

Behavior of Helminthes in Laying Hens During the Period 2014-2017.

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Abstract

The helminthological infestation of birds useful for man, is favored with the concentration of these in the breeding areas, which together with poor hygienic-sanitary conditions benefits the development and reproduction of them, increasing associated metabolic and physiological disorders that weaken the chicken. In the present study, all laying hens referred to the Parasitology Department of LARD during the 2014-2017 period were analyzed, in order to determine the behavior of the helminths that affected them. A total of 3103 samples from different sectors were investigated, incomplete helminthological necropsy was performed and the prevalence and invasion intensity of the diagnosed parasites was determined. The main helminths found were *Raillietina* spp., *Raillietina cesticillus*, with a high prevalence, *Raillietina tetragona*, *Choanotaenia infundibulum*, *Ascaridia galli*, *Subulura suctorica*, *Heterakis gallinarum* and *Tetrameres americana*, the latter being the one with the highest Average Invasion Intensity. Of the polyhelminthiasis detected, the most frequent were the associations of *Raillietina cesticillus-Ascaridia galli* and *Raillietina cesticillus-Heterakis gallinarum* with 18 and 19% respectively. The values indicated that the cestode *Raillietina cesticillus* was the one that most affected the hens in production, causing a severe helminthiasis.

Keywords: Laying hens; Helminthes; Cestode; Nematode

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Introduction

The current Cuban poultry farming is based on the exploitation of commercial hybrids specialized in the production of eggs with high-capacity laying hens. Egg production has reached a high level of specialization, especially under conditions of controlled environments and balanced feeding; however, under hot-humid conditions, without adequate control of environmental variables and less efficient feeding systems, the results may be affected, so it is of great interest to monitor the main causes that affect the functioning of a productive system (López., et al. 2004, Fernandez and Pérez 2008).

The poultry industry is one of the most important sectors in the livestock activity in Cuba, so it is vital to update the state of health of the country and its regions, design efficient programs to reduce health risks that may affect the economy in the short term and long term. And the stability of the companies dedicated to this purpose (Albizures., et al. 2016). Gastrointestinal parasitism is one of the main

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problems that affect the performance of these birds, causing morbidity and mortality, which negatively affects the production rates and, therefore, the economic aspect of the producers. Gastrointestinal parasitosis caused by helminth affects the health of birds by reducing the production of meat and eggs, causing economic losses annually for the poultry sector and reducing the availability of products for human consumption (Ensuncho, *et al.* 2015; Albizures, *et al.* 2016).

The control of parasitic diseases depends on the precise and timely diagnosis of the etiological agents, in order to establish the correct and effective treatment that allows to improve the profitability of the productive unit. Based on this, the objective of the work is to determine the behavior of helminths diagnosed in laying hens during the 2014-2017 period.

Materials and Methods

In the present study, all laying hens referred to the Department of Parasitology of the Laboratory of Avian Research and Diagnostics (LIDA), belonging to the Poultry Research Institute (AVIS), were analyzed during the period 2014-2017, in order to determine the main helminths that affected them.

We investigated 3103 chickens from various sectors such as state, national plan, genetics and particular. For the study of the helminths, an incomplete helminth necropsy was performed as established by Rodríguez, *et al.* (2002) where the intestines and blind were inspected and consisted essentially of the scraping of the intestinal mucosa, dilution and decantation of the contents. The proventriculus and gizzard of birds with suspected nematodes in these organs were also analyzed.

The prevalence and Average Invasion Intensity of each parasite diagnosed was determined by the formula proposed by Roque (2015):

Prevalence = Number of positive samples/Number of samples worked *100

Average Invasion Intensity (A.I.I.) = Amount of parasites/Number of positive birds

For the calculation and interpretation of the results, it was based on the four categories, according to the degree of pathogenicity of the helminths (Rodríguez, *et al.* 2002):

- Negative: when parasitic forms or their larvae do not appear.
- Mild: little and moderately pathogenic species, the product of prevalence by A.I.I. is equal to or less than 125. Pathogenic species, the product of prevalence by A.I.I. is equal to or less than 25.
- Average: low and medium pathogenic species, the product prevalence by A.I.I. is greater than 125 and less than or equal to 225. Pathogenic species, the product prevalence by A.I.I. is greater than 25 and less than or equal to 50.
- Severe: low and medium pathogenic species, the product prevalence by A.I.I. is greater than 225. Pathogenic species, the product prevalence by A.I.I. is greater than 50.

