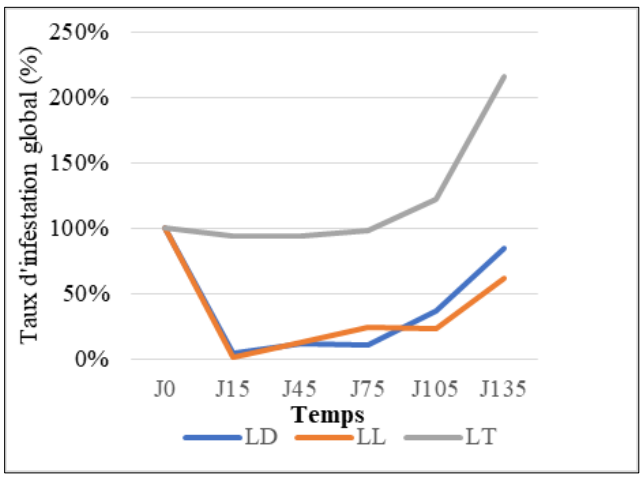


Figure 4 Evolution of the overall infestation rate during the experiment

Figure 4 shows the evolution of the infestation rates in the 3 batches after administration of antiparasitics on D0.

Over the entire period, the infestation rates obtained in the control group (LT) increased. These rates for the positive group (LL) with the administration of levamisole and the case group (LD) with the administration of *Dysphania ambrosioides* experienced significant decreases between D0 and D15. These rates were respectively 94.6% for LL and 95% for LD. From D15 to D135, the infestation rates for LL and LD increased regularly without, however, reaching the infestation rate on D0.

3.4.2. Evolution of parasite infestation rates in the batch treated with Dysphania ambrosioides (LD)

*Dysphania ambrosioides*is effective against all observed parasites, but *Ascaridia galli*, *Syngamus trachea*, and *Emeria spp*. are reduced to 0% 15 days after treatment. For *Heterakis gallinarum* and *Capillaria spp*., very low rates were observed after 15 days of treatment (10.7% and 12.5%), but the parasite reduction remains greater than 80% (see Figure 5).

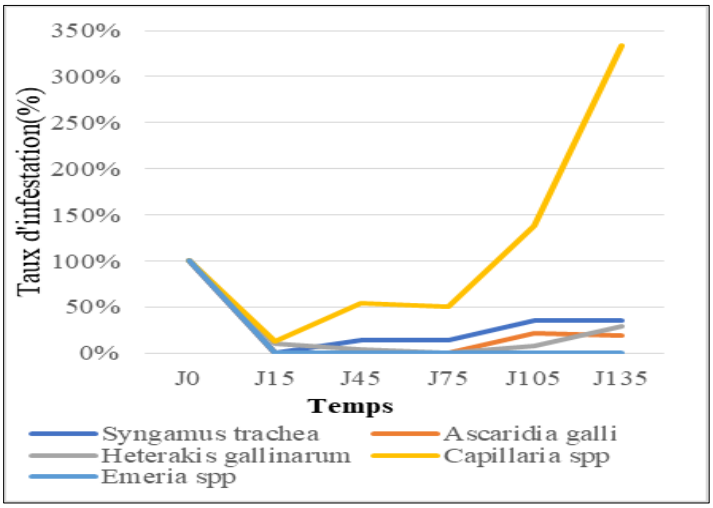


Figure 5 Curve of evolution of LD parasite infestation over time

3.4.3. Evolution of parasite infestation rates in the batch treated with levamisole (LL)

Four parasitic species were identified in the batch treated with levamisole. Different efficacy rates were observed for these four parasitic species. At day 15, the efficacy rate was 100% for *Capillaria spp*, 96% for *Ascaridia galli*, and 0% for *Raillietina cesticilus*. Parasite reinfestation was observed after one month of treatment, with an average increase of 47%. Figure 6 shows the action of levamisole on parasites.

