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The First Report about *Allopsoroptoides galli* n. g., n. sp (Acari: Analgoidea: Psoroptoididae) Infected Layer Hens: Hematological, Serum Chemistry, and Histopathologic Findings

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Abstract: We have reported the first record of an exotic species of mites from an avian host of the order Galliformes in Bastos region, State of São Paulo, Brazil. The new feather mite was identified as *Allopsoroptoides galli* n. g., n. sp. (Acari: Analgoidea: Psoroptoididae). The hens parasitized by mites had intense itching, desquamation and marked drop in egg production (between 20-30%). Based on the observed signals, this study aimed to verify the influence of parasitism on the blood profile, biochemical and histopathological changes in infested chicks. The infected hens showed hematocrit decrease, leukocytosis and eosinopenia. In serum chemical were observed decrease of alkaline phosphatase (ALP) and creatinokinase (CK) and increase of gama glutamiltransferase enzymes (GGT), cholesterol, and total serum protein. All infected cases had skin lesions such as: hyperkeratosis, inflammatory heterophilic infiltration; hydropic degeneration and mixed cellular infiltration of lymphocytes and plasmocytes. The histopathological observation on the kidney in infected hens showed mild changes such as degeneration of kidney tubules, pyknosis and hemorrhage. The liver of birds infested presented infiltrates of mononuclear cells and vacuolation. It can be concluded that feather mite's infection causes serious damage to the hens. These results could be really useful to assist diagnosis and prognosis of this infection.

Key words: Feather mites, layer hens, hematology, serum chemistry, histopathology

INTRODUCTION

Brazil is one of the world's leading agricultural and livestock product suppliers and one highlight is the poultry industry, ranking the seventh place in egg production (FAOSTAT, 2009).

These modern commercial poultry production uses fully integrated production techniques that allow for the production of a large number of eggs on a small amount of land. However, the intensive husbandry conditions using high densities of animals have expedited the outbreaks of arthropod pest problems due produce large quantities of wastes as manure and dead birds (Axtell, 1999; Guimarães and Chernaki-Leffer, 2009).

In this way, we have reported the first occurrence of exotic feather mites infesting laying hens in Bastos, State of São Paulo (SP), Brazil between December, 2010 and January, 2011. Mites were identified by Mironov (2013) as *Allopsoroptoides galli* n. g., n. sp. (Acari: Analgoidea: Psoroptoididae).

Laying hens affected manifested dermatitis, papular eruption, wrinkled skin, itching and redness. The lesions were mostly confined to ventral wings. In addition, others changes like anorexia, reduction in food consumption; decreased in egg production (between 20 and 30%) and loss weight gain was also observed.

Limited correlations have been found between parasitism and clinical parameters in layer hens, except studies to indicators of effect of mycotoxins (Denli *et al*., 2008; Fernandez *et al*., 1994). According to Ogbe *et al*. (2010), hematological, biochemical profile and histopathology changes in organs or tissues of animals are important indices of health status of animals (disease conditions, stress, others).

The present study was undertaken to provide information on the hematological and biochemical pattern and histopathological changes in layer hens naturally infested with the exotic mites Psoroptoididae.

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MATERIALS AND METHODS

Hens: A total of 20, 50-week-old commercial laying hens (*Dekalb White*) were studied. Hens were housed in battery cages and light was provided for 17 h per day. The study was conducted at the caged-layer facilities at Bastos city, SP, Brazil (21°55'19"; 50°44'02"). Two lots of 10 birds each were selected and designated as group A (infected) and Group B (parasite free).

Hematological and biochemical analysis: Blood samples were taken from the wing vein and transferred immediately into a set of sterile tubes containing anticoagulant, disodium-salt of Ethylene Diamine Tetracetic Acid (EDTA) or without EDTA for biochemical analysis. The microhematocrit method and cyanme-themoglobin method were used to determine Packed Cell Volume (PCV) and Hemoglobin (Hb), while Red Blood Cell (RBC) and White Blood Cell (WBC) counts were determined using the Neubauer hemocytometer method. The tests were conducted within 2 h of collecting the blood. The Mean Corpuscular Volume (MCV) and Mean Corpuscular Hemoglobin Concentration (MCHC) were calculated from these hematological measurements. Leukocyte differential counts were made on blood films stained with Wright´s stain, using average of 100 leukocytes. The serum chemistry parameters: uric acid, urea, total proteins, albumin, glucose, aspartate amino transferase (AST) and gama glutamiltransferase (GGT) were determined with an automated (spectrophotometer) chemistry analyzer SBA-200 (Celm® SBA-200).

Histopathology: Histopathologic examination of each group was carried out (Behmer *et al*., 1976) at Laboratory of Pathology, Center for Research and Development in Animal Healthy, Biological Institute, São Paulo, SP, Brazil. This was done by first harvesting the skin, liver and kidneys.

Statistical analysis: Data were subjected to analysis of variance and means were compared by the Turkey's test in the program SAS (2008), when significant at 5% probability.

