



## CASE REPORT

### Invasion of Red Mite (*Dermanyssus gallinae*) As a Cause of Foot Self-Mutilation in a Laying Hen Flock

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#### ABSTRACT

This case report describes *Dermanyssus gallinae* infestation as a cause of foot self-mutilation in a laying hen (*Gallus gallus*) flock. The wounds were observed on one or both feet on the dorsal part of the metatarsus and third digit. Some birds have severe lesions - the tendon and muscle were damaged, and the bone of the digit was visible. The high number of red mites on the dead birds and in the poultry house was noted. The warm summer and high temperatures (30°C) were optimal for red mite development, leading to their high numbers in the environment. The observations suggest that during the examination of foot injuries in birds, self-mutilation caused by red mite invasion should be considered as a possible cause, in addition to pododermatitis and scabies.

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#### INTRODUCTION

In vertebrates, the skin is the first layer of protection against the external environment which plays an important role in thermal, hygrometric, and chemical regulation. Some skin problems and injuries in birds may be caused by bad environmental conditions in terms of animal welfare, behavior problems, diseases and diet (Couteaudier and Denesvre, 2014). For example, injurious pecking is a behavioral problem that has several manifestations, including feather pecking (pulling at and removing the feathers of another bird), vent pecking (pecking at the cloaca of another bird), and cannibalistic pecking (pecking at the skin of another bird). These behaviors may be associated with stress, pain, and fear, as well as increased mortality and feed consumption due to heat loss. Feather pecking is often observed in non-cage housing systems for laying hens (*Gallus gallus*) in large flocks (Heerkens *et al.*, 2015). Self-mutilation and self-pecking associated with stress have also been described in caged hens and exotic birds. The aim of this study was to describe a case of foot self-mutilation in laying hens caused by red mite invasion.

**Case history:** In September 2015, the owner of a flock of 3,000 laying hens (White Leghorn; age: 50 weeks) informed us of problems with higher mortality in the flock. Birds were kept in free run system (6 hens/m<sup>2</sup>), in a

poultry house with wooden nest boxes and perches, and an automatic egg collection system. The flock owner observed that birds were irritated, and intensive self-pecking was noted. During one week, 30 birds died, with visible body injuries. A decrease in laying production due to the higher mortality rate was observed.

**Postmortem examination and diagnostic:** Eight dead hens and a fecal sample from the flock were delivered to the Department of Epizootiology and Clinic of Bird and Exotic Animals of the Faculty of Veterinary Medicine at the Wrocław University of Environmental and Life Sciences. During postmortem examination, organs were collected and examined microbiologically.

Feces were examined for *Eimeria* oocysts and nematode eggs by the flotation method. Intestines of birds were collected, and parasitic macroscopic and microscopic examinations were made. Scrapings from lesions on the feet were microscopically examined, and external parasites were collected. Samples of organs used for microbiological testing were immediately delivered to the laboratory at the Department of Epizootiology and cultured using commercial growth media for isolation of aerobic or anaerobic bacteria and fungi.

All necropsied birds showed anemia and mutilation of one or both feet (Fig. 1). In two cases of foot mutilation, the area around the wound was swollen. In three birds, the foot mutilation was severe; the wound on

the dorsal part of the metatarsus and third digit exceeded 0.5 cm in diameter. In these cases, in addition to the skin, the tendon and muscle were damaged, and the bone of the digit was visible. No lesions of the internal organs were observed; however, all of the organs were pale. In one individual, evidence of cannibalism was found, as the oviduct and intestines had been pulled out. High numbers of red mites were observed on all dead birds. Parasites were mostly on the feathers and, to a lesser extent, the feet.

After microscopic examination of found mites, the external parasites were recognized as *Dermanyssus gallinae* (Di Palma *et al.*, 2012). Macroscopic examination of intestinal tract did not reveal the presence of parasites. Microscopic examination of scrapings of mucosa from the duodenum, jejunum, ileum, and cecum did not show the presence of *Eimeria* spp., nor were *Eimeria* oocysts or nematode eggs found in the fecal examination. Skin scrapings did not exhibit *Cnemidocoptes* spp. Microbiological testing did not indicate the growth of bacterial or fungal pathogens in the organs of dead birds. No fungi growth was observed on the foot lesions.

