Allergic dermatitis caused by *Culicoides* in Texel sheep in the state of Pará, Brazil

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Allergic dermatitis was studied at a farm located in the municipality of Castanhal in the state of Pará, Brazil, from December 2009 to December 2012. Clinical and epidemiological data were obtained during monthly visits to the farm. Skin biopsies were performed for histopathological examinations, and insects were captured with Centers for Disease Control and Prevention (CDC) traps and live-bait entomological vacuum devices. The property housed a herd of both genders, with 45 Santa Inês sheep of different ages and 72 Texel adults. Of the 72 Texel sheep, 56 were affected. Of these, 24 exhibited alopecia, erythema, edema, and crust in the ears, on top of the head, and less often, around the eyes. In addition to the lesions described above, 14 animals exhibited hyperpigmentation of the ears and/or around the eyes and crust in the nose. Another 18 animals exhibited chronic lesions characterized by deformed and thickened ears, alopecia with hyperpigmentation, and in most cases, secondary bacterial infections with abscesses and/or myiasis. Some of these animals had lost part of their ears. Histologically, the lesions were characterized as orthokeratotic hyperkeratosis, acanthosis, vacuolization, and necrosis of epidermal cells. An inflammatory infiltrate was present in the dermis, which was composed mainly of eosinophils and macrophages, some lymphocytes and mast cells, and few neutrophils, in addition to edema and collagen deposition. The Santa Inês sheep were not affected. Among the captured insects, 294 specimens of *Culicoides* (*Hoffmania*) *plaumanni* Spinelli, 57 specimens of *C.* (*Hoffmania*) *insignis* Lutz, and 27 specimens of other *Culicoides* species were identified. We conclude that *C. plaumanni*, *C. insignis*, and possibly other *Culicoides* species are involved in the etiology of allergic dermatitis in Texel sheep in the state of Pará. Santa Inês sheep in the same region and under the same conditions were not affected, which suggests lower susceptibility of these animals.

**INDEX TERMS:** Allergic dermatitis, *Culicoides*, Texel sheep, hypersensitivity, seasonal dermatitis, Brazilian Amazon.

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INTRODUCTION

In Brazil, the disease was reported for the first time in the state of Rio Grande do Sul (Corrêa et al. 2007) in sheep from different breeds, including Ideal, Corriedale, Texel, Hampshire Down, and Crioula. The morbidity ranges from 10 to 80%. The first cases occur from October to December, with morbidity reaching 60 to 80% from January to March, and markedly decreasing from March to the end of April, during which some chronic cases are observed (Souza et al. 2005, Corrêa et al. 2007).

In the semiarid region of the state of Paraíba, two cases of the disease were diagnosed in sheep (Macêdo et al. 2008). In the state of Rio Grande do Norte, Portela et al. (2012) described the disease in a herd with 40 Santa Inês sheep that were raised extensively on natural pasture. The morbidity rate reached 32.5%. Lesions were observed during the rainy season and completely or partially receded during the drought, reappearing in the next rainy season. The disease was associated with bites from Culicoides insignis Lutz.

In the North region, the disease was diagnosed at 15 farms in the state of Pará and at one farm in the state of Roraima, affecting Santa Inês and mixed-breed sheep from both genders. The most affected animals were aged from 2 to 4 years, and it was suggested that the allergic dermatitis was associated with insects from the genera Simulium and Hippelates (Barbosa et al. 2011).

The present study aimed to describe allergic dermatitis in Texel sheep in the municipality of Castanhal, in the state of Pará, at a farm with Santa Inês sheep that were not affected. The epidemiological aspects of the disease and the clinical-pathological condition of the animals were studied, and the biting midges species possibly associated with the disease etiology were identified.

MATERIALS AND METHODS
The disease was studied at a farm located in the municipality of Castanhal, state of Pará, monthly from December 2009 to December 2012. The Castanhal region is composed of secondary forest with a humid equatorial megathermal climate, which corresponds to the Ami type in the classification by Köppen, with high temperatures and relative humidity between 85 and 90%. The average annual rainfall ranges from 2,500 mm to 3,000 mm and is concentrated mainly in the rainy period, which occurs from November to May (Santos et al. 2006).

