Veterinary Parasitology 192 (2013) 301–306

Contents lists available at SciVerse ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Short communication

On the aggregated nature of chronic *Sarcoptes scabiei* infection in adult pigs

E. Goyena[a], R. Ruiz de Ybáñez[a], C. Martínez-Carrasco[a], A. Balseiro[b], F. Alonso de Vega[a], R. Casais[b], M. Prieto[b], J.F. García-Marín[c], E. Berriatua[a,*]

[a] *Animal Health Department, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, Espinardo, Murcia, Spain*
[b] *Servicio Regional de Investigación y Desarrollo Agroalimentario del Principado de Asturias, Spain*
[c] *Anatomía Patológica, Universidad de León, Spain*

ARTICLE INFO

Article history:
Received 1 June 2012
Received in revised form 8 October 2012
Accepted 9 October 2012

Keywords:
Sarcoptes scabiei
Pigs
Chronic infection
Parasite aggregation

ABSTRACT

The prevalence and body distribution of *Sarcoptes scabiei* and associated dermatitis was investigated in sows and boars from four herds with long standing mange. Macroscopic hyperkeratotic dermatitis (crusted mange) was present in 1–6% of herd sows. Mite estimated prevalence (95% CI) in ear scrapings was 11% (6–17%) including 100% (13/13) and 2% (3/134) in sows with and without crusted mange, respectively, and the later had very few mites compared to the former. *S. scabiei* body distribution and dermatitis were further investigated in 59–64 skin scrapings/sow taken post-mortem from four culled sows including two (sows 1 and 2) with and two (sows 3 and 4) without crusted mange. The proportion of skin samples with eggs, instars or adults was 59% in sow 1, 84% in sow 2, 0% in sow 3 and 3% in sow 4. *S. scabiei* distribution in sows 1 and 2 ranged from being present in all skin ear and head samples to absent in those from the inner side of the limbs and mammary glands. Crusted lesions were observed in the skin of the ears, neck and lower limbs and contained the largest mite populations. Histopathological analysis of skin samples identified mites, inflammatory cellular infiltrate (mainly lymphocytes, neutrophils and eosinophils) and hyperkeratosis, acanthosis and spongiosis in 78%, 54%, 20% and 25% of samples from sows 1, 2, 3 and 4, respectively, being lesion severity positively associated to mite presence. The study provides further evidence that in herds with long-standing exposure to *S. scabiei*, infection becomes highly overdispersed with large mite populations present only in a few pigs and in specific body areas. Although the reasons for mite aggregation have not been identified, it is important controlwise because treating or eliminating a few and easy to identify heavily infected adult pigs, should markedly decrease the herd's parasite load and reduce the use of acaridal drugs.

1. Introduction

Sarcoptes scabiei (De Geer) are burrowing mites of the epidermis of mammals, including humans (Arlian, 1989). *S. scabiei* var. *suis* causes swine mange, a chronic, debilitating dermatitis. In spite of the availability of effective acaricidal treatments swine mange remains endemic worldwide. The disease is not notifiable in Spain and a recent epidemiological study of *S. scabiei* infestation in southeast Spain indicates *S. scabiei* is endemic in the region and farmers periodically treat their animals against mange, but do not aim at eradicating the mite from their herd (unpublished results); most consider that acaricidal treatments avoid significant disease losses and are not prepared to outlay the resources to attain and maintain a *S. scabiei*-free farm in the long term. In this scenario it is important

* Corresponding author. Tel.: +34 868 883 997; fax: +34 868 884 147.
E-mail address: berriatu@um.es (E. Berriatua).

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http://dx.doi.org/10.1016/j.vetpar.2012.10.007

to maximise treatment efficacy and identify and treat adult pigs acting as infection reservoirs.

Two typical forms of dermatitis are commonly observed independently in *S. scabiei* infected farms: hypersensitivity mange characterised by a generalised reaction with raised papules, erythema and itching, and hyperkeratotic mange, a dermatitis with abundant asbestos-like, pale grey crusts (Sheahan, 1975a; Cargill and Dobson, 1979a; Martineau et al., 1984; Davis and Moon, 1990a). The hypersentivity form occurs following primoinfestations, and it is typically seen in fattening pigs. Hyperkeratotic crusted lesions occur in a small number of adults, they tend to be localised especially in ear pinnae, and often contain large mite populations. This article address two scarcely studied aspects of chronically infected and other in contact crust-free adult breeding animals, specifically, their relative percentage in the herd and the abundance and body distribution of *S. scabiei* and associated dermatitis in these animals (Davis and Moon, 1990b).