**Red mite monitoring on the farm:** Because of high number of parasites on the necropsied birds, the red mite traps, based on the description by Nordenfors and Höglund (2000), measuring 10x7 cm, open on the longer side were placed in nest (10 traps) and on perches (10 traps). They were taken down 24 h later and placed in hermetically sealed bags for transport to the laboratory where they were frozen at -20°C for 24 h. The number of mites obtained from the traps placed in the nest boxes was 2-2.5 thousand each, and for the traps placed on the perches 4-5 thousand each.

Because of birds age, high mortality and lack of registered in Poland medicaments which could be used on birds, the owner decided to slaughter the birds.

## DISCUSSION

The hematophagous poultry red mite, *D. gallinae*, is a member of the order *Parasitiformes*, which contains ticks and mites. This parasite requires blood meals to develop into the last three stages of its life cycle and to develop eggs during oviposition (Tucci *et al.*, 2008; Abbas *et al.*, 2014). *D. gallinae* is distributed throughout the world and considered to be the most serious and economically significant ectoparasite affecting poultry. The total annual cost of *Dermanyssus* invasion in the European Union was estimated to be €130 million (George *et al.*, 2015).

The high costs derive from the high mortality rate of the infected birds, resulting from exsanguination and transmission of several significant pathogens e.g., *Borrelia*, *Erysipelothrix*, *Spirochetes*, *Pasteurella*, fowl poxvirus, Newcastle disease virus, and eastern equine encephalitis virus (Moro *et al.*, 2009) as well as the reduced egg production. Among hens, infestation can result in a death rate of 1% to 4% and a reduction in laying performance of up to 10%.

Pathological features of *D. gallinae* infestation vary depending on the infestation rate. Invasion with even a small number of parasites can result in stress, as

evidenced by the increased levels of corticosterone among birds exposed to *D. gallinae* compared to unexposed birds (Kowalski *et al.*, 2006). Severe infestation causes stress and discomfort to the infected birds, which become nervous and irritable. Itching, sleep disorders, feather pecking, and cannibalism are the most common symptoms, which can lead to anemia that may be fatal (Cosoroaba, 2001).

In the described case, foot mutilation and cannibalism in the laying hens were observed. We found a high number of *D. gallinae* on examined birds. The owner confirmed a huge amount of red mites during the last month, as well as pecking behavior. The heavy burden of red mite was set by Nordenfors and Höglund (2000) to 1000 or more mites per trap, and in described case the 2-5 thousand parasites per trap were observed.

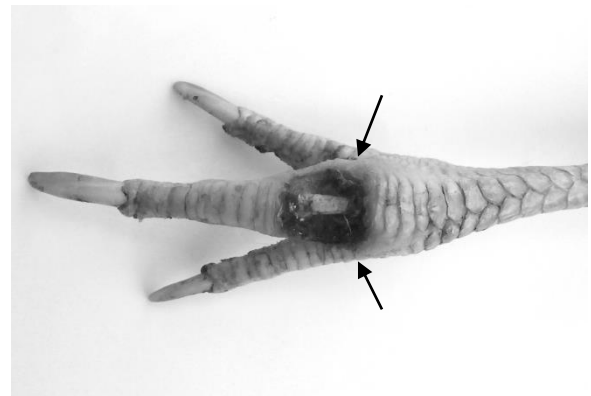


Fig. 1: Feet self-mutilation during *Dermanyssus gallinae* invasion.



Fig. 2: Red mite on the necropsied birds (A) and from traps (B).

The cause of irritation and, indirectly, foot self-mutilation was high number of the red mites in the environment, resulting from the high temperatures in Poland last summer (~30°C during June, July and August, the 3 months before examination of the birds). The optimal temperature for *D. gallinae* development is 30°C, which results in the greatest survival of mites in all stages and the shortest development time. At environmental temperatures of 25 to 35°C, the life cycle of the red mite is 6 to 7 days, with cycle elongation as the temperature decreases; 11 days at 20°C and 28 days at 15°C (Tucci *et al.*, 2008).

The large number of parasites in the environment is consistent with the anatomo-pathological findings of paleness due to blood loss and the presence of red mites on the dead birds. Foot self-mutilation was the main lesion in the diagnosed flock. Previously described cases of cannibalistic behavior connected with red mite infestation have focused on vent pecking. In the present case report, vent pecking was observed in only a small number of birds. Our observations suggest that during the examination of foot injuries in birds, self-mutilation caused by red mite invasion should be considered as a possible cause, in addition to pododermatitis and scabies.

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**Authors contribution:** KB and AG executed the postmortem examination, the microbiological examination

and parasite analysis. All authors interpreted the data, critically revised the manuscript and approved the final version.

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