

## Pathological lesions as consequence of apilic accident in Blue-and-yellow macaw (*Ara ararauna*)

### Lesões patológicas como consequência de acidente apílico em ararauna azul e amarela (*Ara ararauna*)

DOI: 10.34188/bjaerv5n3-057

Recebimento dos originais: 06/05/2022

Aceitação para publicação: 30/06/2022

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#### **ABSTRACT**

Apilic accident, in medicine, is the name given to the phenomenon of aggression by bees of the genus *Apis*. This article describes the pathological consequences of a case of Africanized bees attacking examples of Blue-and-yellow macaw (*Ara ararauna*) captive by a wild fauna maintainer, located in the south of Minas Gerais State. Anatomically, vascular changes and inflammatory reactions were observed in the stung site as flushing, bruising and edema, as well as the histopathological evaluation showed generalized congestion, disseminated intravascular hemolysis, inflammatory infiltration composed of eosinophils, basophils and lymphocytes. Microscopically, vascular lesions were found, as already seen in macroscopy, with renal and hepatic edema being observed in all individuals, necrosis in proximal contorted tubules and inflammatory infiltration throughout the renal and pulmonary interstitium. Other changes observed included myocardial edema, increased cell volume in renal tubules, inflammatory infiltrate into the liver parenchyma, pulmonary edema and hepatocyte vacuolization. According to histopathological findings, we can state that the characteristic of type I hypersensitivity lesions was found in the macaws of this case, being similar to that observed in mammals. Therefore, this information contributes to a better understanding of avian apilic accidents, as well as in order to influence studies for future therapeutic procedures for birds.

**Keywords:** Apilic accident, type I hypersensitivity, toxicology, avian pathology.

## RESUMO

Acidente apílico, na medicina, é nome dado ao fenômeno de agressão por abelhas do gênero *Apis*. O presente artigo descreve as consequências patológicas de um caso de ataque de abelhas africanizadas a exemplares de Arara-canindé (*Ara ararauna*) cativas de um mantenedor de fauna silvestre particular localizado no Sul de Minas Gerais. Anatomicamente foram observadas alterações vasculares e reações inflamatórias nos locais que foram ferroados como rubor, hematomas e edema nos locais das picadas em na avaliação histopatológica foram observadas congestão generalizada, hemólise intravascular disseminada, infiltração inflamatória composta por eosinófilos, basófilos e linfócitos. Microscopicamente foram encontradas lesões vasculares, como já constatada na macroscopia, sendo observado em todos os indivíduos edema renal e hepático, necrose em túbulos contorcidos proximais e infiltração inflamatória por todo interstício renal e pulmonar. Outras alterações observadas incluíram edema em miocárdio, aumento de volume celular em túbulos renais, infiltrado inflamatório em parênquima hepático, edema pulmonar e vacuolização de hepatócitos. Conforme os achados histopatológicos podemos afirmar que as lesões características de hipersensibilidade do tipo I encontradas nas aves deste estudo são semelhantes ao observado em mamíferos, sendo que estas informações contribuem para que possamos entender melhor os acidentes apílicos aviários e também ajudar futuramente em procedimentos terapêuticos se porventura houver novos casos.

**Palavras-chave:** Acidente apílico, hipersensibilidade tipo I, toxicologia, patologia aviária.

## 1 INTRODUCTION

Diseases due to poisonous insect bites in humans, pets, farm animals and even wild animals, are described sporadically<sup>(1)</sup>, where accidents by insects of the order Hymenoptera (Insecta: Endopterygota) are commonly involved. Hymenopterans comprise ants, hornets, wasps and bees<sup>(2)</sup>; among these insects, bees are a relevant group in cases of bites and Brazil is the country in Latin America with the highest notification of accidents by bees<sup>(3)</sup>.

