



Case report: *Tyrophagus putrescentiae* (Acari) attacking laying birds in conventional poultry houses

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Abstract

Tyrophagus putrescentiae (Schrank) (Acaridae) is one of the most allergenic mite species worldwide, and it particularly infests household environments, animal feed factories, and food factories. It has been the aim of several studies recently in the healthcare area due to its allergenic potential. However, there had been no records of this species attacking laying birds until this report. This is the first record of adverse reactions in animals triggered by infestations of this species. Therefore, the present study aims at describing the damages and symptomatology of *T. putrescentiae* infestations on commercial laying hens. Alopecia and dermatitis were symptoms exacerbated by *T. putrescentiae* infestation starting at 40 weeks old. The presence of this species on hens, as observed in the present study, might be directly related to the accumulation of food and poultry litter on these birds, in their cages, or in the vicinities. Hence, the results might be related to their feeding behavior, which consists of continuous supply of animal feed in these management systems. The present study provides an unprecedented record that reveals the importance and potential for emergency pest status of *T. putrescentiae* in the poultry industry. Its infestations in poultry houses probably required constant sanitary care and monitoring are required in order to prevent outbreaks of this mite.

Keywords Acaridae · Cage system · Cutaneous symptoms · Itching · Mites

Background

Tyrophagus putrescentiae (Schrank) (Acaridae) is one of the most allergenic mite species worldwide, and it particularly infests household environments, animal feed factories, and food factories. It is an allergy-inducing species, which causes manifestations such as dermatitis, rhinitis, and asthma in humans (Colloff 2009; Liao et al. 2013a), and mites of this species have even caused anaphylaxis through ingestion of mite-contaminated foods (Liao et al. 2013a, b). *Tyrophagus putrescentiae* has been the aim of several studies recently in the healthcare area due to its allergenic potential (Arlian et al. 1984; Hage-Hamsten and Johansson 1998; Bravo et al. 1999; Elder et al. 2012; Liao et al. 2013a, b; Yu et al. 2014).

Núñez et al. (2016) described a strong allergic inflammation induction in lungs of mice, both in acute and chronic models.

However, there had been no records of this species attacking laying birds until this report. This is the first record of adverse reactions in animals triggered by infestations of this species. Therefore, the present study aims at describing the damages and symptomatology of *T. putrescentiae* infestations on commercial laying hens.

Materials and methods

Study Area

The species was reported in a poultry house in the municipality of Vacaria, state of Rio Grande do Sul (RS), Brazil. Laying hens were reared in conventional systems (battery Cage) and the number of birds per cage was 12. High *T. putrescentiae* infestations were observed on their feathers during routine veterinarian analyses and monitoring. The birds were 82 weeks old; however, the first infestation focal

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points started in hens aged around 40 weeks. Generally, to these monitoring and daily analyses of biosafety to poultry mites were collected feathers, traps to ectoparasites, and organic matter (Silva et al. 2013; Faleiro et al. 2015; Horn et al. 2018).

Material sampling and processing in the laboratory

Five feathers were collected per bird, sampled from 10 birds, totaling 50 feathers. The feathers were kept in tagged plastic containers containing 70% alcohol. Alcohol filtering process was performed using a qualitative filter paper with 12.5 cm diameter and 80 g/m grade. All material collected was observed using a Leica S6E binocular stereoscopic microscope. Mites were removed with the help of a thin-tipped brush, mounted on microscope slides in Hoyer's medium (Jeppson et al. 1975), and maintained at 50–60 °C for approximately seven days, for fixation, distension, and clarification of specimens and drying of medium. Mite specimens were deposited in the Laboratório de Acarologia of Universidade do Vale do Taquari – Univates, Lajeado, Rio Grande do Sul. Mite species were identified using the following dichotomous keys: Krantz and Walter (2009), Hughes (1976), Flechtmann (1985), Klimov and OConnor (2009, 2010) and Fan and Zhang (2007), with the help of a Zeiss Axio Scope A1 phase contrast optical microscope.

Several morphological characters were used to distinguish this species from the others. *Tyrophagus putrescentiae* is generally characterized by dorsum presenting four pairs of prodorsal setae and 12 pairs of hysterosomal setae, all dorsal setae slightly barbed; External vertical setae (*ve*) obviously long, situated at anterior lateral margins of prodorsal shield;

External scapular setae (*sce*) shorter than internal scapular setae (*sci*). The shape of coxal sclerotization II; presence of two pigmented eyespots on the prodorsal shield; a prominent and apical enlarged supracoxal seta (*scx*) with pectinations; Seta *d1* always more than twice as long as *d2*; Female without bifid claws (Klimov and OConnor 2009; Fan and Zhang 2007).

Clinical diagnosis

The only species identified using the feathers sampled was *T. putrescentiae*. The clinical symptoms observed on the birds were rash and restlessness. Alopecia and dermatitis were symptoms exacerbated by *T. putrescentiae* infestation starting at 40 weeks old (Fig. 1). Itching was exacerbated as hens pecked their own feathers, followed by gradual feather loss. Skin lesions were observed right after feather loss; consequently, there was eventual skin damage as there was higher skin exposure due to restlessness and rash.

There were no observed in the poultry house analyzed any other mite species, such as *Dermanyssus gallinae* (De Geer), *Ornithonyssus* spp. or *Megninia ginglymura* (Méglin). In addition, when *T. putrescentiae* was absent the laying hens are not present any clinical symptoms as above described.

Discussion

Tyrophagus putrescentiae is generally present in foods, poultry litter, and molds, and there have been no records of this mite causing damages to hens. These mites are usually directly associated to degradation of animal feed

Fig. 1 a-b: Injuries (e.g. alopecia and dermatitis) in chicken infested with *T. putrescentiae* in the municipality of Vacaria/RS. Photo: Univates



and other foods in silos and warehouses (Colloff 2009). The present study provides an unprecedented record that reveals the importance and potential for emergency pest status of *T. putrescentiae* in the poultry industry. The presence of this species on hens, as observed in the present study, might be directly related to the accumulation of food and poultry litter on these birds, in their cages, or in the vicinities. Hence, the results might be related to their feeding behavior, which consists of continuous supply of animal feed in these management systems; there have been records of this species in abandoned nests of *Columbina picui* (Temminck) (Silva et al. 2013, 2018).

Aside from affecting the health of workers, by causing dermatitis, these mites act as vectors of pathogenic microorganisms (Green and Woolcock 1978; Duek et al. 2001; Erban et al. 2016; Silva et al. 2019). Siegert et al. (2018) showed that *T. putrescentiae* was one of the most abundant species in brans found in an animal feed factory. Therefore, the feed offered to hens during confinement in the present study might have represented a suitable habitat to the development of these mites, which corroborates Horn et al. (2018), who also found these mites in an egg-laying poultry house with different confinement systems.

Direct damages to egg production and feather loss levels are not yet clear and have not been proven, as the infestation level that might be endured by chicken up to when its yield is affected is yet to be known. Therefore, the present study draws attention to the species *T. putrescentiae* and its infestations in poultry houses, thus suggesting constant sanitary care and monitoring are required in order to prevent outbreaks of this mite.

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Author contributions GLS, LJ, NJF and FRS designed the study; GLS, LJ, AMP, MS, LMO performed research, laboratory activities; FRS, GLS contributed to diagnosis and writing; GLS and LMO drafted the paper with contributions from all other authors.

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Data availability All data and materials are available for publication.

Declarations

Ethical approval All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

Consent to participate All authors participated voluntarily in the research.

Consent for publication All authors read and approved the final manuscript.

Conflict of interest The authors declare no conflict of interest.

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