Statistical Analysis: The analysis of comparison of proportions to prevalence values was carried out, with the support of the statistical package COMPROP1.

Results and Discussion

In table 1 it can be seen that in the different years the same helminths were presented, except for the year 2014 where *Raillietina* spp. and 2016 where *Raillietina tetragona* and *Tetrameres americana* were diagnosed. However, although they did not appear throughout the period, these parasites are very frequent, coinciding with Pardo (2007) who states that *Tetrameres americana* is present in numerous avian troops and with Sanchez (2004) when referring that within the cestodes that affect the most frequent birds are *Raillietina* spp., being known *Raillietina cesticius*, tetragona and echinobotrída as the most frequent in the domestic chicken that is the definitive host.

Year	Worked samples	Positive samples	Helminth diagnosed
2014	272	1	<i>Raillietina spp.</i>
		37	<i>Raillietina cesticillus</i>
		33	<i>Choanotaenia infundibulum</i>
		4	<i>Ascaridia galli</i>
		7	<i>Subulura suctoria</i>
		34	<i>Heterakis gallinarum</i>
2015	858	139	<i>Raillietina cesticillus</i>
		29	<i>Choanotaenia infundibulum</i>
		39	<i>Ascaridia galli</i>
		67	<i>Subulura suctoria</i>
		47	<i>Heterakis gallinarum</i>
2016	889	196	<i>Raillietina cesticillus</i>
		2	<i>Raillietina tetragona</i>
		21	<i>Choanotaenia infundibulum</i>
		34	<i>Ascaridia galli</i>
		21	<i>Subulura suctoria</i>
		45	<i>Heterakis gallinarum</i>
2017	1084	237	<i>Raillietina cesticillus</i>
		106	<i>Choanotaenia infundibulum</i>
		20	<i>Ascaridia galli</i>
		5	<i>Subulura suctoria</i>
		43	<i>Heterakis gallinarum</i>
Total	3103	1170	-

Table 1: Diagnostic helminths in laying hens during the period 2014-2017.

These parasites especially affect young birds and in laying period due to the expoliation effect, which decreases the rate of growth and production levels and eventually causes death (López., *et al.* 2004).

Table 2 reflects the behavior of the prevalence of diagnosed helminths. The results reveal that the cestode *Raillietina cesticillus* with a 19.63% prevalence is the most frequent and *Raillietina spp.* together with *Raillietina tetragona* and *Tetrameres americana* those of lower prevalence. In research conducted by Colas., *et al.* (2010) showed that in laying hens the cestode *Raillietina cesticillus* was found in greater proportion. These results coincide with studies conducted by Hernández., *et al.* (2004) and Colas., *et al.* (2006) highlighting that this helminth was the most frequent in domestic chickens in commercial breeding in Cuba and in laying hens, however Albizures., *et al.* (2016) report that research conducted in Central America has resulted in the nematode *Ascaridia galli* being the helminth with the highest incidence.

In studies conducted by Ensuncho., *et al.* (2015) in Colombia obtained that within the helminths, the nematode of the genus *Capillaria spp.* was the most frequent, followed by *Ascaridia galli*, *Heterakis gallinarum* and *Syngamus trachea*. Among the group of custodies, the most frequent were the genus *Raillietina spp.* and *Davainea proglottina*. These results are similar to those found by Marín and Benavides (2007) in the department of Caldas, Colombia, where they found *Heterakis gallinarum*, *Ascaridia galli* and *Capillaria spp.* among the most

frequent genera of nematodes. Unlike our study, nematodes were not relevant and positive results were not obtained for *Capillaria* spp., *Syngamus trachea* and *Davainea proglottina*.