In Brazil the predominance of bees in beekeeping is composed of swarms of hybrid specimens of European bees (*Apis mellifera mellifera* or *Apis mellifera ligustica*) as the African Bee (*Apis mellifera scutellata*), known as africanized bees. African Bee in characterized by a high honey productivity, high resistance to pests, but with a very intense defensive behavior that is responsible for the accidents that occurred by these bees<sup>(4)</sup>.

Apilic attack or accident, in medicine, is the name given to the phenomenon of aggression by bees of the genus *Apis*. The aim of this article was to describe the pathological findings of a case of Africanized bees accident on examples of captive Blue-and-yellow macaw (*Ara ararauna*) in a wild fauna maintainer, located in the south of Minas Gerais State.

## 2 CASE PRESENTATION

In December of 2017 (summer in Brazil), in a wildlife maintainer located in the south of Minas Gerais State, Brazil, a stimulation of an Africanized bees box, caused by a free-living specie of *Didelphis* spp. resulted in the formation of a swarm that attacked a nursery containing 34 specimens of Blue-and-yellow macaw (*Ara ararauna*).

Since the attack immediately observed, the birds were rescued and medicated as possible, with immediate priority being given to the manual removal of stinger, when visible on the birds. Six (6) Canindé Macaws died immediately after the attack while 28 underwent to emergency procedures, receiving corticosteroids (through intravenous or intra muscular via) and adrenaline (used in the ones in shock), in addition to supportive fluid therapy. Additionally, four (4) Macaws died into the next 72 hours, even after the emergency protocols, totalizing ten (10) deaths.

Died Macaws were necropsied immediately with stingers being removed along the body during the external examination, mainly in naked areas (Figure 1A). As a curiosity title, just in one Macaw it was observed 80 face stings. Bees were also found in the oral cavity, esophagus and crop.

In general, vascular and inflammatory changes, such as flushing, bruising and edema, were internally observed in the stung sites, (Figures 1B, 2A e 2B). Other kinds of lesions were not observed. Heart, lung, kidneys and liver were collected and fixed in 10% formalin solution for histopathological analysis. Slides with 5 µm tissue cuts were stained by the Hematoxylin and Eosin technique, for further analysis with optical microscopy.

In histopathological evaluation it was manly observed generalized congestion, disseminated intravascular hemolysis, inflammatory infiltration composed of eosinophils (rare), basophils and lymphocytes (predominance). Microscopically, vascular lesions were found, as already seen in macroscopy, with renal and hepatic edema, necrosis in proximal convoluted tubules and inflammatory infiltration throughout the renal and pulmonary interstitium were observed in all individuals. (Table 1). Other changes observed included: myocardial edema, increased cell volume in renal tubules, inflammatory infiltrate into the liver parenchyma, pulmonary edema and hepatocyte vacuolization.

According to apilic accident history, macroscopic changes and, mainly, due to microscopic lesions, it is concluded that the birds died due to anaphylactic shock due to bee stings.

### 3 DISCUSSION

Africanized bees are highly defensive, their aggressiveness being greater in the late afternoon and in the rainy season<sup>(5)</sup>. Specifically, in the southeastern region of Brazil, where the State of Minas Gerais is located, December is a rainy season<sup>(6)</sup>, which justifies the high reactivity of bees observed in this report.

From a clinical point of view, bee stings cause local and systemic responses of hypersensitivity, with local dermatological reactions of different degrees (pain, edema and hyperemia), anaphylactic reaction (urticaria, bronchospasm, hypotension and cardiovascular collapse), and the systemic toxic reaction, characterized by clinical signs such as edema, acute renal failure, convulsions and changes in mental state, that often precede death<sup>(4,7)</sup>. In severe cases of poisoning, phenomena such as hemolysis and rhabdomyolysis are observed, and this hemolysis, in histopathological findings, is an important evidence of anaphylactic shock<sup>(8)</sup>. The reactions triggered by the bee's sting are variable, and the location and the number of stings influence the intensity<sup>(4)</sup>.