RESULTS AND DISCUSSION

Hematological and serum biochemical analysis have been considered useful as a guide in the diagnosis of many diseases, including assess the effect of parasite infections and evaluation of body condition and the nutritional and immune status in live animals (Mohamed *et al*., 2012).

In the present study, significant differences between infected and parasite free hens were observed like hematocrit and leukocytes decrease (P<0.05) (Table 1). Similar results like total white cell count decrease in birds infected with cysticercoids of *Raillietina tetragona* (Eucestoda) have been reported previously (Vijayakumaran, 1981).

Table 1: Hematological values for *Dekaub White* free infested and infested for feather mites Psoroptoididae

Variable	Free infested	Infested
Erythrocytes (x10^6/µL)	2.44±0.83^a	2.47±0.16^a
Hemoglobin (g/dL)	14.18±0.89^a	11.90±0.73^a
PVC (%)	31.20±0.53^a	26.20±0.70^b
MCV (fl or x10^{-15})	129.64±5.66^a	110.17±7.71^a
MCHC (%)	45.29±2.38^a	45.81±3.17^a
Leukocytes (x10^3/µL)	18.40±1.18^a	10.80±1.31^b
Monocytes	5.70±0.82^a	6.80±0.57^a
Lymphocytes	53.50±2.51^a	49.30±3.75^a
Basophils	4.20±0.61^a	4.10±0.84^a
Eosinophils	3.60±1.08^a	0.60±0.27^b
Heterophils	33.00±2.51^a	38.90±3.42^a

PCV: Packed cell volume; MCV: Mean corpuscular volume; MCHC: Mean corpuscular hemoglobin concentration

Means followed by different letters in the same row are significantly different (p<0.05)

Table 2: Serum biochemical values for *Dekaub White* free infested and infested to feather mites Psoroptoididae

Variable	Free infested	Infested
AST (UI/L)	254.00±8.96^a	235.00±6.87^a
ALP (UI/L)	1331.00±310.57^a	495.00±125.53^b
CK (UI/L)	3324.00±285.37^a	2511.00±221.48^b
GGT (UI/L)	32.60±0.60^a	111.50±35.20^b
Glucose (mg/dL)	210.90±12.43^a	191.30±4.82^a
Cholesterol (mg/dL)	87.80±13.2^a	152.20±9.87^b
Uric acid (mg/dL)	7.78±0.84^a	6.66±0.54^a
Protein (g/dL)	4.29±0.2^a	7.83±0.32^b
Albumin (g/dL)	1.58±0.05^a	1.85±0.14^a
Urea (mg/dL)	0.70±0.37^a	2.60±1.37^a

AST: Aspartato aminotransferase; CK: Creatinocinase; ALP: Fosfatase alcalina; GGT: γ-glutamiltransferase

Means followed by different letters in the same row are significantly different (p<0.05)

In regards to leukocytic components, only eosinophils parameters differed significantly within groups infected and parasite free (P<0.05). The slightly lowered eosinophil count may be associated to stress conditions in infected hens (Latimer and Bienzle, 2000).

The biochemical findings are presented in Table 2. It is evident that the chemicals constituents of the blood of hens naturally infected with feather mites (Psoroptoididae) presented certain characteristic changes. There were a significant rise in gama glutamiltranferase (GGT), cholesterol and total proteins concentration (TP). This study has record also decreased of alkaline phosphatase (ALP) and Creatine Kinase (CK) activities.

Regarding to histopathology, results were blindly examined by pathologist. In comparison with control group, all infected cases had skin lesions such as: hyperkeratosis, inflammatory heterophilic infiltration; hydropic degeneration and mixed cellular infiltration of lymphocytes and plasmocytes. These findings support works of Sokol and Rotkiewicz (2010) and Hobbenaghi

et al. (2012) which reported hyperkeratosis in *Dermanyssus gallinae* (Acari: Dermanissidae).

The histopathological observation on the kidney and liver in infected hens showed mild changes such as degeneration of kidney tubules, pyknosis and hemorrhage. The liver of birds infested presented infiltrates of mononuclear cells and vacuolation.

Comparing the hematological and chemical changes obtained with reported histopathologic findings associated with parasitic infection, it is easy to emphasize some inferences. GGT levels are reportedly elevated in liver disease (Cornelius, 1989). So, it is probably that this elevation coincided with the degree of alterations observed in the liver of laying hens.

Conclusion: In summary, this study presents baseline hematologic, biochemical and histopathological information for naturally infested layer hens to feathers mites Psoroptoididae. Comparisons between the groups (infested and free infested birds) are preliminary and suggest a testable hypothesis that these mites can induce changes such as hematocrit decrease, leukopenia and eosinopenia; decrease of ALP and CK, increase of GGT, cholesterol and proteins, in addition to dermatologic, hepatic and kidney changes. Furthermore, complement the diagnosis the increase in enzymatic activity of GGT and non-infectious inflammatory changes in the liver.

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