Helminth species	Positive birds	Prop.	Prev. (%)
<i>Raillietina</i> spp.	1	0,0003	0,03 ^d
<i>Raillietina cesticillus</i>	609	0,1963	19,63 ^a
<i>Raillietina tetragona</i>	2	0,0006	0,06 ^d
<i>Choanotaenia infundibulum</i>	189	0,0609	6,09 ^b
<i>Tetrameres americana</i>	3	0,0009	0,09 ^d
<i>Ascaridia galli</i>	97	0,0313	3,13 ^c
<i>Subulura suctoria</i>	100	0,0322	3,22 ^c
<i>Heterakis gallinarum</i>	169	0,0545	5,45 ^b
Total birds analyzed	3103		

Table 2: Behavior of the prevalence of helminths diagnosed in laying hens in the period 2014-2017.

Comparison of proportions: Test F = 290.59*** (ES = 0.00)

(Different letters in the same column differ with high significance for p-value < 0.001)

The helminths diagnosed in these birds were manifested with a higher Intensity of Invasion for American *Tetrameres* followed by *Heterakis gallinarum* and *Subulura suctoria* (Table 3). While the *Tetrameres Americana* proventricule nematode is moderately pathogenic, the nematodes of the blind *Heterakis gallinarum* and *Subulura suctoria* are low pathogens, according to the degree of pathogenicity for Cuba, considered by Rodríguez, *et al.* (2002), so that so the injuries do not go from a simple irritation and thickening of the mucous membranes.

Helminth species	Total Parasites	Positive Birds	All.
<i>Raillietina</i> spp.	2	1	2
<i>Raillietina cesticillus</i>	3433	609	5,64
<i>Raillietina tetragona</i>	9	2	4,50
<i>Choanotaenia infundibulum</i>	793	189	4,19
<i>Tetrameres americana</i>	49	3	16,33
<i>Ascaridia galli</i>	1037	97	10,69
<i>Subulura suctoria</i>	1181	100	11,81
<i>Heterakis gallinarum</i>	2196	169	12,99

Table 3: Average Invasion Intensity Behavior of the helminths diagnosed in laying hens in the period 2014-2017.

Despite the results obtained, it is important to highlight the hematophagous power of the *Tetrameres Americana* females, coinciding with Pardo (2007), by stating that the females parasitize the proventriculus glands causing atrophy and strong gastritis. The expoliation reaction (hematophagous) is direct on the bird's organism, causing inflammatory reactions with diminution of the physiological activity of the proventriculus. It also highlights the nematode *Heterakis gallinarum* that its importance lies in that it is an intermediary host of the protozoan *Histomona meliagridis* which, although it does not constitute a great danger to the domestic chicken, if it represents it for turkeys.

Table 4 reveals the levels of infestation of the helminths diagnosed, highlighting the Cestode *Raillietina cesticillus* that causes a severe helminthiasis and *Choanotaenia infundibulum* and *Ascaridia galli* with media levels. These helminths are considered very pathogenic, so they cause damage to the bird's organism, affecting its performance and indicating the need for the application of a treatment. The results coincide with Martín-Gómez and Benavides-Montaño (2007) who state that birds with high helminth loads show decay, wasting, diarrhea, reduced food efficiency and in severe cases, death. On the other hand, Junquera (2018) reports that studies carried out in several countries have reported that more than 90% of the hens investigated were infected with *Ascaridia galli*, that their high intensity causes intestinal obstruction and in layers the infection can cause loss of performance and discolored buds, however Corridor, et al. (2006) state that for *Ascaridia galli*, the age of the host and its diet play a very important role in the development of the disease, where chickens under three months of age are much more receptive to parasitism and disease It is much more serious. The results showed *Raillietina cesticillus* as the most present helminth.

Level of infestation		
Mild	Half	Serious
Raillietina spp.	Choanotaenia infundibulum	Raillietina cesticillus
Raillietina tetragona		
Subulura suctorica	Ascaridia galli	
Heterakis gallinarum		
Tetrameres americana		

Table 4: Level of Infestation of the helminths diagnosed in laying hens in the period 2014-2017.