The lesions observed in cases of bee sting poisoning occur due to different toxins, known as apitoxin, which include: apamine, melitin, phospholipase A2, mast cell degranulate factor and basophils that release histamine, serotonin, bradykinin, in addition to hyaluronidase and catecholamines<sup>(4,9)</sup>.

Anaphylactic shock involves the production of IgE with the release of inflammatory mediators, with mast cell degranulation, increasing the amount of serum histamine and worsening cardiopulmonary manifestations<sup>(10)</sup>. These reactions justify the inflammatory infiltration in the renal and pulmonary interstitium observed in this report.

Tubular obstruction and retrograde tubular overflow occur due to excess water and solutes in the tubules and renal vasoconstriction caused by the inflammatory reaction. This obstruction leads to an increase in cell volume in renal tubules and inflammatory infiltration in the renal interstitium<sup>(11)</sup>, as observed in all the Canindé Macaws analyzed, as well as the observation, in seven Macaws, of increase in cell volume of the renal tubules.

Massive attacks by bees cause obstruction of kidney structures, leading to damages such as acute tubular necrosis. This necrosis is related to ischemia and the direct action of nephrotoxic agents on tubular cells that, when moving into the renal tubule to be excreted and, due to their large amount, these nephrotic agents accumulate into the lysosomes, interfering phospholipases actions, resulting in lysosomal phospholipidosis that generates rupture of the lysosomes and necrosis of the proximal tubular epithelial cells<sup>(11,12)</sup>. These findings were observed in all the animals necropsied.

In birds the main organ affected in shock situations is the respiratory tract, with clinical signs of dyspnea and even seizures. Pulmonary edema occurs due to the release of mediators such as histamine, serotonin and leukotrienes<sup>(10,13)</sup>, alterations observed in six (6) Macaws.

In its initial phase, pulmonary fibrosis presents an inflammatory process in the interstitium, as well as in the alveolar lumen, being defined in the histopathological diagnosis as interstitial pneumonia. Lung interstitial diseases include infiltrative inflammatory processes, with chronic or subacute evolution<sup>(14)</sup>. This outcome was present in 100% of animals of this report.

As a consequence of interstitial changes there is a sudden accumulation of fluid into the lungs, pulmonary edema due to changes in blood pressure, corroborating with the pulmonary edema observed in the histopathological analysis in a prevalence of 60% of the analyzed Macaws. Other possible clinical pathological changes already described, as characteristic of bee poisoning, are liver dysfunction and myocardial injury<sup>(15)</sup>, also observed in this report, confirming the aggressiveness of apitoxin for Macaws.

In a general context, death by bee sting is a type I hypersensitivity reaction and it can range from an immediate death to a few hours' death after the apilic accident<sup>(8,13)</sup>. Although apilic accidents are well studied in man, with several reports in mammals, no case reports were found describing it in birds.

#### **4 CONCLUSIONS**

Therefore, according to histopathological findings, we can affirm that the characteristic of type I hypersensitivity lesions found in Macaws in this study are similar to those observed in mammals, and this information contributes to better understanding of the avian apilic accidents, as well as it may will help improve future therapeutic procedures on new cases.

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Figure 1. Apilic accident in *Ara ararauna*: A. Presence of several stingers (blackened points) stuck in the Macaw's naked face; B. Subcutaneous edema in the pectoral region (shiny area).