2. Materials and methods

2.1. Study design, herds and pigs

The investigation, carried out in 2010, included an epidemiological study in four herds with long-term mange to assess the prevalence of hyperkeratosis and *S. scabiei* in sows and boars, and a study in four culled sows from these herds to analyse the body distribution of *S. scabiei*. Herds were family run and adult herd size was 122, 30, 50 and 165 pigs in herds A, B, C and D, respectively. They were selected after *S. scabiei* had been detected in ear skin scrapings from slaughtered fatteners, at an estimated prevalence (95% CI) of 18% (12–26%) in herd A, 33% (11–66%) in herd B, 52% (32–71%) in herd C and 84% (75–90%) in herd D (unpublished results). Farmers had used in the past the non-systemic acaridal pour-on Foxim (Sarnacuran, Bayer®) in adults to control mange and the time since the last treatment before the study was 4, 9, 6 and 12 months in herds A, B, C and D, respectively.

The epidemiological study involved a visual examination of all sows and boars in these herds to detect macroscopic hyperkeratotic dermatitis around the body and ear pinnae. Skin scrapings were taken from both ears for *S. scabiei* diagnosis from 147 animals including 13 pigs with hyperkeratotic dermatitis and a random sample of 20–57 pigs/herd with no evidence of hyperkeratosis. Culled sows selected to study *S. scabiei* body distribution were 3–4-year-old, two (sows 1 and 2) had hyperkeratotic crusted lesions and mites in the ear pinnae and two (sows 3 and 4) did not have lesions or mites (sows 3 and 4). Furthermore, sow 1 had mites in both ears visible upon direct observation of ear scrapings in the stereomicroscope and hyperkeratosis also in the left front and back legs in contrast, mites in sow 2 were detected only following the flotation method (see below) and hyperkeratosis affected limbs, head and neck (Fig. 1). Sows 1, 2 and 3 were from herd C and sow 4 came from herd B.

2.2. Skin sampling and mite detection in skin scrapings from culled sows

Sows were euthanised with a 5 ml intramuscular injection of a combination of tiletamine at 250 mg/ml and zolazepam at 250 mg/ml (Zoletil 100®, Virbac, Spain) followed 10 min later by an intravenous injection of 20 ml of sodium pentobarbital at 200 mg/ml (Eutanax®, Fatro, Spain). The skin of each sow was divided into 64 equidistant 12 cm × 12 cm squares (Fig. 1), a 1 cm × 1 cm skin sample was taken from the centre of each corresponding square and stored in 10% buffered formalin for histological analysis; subsequently, the remaining skin was cut out, refrigerated and used within 2 h to obtain an epidermal skin scraping for *S. scabiei* diagnosis as described earlier (Alonso de Vega et al., 1996). Briefly, skin scrapings taken with a dermal curette were observed for mite stages under a stereomicroscope before and after incubation at 37 °C for 12 h. Prior to this, 2 g of epidermis were separated and digested in 10% potassium hydroxide overnight (12 h approximately) at 22–25 °C. The incubation time was selected after checking that it adequately digested the tissue without significantly changing parasite counts. Following, digestion tubes were centrifuged at 500 × *g* for 10 min, the sediment was resuspended in 20 ml Sheather's sucrose solution and the mixture used to enumerate parasite stages in a McMaster's counting slide with the following formula:

$$\mathrm{NPG} = \frac{(v_{\mathrm{sh}} \times n_{\mathrm{p}})/v_{\mathrm{Mc}}}{w_{\mathrm{s}}}$$

where NPG is the number of parasites per gram of epidermis, v_{sh} the volume of Sheather's solution, n_{p} the number of parasites counted, v_{Mc} the volume of McMaster chamber examined (1 ml) and w_{s} is the weight of epidermis sample. Negative samples were re-examined using a sensitive flotation technique by filling the tube with flotation solution to form a convex meniscus, which was overlaid with a cover glass and examined for mites adhering to it 10–20 min later.

2.3. Histological analysis of skin samples from culled sows

Fixed skin samples were routinely processed for histopathological analysis. Four micrometer sections were stained with haematoxylin and eosin (HE) and classified on the basis of presence of (i) *S. scabiei*, (ii) hyperkeratosis, acanthosis and spongiosis (CrIn) and (iii) dermal inflammatory cell infiltrate consisting of lymphocytes, macrophages and eosinophils (AcIn). The lesion degree was obtained by adding numerical values, ranging from 1 to 3, given to each category; mites, when present, were categorised as 1 (1–4 mites), 2 (5–8 mites) and 3 (>8 mites), hyperkeratosis, acanthosis and spongiosis were graded as 1 (mild), 2 (moderate) or 3 (severe) and inflammatory infiltrate as 1 (focal perivascular infiltrate), 2 (multifocal and perivascular infiltrate) and 3 (diffuse infiltrate affecting deep areas of the dermis). Subsequently lesion values for each sample were added together and results used to classify samples