Comparison of proportions: Test F = 9.52*** (ES = 0.02)

(Different letters in the same column differ with high significance for p-value < 0.001)

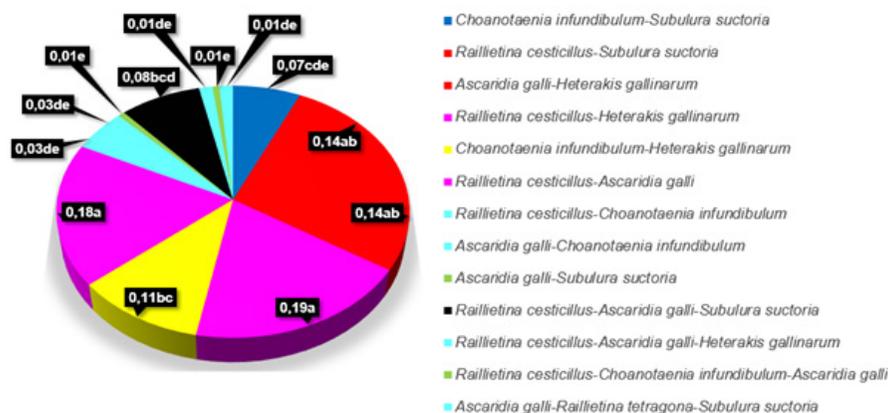


Figure 1: Behavior of the prevalence of polyhelminthiasis diagnosed in laying hens in the period 2014-2017.

Figure 1 shows the behavior of the polyhelminthiasis diagnosed in these birds, where it is revealed that the associations *Raillietina cesticillus-Heterakis gallinarum* and *Raillietina cesticillus-Ascaridia galli* are the most prevalent, showing very significant differences with respect to the other combinations. The association *Raillietina cesticillus-Ascaridia galli* is of great importance in poultry farming because both are considered highly pathogenic, so their combination causes alterations in the organism of these birds and can cause death if not treated in time.

This study shows that monoparasitism occurred in 87.44%, whereas multiple infections (12.56%) occurred with up to two and three taxa. As stated by Ensuncho., *et al.* (2015) birds can be infected through food, water and soil (in search of invertebrates who can act as intermediate or paratenic hosts of various kinds of helminths). Lizaso (2014) considers that spring and summer are the times of greatest abundance of helminths, mainly due to the greater presence of intermediate hosts.

A few parasites do not cause serious damage, however, if there are massive invasions, the effects on the host increase. In laying birds, there is a decrease in the rate of laying on the affected farms, coinciding with Pardo (2007). On the other hand, Lizaso (2014) considers that, in laying hens, one of the first symptoms that appear after a helminth infestation is the increase in the number of declassified eggs, mainly of pale eggs.

In research carried out on fighting cocks in Venezuela Cazorla and Morales (2013), they found that 37.3% of the birds presented one or more helminth taxa in their digestive tracts. Monoparasitism occurred in 8.8% of cases, while multiple infections occurred with up to six taxa. In his studies the ascaris *Heterakis* spp. and *Ascaridia galli* were the most frequent, while our results showed *Raillietina cesticillus* in this place.

Conclusions

- The helminths diagnosed in laying hens during the period 2014-2017 were the cestodes *Raillietina* spp., *Raillietina cesticillus*, *Raillietina tetragona*, *Choanotaenia infundibulum* and the nematodes *Tetrameres americana*, *Ascaridia galli*, *Subulura sutoria* and *Heterakis gallinarum*.
- The most prevalent helminth was the Cestode *Raillietina cesticillus*, causing a severe helminthiasis.
- The highest Average Invasion Intensity was presented for the *Tetrameres Americana* nematode.
- The most prevalent polyhelminthiasis were the *Raillietina cesticillus-Heterakis gallinarum* and *Raillietina cesticillus-Ascaridia galli* associations.

Comparison of proportions: Test F = 290.59*** (ES = 0.00)

(Different letters in the same column differ with high significance for p-value < 0.001)

Conflict of interest

There are no conflicts of interest

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