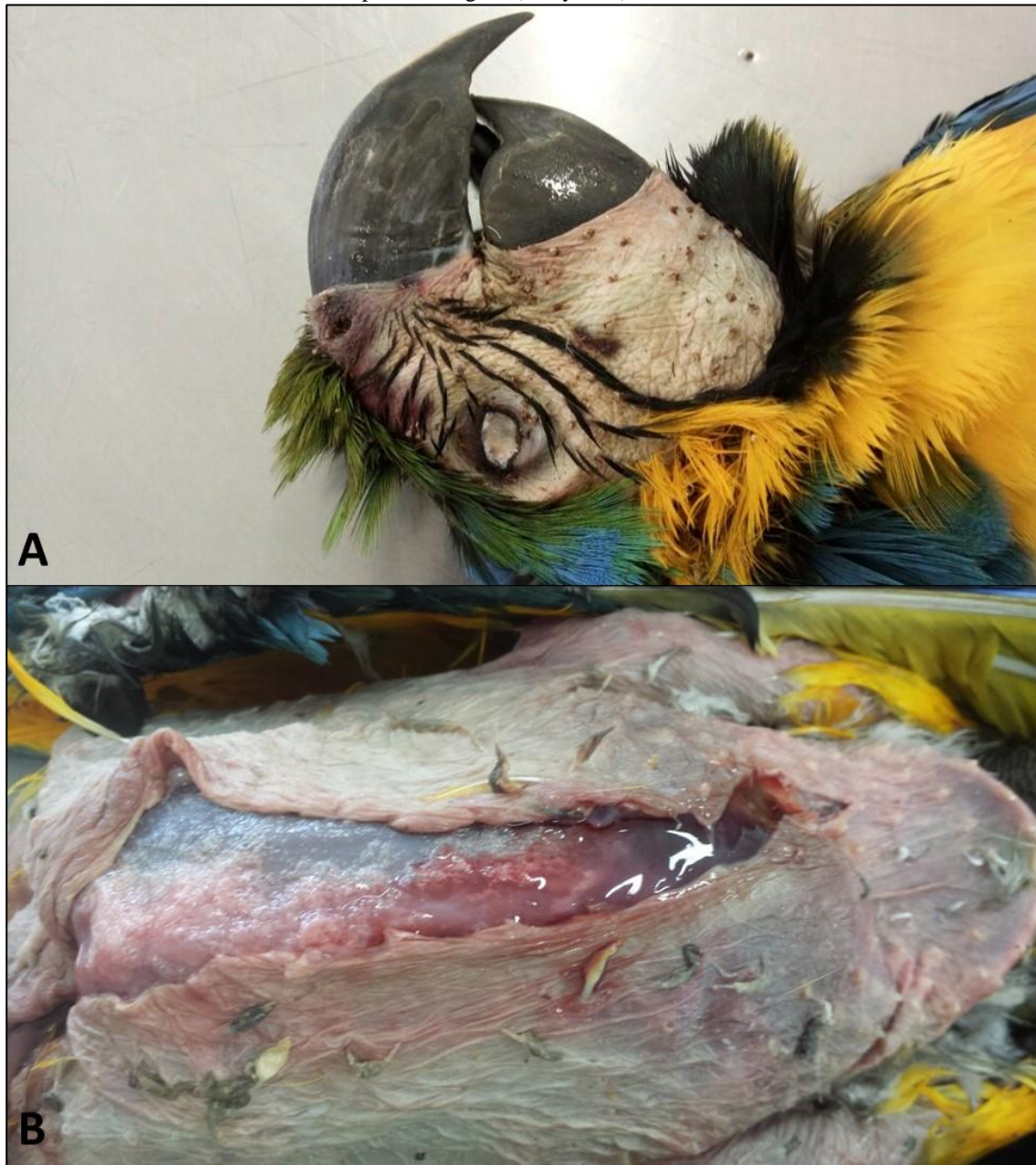


Figura 2. Apilic accident in *Ara ararauna*: A. Subcutaneous hematoma in the cervical region; B. Cardiac and hepatic congestion.