Clinical and epidemiological data were obtained during monthly visits to the farm. A skin biopsy was performed in the dorsal region of the ear of four sheep for histopathological examination. The samples obtained were fixed in 10% formalin, embedded in paraffin, cut at a thickness of 5 µm, hematoxylin-eosin stained, and evaluated with an optical microscope.

The insects were captured twice, in December 2009 and December 2012. The first capture was performed with three CDC light traps placed at a 120 to 150 cm distance from the ground, which functioned continuously from 5:00 pm to 6:00 am of the next day for three consecutive days. The second capture was performed with an entomological vacuum device using three mixed-breed Texel sheep as live bait from 5:00 am to 7:00 am and from 5:00 pm to 7:00 pm for three consecutive days. At the time of the first capture, there were 72 Texel sheep on the farm, of which 56 were affected. At the time of the second capture, Santa Inês and mixed-breed Texel sheep were housed on the farm, and two predominately white mixed-breed animals had lesions that were suggestive of allergic dermatitis. After capture, the insects were placed in containers containing 70% ethanol and sent to the Ceratopogonidae Collection (CCER) of the Laboratory of Diptera of the Oswaldo Cruz Foundation for mounting, identification and deposit. Part of the specimens were preserved in Kahle-Dietrich solution and part was slide-mounted in phenol-balsam in the manner described by Wirth & Marston (1968). The identification was based on the key and descriptions of species found in Spinelli et al. (1993).

RESULTS
The farm housed a herd with 117 sheep of both genders, with 45 Santa Inês sheep from diverse categories (sheep, lambs, ewes, and rams) and 72 Texel adults. The animals were extensively managed with Panicum maximum cv. Masai grazing during the day. At night, they were kept in two collective pens of approximately 100 m² each, with 6 m between them. The Texel sheep remained in one of the pens, whereas the Santa Inês sheep remained in the other. The pens had a cement floor, and accumulation of fecal matter and urine occurred. Of the 72 Texel sheep, 56 had lesions suggestive of allergic dermatitis. Of these, 24 had alopecia, edema, and crust in the ears, on top of the head (Fig. 1A), and less often, around the eyes. In addition to the lesions described above, 14 animals exhibited hyperpigmentation of the ears and/or around the eyes and crust on the nose. Another 18 animals had chronic lesions (Fig.1B) characterized by deformed thicker ears, with alopecia, hyperpig-
mentation, and in most cases, secondary bacterial infection with formation of abscesses at the base of the ears and myiasis. Some of these animals had lost part of their ears.

According to the keepers, the Texel animals were restless in the pens due to attacks of "biting midges". The Santa Inês sheep were not affected. The two herds were observed periodically during a three-year period, and most of the Texel sheep affected exhibited lesions that partially receded during the drought and worsened during the rainy season. As a result of the disease severity, in October 2012, the pure Texel sheep were transferred to another farm, and only the Santa Inês sheep and some crossbred Texel sheep remained at the farm. In December 2012, two predominantly white crossbred animals exhibited allergic dermatitis lesions.

Histologically, the lesions were characterized by orthokeratotic hyperkeratosis, acanthosis, vacuolization, and necrosis of epidermal cells. An inflammatory infiltrate was present in the dermis, which was composed mainly of eosinophils and macrophages, some lymphocytes and mast cells, and few neutrophils, in addition to edema and collagen deposition (Fig.2).