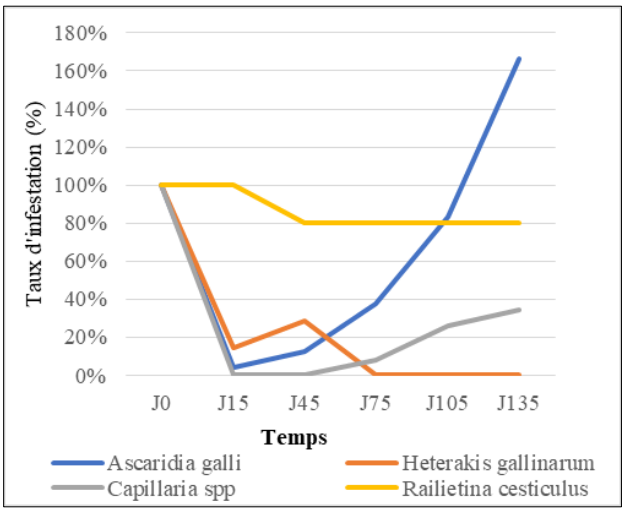


Figure 6 Curve of the evolution of the parasite infestation rate of the LL batch over time

3.4.4. Evolution of parasite infestation rates in the control group (LT) over time

The curve below shows that 4 parasite species are in the control group. Since no treatment was carried out on the poultry in the control group, a progressive increase in infestation reaching up to 200% is observed at D135 compared to the initial rate at D0 for *Ascaridia galli* and *Singamus trachea*, as shown in Figure 7.

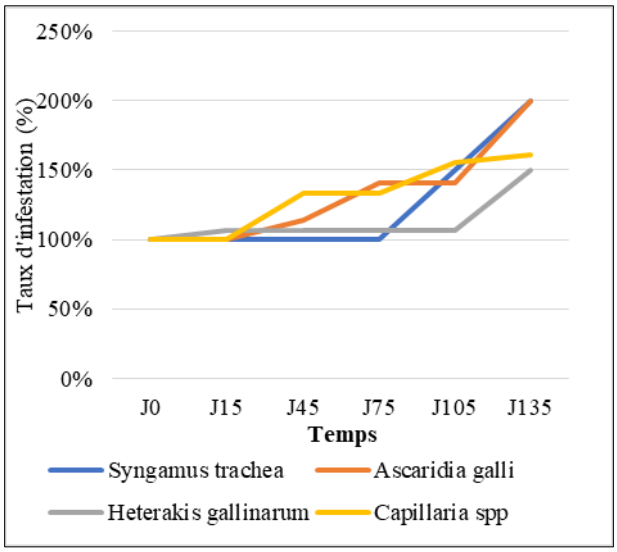
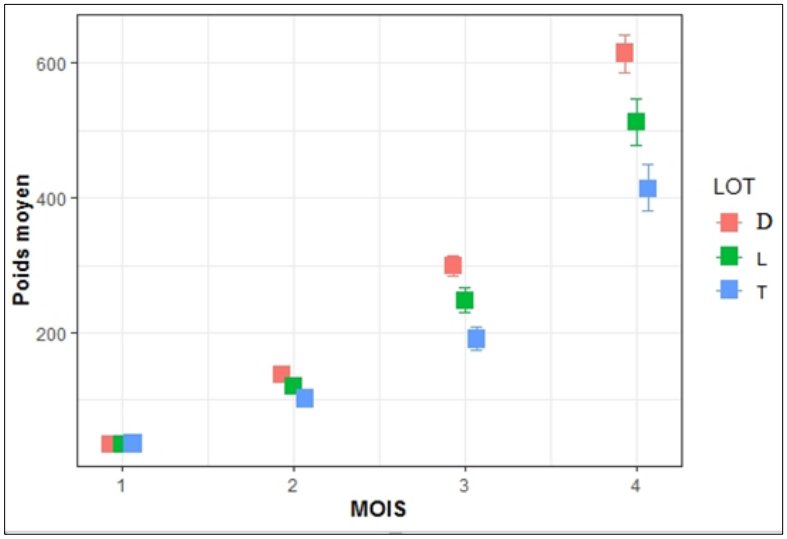


Figure 7 Evolution of the parasite infestation rate of the LT batch over time

3.5. Impact of treatment on *Dysphania ambrosioides* on chick growth

The overall mean weights of the chicks were 34.8g at the beginning and 511.8g at the end of the experiment. Significant differences in weight gain between the 3 batches of chicks were observed during the experiment (p-value = 0.00). It is found that the treatment significantly influences the weight performance of the chicks because, as the treatment time progresses, there is a considerable shift in the weight of the chicks in each batch. Before treatment, the average weight of the chicks was approximately 34 g for all batches, but 4 months later, they reached 634.5 g and 508.2 g respectively for the batches treated with *Dysphania* (LD) and levamisole (LL) compared to 392.8 g for the control batch (LT) (Figure 8).