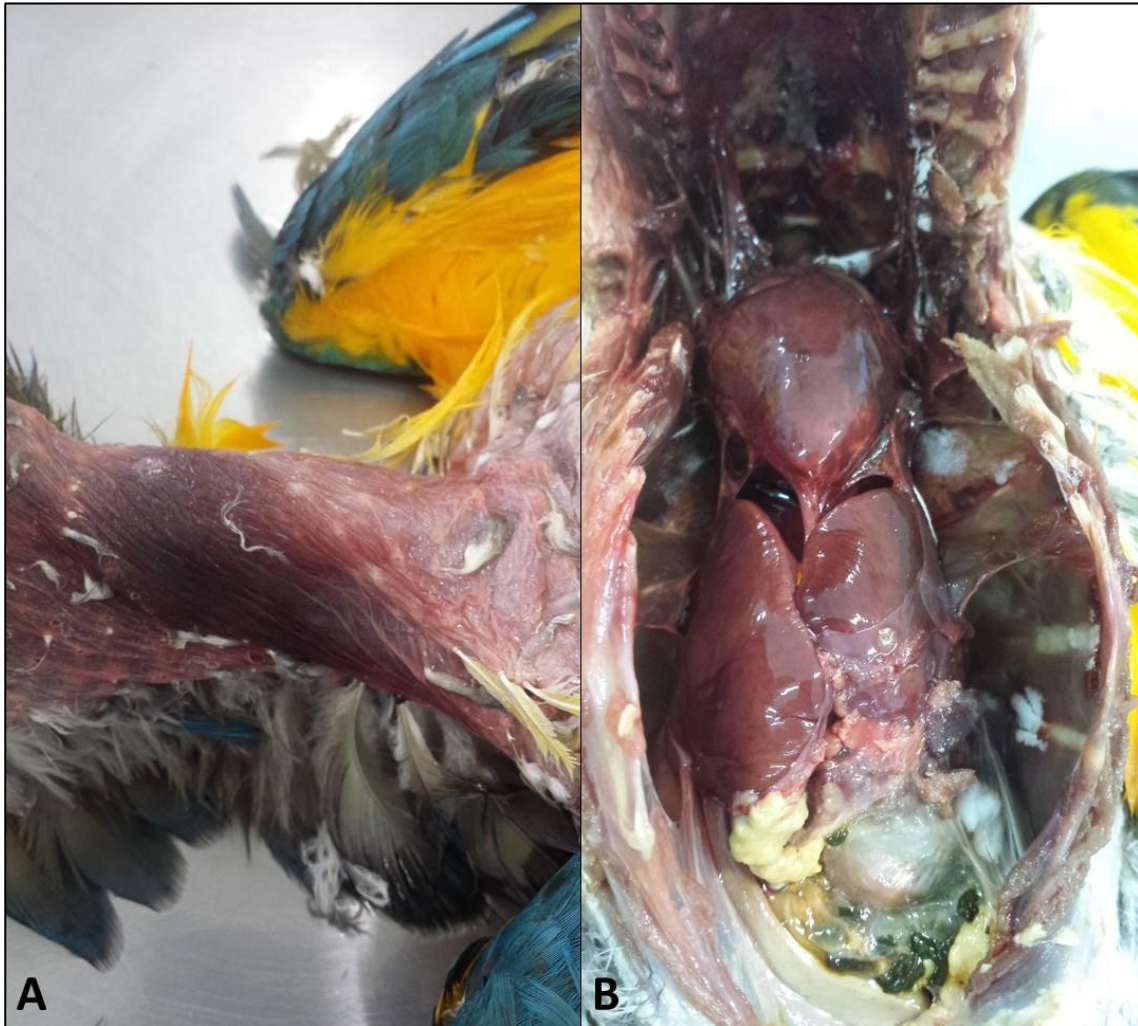




Table 1: Microscopic changes observed in specimens of *Ara ararauna* attacked by Africanized bees.

Changes	Total (N=10)	Prevalence (%)
Renal edema	10	100
Tubular necrosis	10	100
Increased cell volume in renal tubules	7	70
Inflammatory infiltration in renal interstitium	10	100
Hepatic edema	10	100
Hepatocyte vacuolization	4	40
Inflammatory infiltration in hepatic parenchyma	7	70
Pulmonar edema	6	60
Inflammatory infiltration into the pulmonary interstitium	10	100
Myocardial edema	9	90