In total, 378 female specimens of biting midges were captured both in the CDC light traps and in the live-bait traps. Of the trapped material, 179 specimens of C. (Hoffmania) plaumanni Spinelli, 47 specimens of C. (Hoffmania) insignis Lutz and 14 specimens of Culicoides (Hoffmania) spp. were identified. Of the insects captured on the sheep, 115 C. (Hoffmania) plaumanni, 10 C. (Hoffmania) insignis, eight Culicoides (Hoffmania) spp., one C. (Hoffmania) foxi Ortiz, one C. (Hoffmania) maruim Lutz, one C. (Hoffmania) ocumarenis Ortiz, one C. carsiomelas Wirth & Blanton and one Culicoides sp. were identified. Culicoides insignis and C. plaumanni are the most abundant species and belong to the Culicoides guttatus group of the subgenus Hoffmania. They can be distinguished from the other species of the group by the following combination of morphological characters (Fig.3): wing with contrasting pattern of dark and pale spots; r-m crossvein dark; cell r3 with one distal pale spot; third palpal segment with irregular palpal pit; cell m1 with one distal pale spot (in C. insignis) or two distal pale spots (in C. plaumanni); vein R3 pale (in C. plaumanni) or dark up to the point where it turns abruptly forward to meet costa (in C. insignis); mandible with 13-15 teeth (in C. plaumanni) or 21-23 teeth (in C. insignis); palpal head ratio 0.83-0.93 (in C. plaumanni) or 0.98-1.08 (in C. insignis); antennal ratio 1.09-1.20 (in C. plaumanni) or 1.19-1.38 (in C. insignis).

**DISCUSSION**

The diagnosis of seasonal allergic dermatitis was based on the epidemiology, clinical signs, pathological changes, and identification of Ceratopogonidae insects from the genus Culicoides. Reports of seasonal allergic dermatitis outbreaks in sheep caused by Culicoides spp. have been documented by several authors (Schild et al. 1993, Yeruham & Braverman 2000, Corrêa et al. 2007, Portela et al. 2012). In Israel, C. obsoletus is responsible for all cases of this disease in sheep (Yeruham & Braverman 2000). C. insignis was indicated as the cause of this disease in Hampshire Down sheep in Rio Grande do Sul (Corrêa et al. 2007). In the pre-
sent study, many specimens of *C. plaumanni* were captured using both the CDC traps and live bait, and they are most likely the main agents responsible for the emergence of the disease. The occurrence of this insect has been reported in Brazil (in the state of Amazonas), Argentina, Peru (Felippe-Bauer et al. 2008), Bolivia, and Colombia (Spinelli et al. 2009). However, there are no case reports of allergic dermatitis in domestic animals associated with this species, although a few insects have previously been collected close to sheep and poultry in Peru (Felippe-Bauer – unpublished data). *C. insignis* and *Culicoides (Hoffmania)* spp., which were captured in low number, may also be associated with the etiology of the disease. In allergic dermatitis outbreaks diagnosed in Santa Inês sheep in the same region of the state of Pará, the disease was attributed to insects from the genera *Simulium* and *Hippelates*, and no insects from the genus *Culicoides* were found (Barbosa et al. 2011).

The skin lesions observed, characterized by alopecia,
Allergic dermatitis caused by *Culicoides* in Texel sheep in the state of Pará, Brazil

Only a few animals, particularly adult sheep, have allergic dermatitis lesions, with a morbidity rate ranging from 5 to 10%, which demonstrates different sensitivity among individuals of the same breed (Gabriela Riet-Correa, unpublished data). In the present study, the affected animals were adults of both genders because the owner was starting a herd and had purchased only adult Texel animals. It is unknown whether the morbidity rate of allergic dermatitis is associated with age.

The disease has a seasonal tendency, with a marked increase in the number of cases in periods with high rainfall and a decrease in periods with low rainfall. A study performed by Corrêa et al. (2007) showed that the period in which the disease occurred was ideal to maintain the breeding sites of the captured insects due to favorable environmental conditions for the reproduction of arthropods. In the present study, the number of cases was higher during December, which is a period of high rainfall, as the rain period in the studied region starts in November and continues until April, which favors the emergence of the disease. However, a three-year follow up of the animals found that even during dry periods, many animals remained sick, but the lesions became more discrete, worsening again in the next rainfall period. A possible explanation is that even in the dry period, rainfall still occurs in the region but with lower intensity and frequency than in the rainfall period.

**CONCLUSIONS**

*Culicoides plamannii*, *Culicoides insignis*, and possibly other *Culicoides* species cause seasonal allergic dermatitis in sheep in the state of Pará.

Texel sheep are more affected than Santa Inês sheep, what suggests higher susceptibility.

**REFERENCES**