LD: Dysphania Lot; LL: Levamisole Lot; LT: Control Lot

Figure 8 Evolution of the average weight of the chicks of the 3 batches during the treatment

4. Discussion

4.1. Livestock management and parasitism

The poultry in our study are raised in an uncontrolled manner. The animals spend most of their time wandering in search of food. This activity can lead to re-infestations of poultry at any time. In addition, a lack of shelter and hygiene was observed in poultry farming practices. This lack of control over livestock management and compliance with minimum biosecurity standards may constitute factors of infestation and re-infestation in the farms. Furthermore, the clinical signs observed in the farms during the experimental period could be factors influencing our results. Indeed, the symptoms observed can reflect various different diseases, including parasitism. [21, 22].

4.2. Methods of coprological analysis and use of *Dysphania ambrosioides*

4.2.1. Coprological analysis methods

We used qualitative coprology using the flotation method and quantitative coprology using the McMaster method. The flotation technique, although widely used in parasitology, is more appropriate for light eggs, including those of nematodes and coccidia [23, 24, 25]. Indeed, very few trematode eggs and cestodes were found in our work. The sedimentation technique, very appropriate for heavy eggs, could have improved the quality of our data and results. During their work on "Research of gastrointestinal helminths in mountain zebras", Kasongo and his colleagues used both techniques (flotation and sedimentation) to avoid bias in egg identification. However, in the same study, they did not do quantitative coprology due to lack of equipment, unlike ours [12].

4.2.2. Method of using Dysphania ambrosioides

In our study, we crushed the fresh leaves of *Dysphania ambrosioides* and administered them after adding mineral water, sieving, and decanting. The study of Kandsi et al. on the antioxidant and antibacterial activities of *Dysphania ambrosioides* in the form of essential oil showed that it had a broad spectrum of action on several bacterial strains, including Escherichia coli, Staphylococcus aureus, and Enterococcus faecalis [14].

We used a dosage of 1 ml per adult poultry and 0.25 ml for chicks. This presentation and dosage are not like those used by Mpoame and Essomba who, in their work, used papaya seed powder at a rate of 10 g per liter of water and made available to broiler chickens. Kandsi et al used *Dysphania ambrosioides* in the form of essential oil to demonstrate its effectiveness on bacterial germs [14, 17].

4.3. The effectiveness of *Dysphania ambrosioides* as an antiparasitic

Our experiment showed a 95% OPG reduction rate 15 days after Dysphania administration ambrosioides (LD). This rate was 94.5% for the batch receiving levamisole (LL) at the same time. However, only the LD showed a significant difference (p-value=0.04). These results are similar to those found by Salifou and colleagues [27, 28] in broiler chickens. In Rabesandratra's work, addressing the problems of digestive parasitosis in village poultry in a controlled environment and using Allium sativum (garlic), the OPG reduction rate was 90%. This could mean that an experiment of the same type in a controlled environment with *Dysphania ambrosioides* could give better results [28]

More specifically, it was observed in the LD, a total reduction (100%) on the OPGs of the genus *Ascaridia galli*, while in the LL, we had the same rate for the genus Capillaria spp. We can thus deduce that *Dysphania ambrosioides* is more effective against parasites of the genus *Ascaridia galli*, while levamisole is more for the genus Capillaria spp. We also note that both genera belong to the Nematoda family. The study carried out in the South of Benin goes in the same direction and confirms the effectiveness of *Dysphania ambrosioides* powder on *Ascaridia galli* in local chickens [25]. Likewise, the work of Salifou et al. in 2013 proved in vivo that the aqueous decoction of *Dysphania ambrosioides* leaves has a significant anthelmintic activity on gastrointestinal nematodes of naturally infested Sahelian goats. The main target of the plant during this study was the genus *Ascaridia galli*. A significant reduction of eggs in the feces was noted after 3 days of treatment and reached 100% after 5 to 6 days of treatment with the concentration of 4 ml/Kg [29]. The results obtained by Maminiaiana in Kianjasoa agree with ours on the tropism of levamisole towards the genus *Capillaria Spp*. [30].

Over time, we have observed that *Dysphania ambrosioides* has a longer duration of efficacy compared to levamisole because parasitic re-infestation is observed 2 months post-treatment, whereas it is 1 month for levamisole. We also observed a tropism or an uncertain or very weak spectrum of action of *Dysphania ambrosioides* for other parasitic

genera and which merits further experimentation. For example, the eggs of *Heterakis gallinarum* and *Capillaria spp*. Remain observable after 15 days of treatment with a reduction rate of less than 88%.

4.4. Antiparasitics used and type of parasites observed

A total of 6 parasitic genera were observed during the coprological analyses. Except for the genus *Railietinia cesticulus* observed in a low proportion, our results are like those found by Mpoame et al. before the administration of papaya seed powder as an antiparasitic. However, and contrary to our observations, the genera *Heteratis* and *Emeria* were more frequent in their study, respectively 71.6% and 51.6%. On the other hand, our study showed a high prevalence of the genus *Capillaria spp*. (49.3%), *Ascaridia galli* (26.6%), higher than that found in their study [17].

4.5. The impact of deworming on the performance of village poultry

During the first four consecutive months of the experiment, a significant weight gain for the animals treated with *Dysphania ambrosioides* and levamisole was observed. Chicks treated with *Dysphania ambrosioides* showed a weight increase of approximately 2 times more than those not treated (634.5g compared to 392.8g for the control group). For levamisole, the chicks reached an average weight of 508g compared to 392.8g in the control group at the end of the experiment, a difference of 115g. Between the 2 treated groups (LD and LL), a difference of 126.5g was observed. The weight gain between the 3 groups is significantly different, with a p-value = 0.00. The same impacts were observed with another medicinal plant because, Mpoame et al. obtained in 2008 a significant improvement in the weight of broiler chickens treated with ethanolic extract of papaya grain in Cameroon. The same goes for that obtained by Maminiaina in 2017 which showed a clear improvement in the weight of chickens treated with levamisole compared to the control batch [8, 30]. The work of Ghoul and Gagui goes in the same direction and highlights the negative impact of the absence of deworming in guinea fowl [4]. For the control group, the weight of the animals remains very low. [25, 31]

Limitations of the study

Our work consisted of collecting the feces and weight of the birds over a period of 6 months to highlight the effectiveness of *Dysphania ambrosioides* on digestive parasitosis and the weight performance of local breed poultry. However, we did not consider the role of the dietary supplement observed in some farms, although distributed in the 3 batches. Indeed, the dietary supplement in poultry farming plays an important role in weight gain. This is seen in several studies that correlate weight gain and the intake of the dietary supplement [32, 33, 34]. Thus, further experimentation that would also consider the general diet of poultry and the food supplement (the energy and protein aspects) could make it possible to improve the quality of our results.

During our periodic surveys, several clinical signs were often observed in poultry in the 3 batches, with no significant difference between the batches. These include: anorexia, prostration, anemia, ruffled feathers, and coughing. A more in-depth look at the reasons for the occurrence of these different clinical signs, the pathological profile of the farms, including prophylactic and vaccination measures, could allow an improvement in the quality of our results [34, 35].

The presence or absence of resistance genes in certain poultry ecotypes could explain to some extent the impact of parasitism and which weight gain or not on the chicks in our study. Indeed, the literature mentions the existence of resistance genes in certain poultry ecotypes against several pathologies such as coccidia infestations [36].

5. Conclusion

The semi-experimental study that we conducted over 6 months in the commune of Imerintsiatosika to highlight the effectiveness of *Dysphania ambrosioides*, also called Taimborotsiloza in Madagascar, on digestive parasitoses in traditional breed poultry, allowed us to arrive at several conclusions.

- Several genera of parasites are present in traditional poultry. A predominance was observed for the nematode family with the genus *Capillaria spp.* (49.3%), *Ascaridia galli* (26.6%). With OPG numbers above 5000 at the start of the experiment, we can speak of hyperparasitism and polyparasitism in local breed poultry
- The administration of *Dysphania ambrosioides* in traditional poultry showed significant tropism towards several parasitic germs with an overall OPG reduction rate of 95% compared to 94.5% for levamisole. The action of *Dysphania ambrosioides on* digestive parasites was significant, unlike that of levamisole, which proved more effective on the genus *Capillaria Spp,* contrary to *Dysphania ambrosioides,* which was more effective on parasites of the genus *Ascaridia galli.*

- Analysis of the weights of young poultry collected periodically showed a significant difference in the average weights of chicks in the 3 batches (LD = 634.5g against g; LL 508g and LT=392.8g). The use of *Dysphania ambrosioides* as an antiparasitic in poultry influences the weight gain of poultry

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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