Lice and mite infestations of cattle in Iceland

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ABSTRACT

The aim of the present study was to survey lice and mite species infesting cattle in Iceland and to evaluate their prevalence on farms, prevalence and site preferences on the animals and correlation with dermatological symptoms. The survey included two separate investigations, a combing study including 50 calves and 50 dairy cows, and a study of skin samples including 27 bullocks and 28 dairy cows. The animals came from farms in Southwest Iceland. In the combing study five preselected areas on each animal were combed. Two lice species were found, the chewing louse *Bovicola bovis* and the sucking louse *Solenopotes capillatus*. Lice were found at 7 of 10 farms. *B. bovis* was found at 50% and *S. capillatus* at 40% of the farms and both species occurred at 20% of the farms. Lice were found on 40% of the calves and 4% of the cows. *B. bovis* was found on 28% of the calves and 2% of the cows. *S. capillatus* was detected on 16% of the calves and 2% of the cows. *B. bovis* was most prevalent on back and rump, less prevalent on the head, neck and tail and was not detected on the front leg. *S. capillatus* was most prevalent on the neck, then head and front leg, and was least prevalent on the posterior back and rump and on the tail. Minor dermatological signs were seen on two cows and three calves. In the study of skin samples, samples were taken from five preselected sites of the animals. In this study the hair follicle mite *Demodex bovis* was found in the skin of the neck of one bullock (1.8%). No macroscopic skin disorders were observed on the samples.

Keywords: Cattle, Iceland, ectoparasites, prevalence, predilection sites

YFIRLIT

Lýs og mítlar á íslenskum nautgripum

Markmið rannsóknarinnar var að athuga hvaða ytri sníkjudýr finnast á íslenskum nautgripum, kanna tíðni þeirra á búum, sýkingartíðni og staðsetningu á gripunum og tengsl við sjúkdómseinkenni. Rannsóknin skiptist í kembirannsókn (50 kálfar og 50 mjólkurkýr) og húðsýnarannsókn (27 geldneyti og 28 mjólkurkýr). Bú voru valin af handahófi á Suðvesturlandi. Í kembirannsókninni voru fimm fyrirfram ákveðin svæði á hverjum grip kembd. Tvær lúsategundir fundust, naglúsin *Bovicola bovis* og soglúsin *Solenopotes capillatus*. Lýs fundust á 7 af 10 búum. Á 50% búa fundust naglýs og á 40% búanna soglýs. Báðar tegundir fundust á 20% búanna. Lýs fundust á 40% kálfanna og á 4% kúnna. Naglúsin fannst á 28% kálfanna og 2% kúnna. Soglúsin fannst á 16% kálfa og á 2% kúa. Fjöldi naglúsa samanlagt á kembdum svæðum á gripum með lýs var 1-18 og fjöldi soglúsa 1-11. Naglúsin fannst oftast á baki og lend, en sjaldnar á haus, hálsi og hala, og ekki á framfæti. Soglúsin

fannst oftast á hálsi, svo á haus og á framfæti, en sjaldnar á baki, lend og hala. Aðeins minniháttar ummerkja, sem tengja mætti lúsasýkingum, varð vart á húð þriggja kálfa og tveggja kúa. Í húðsýnarannsókninni voru sýni tekin af fimm fyrirfram ákveðnum stöðum á gripunum. Í þeirri rannsókn fannst hársekkjamítillinn *Demodex bovis* á hálsi á einum grip (1,8%). Ekki voru nein ummerki sjáanleg um húðbreytingar af völdum mítla.

INTRODUCTION

Iceland is believed to have been colonized mainly during the period 874-930. Most of the settlers came from Norway, Ireland and the islands north of Scotland, and brought with them cattle, *Bos taurus* L. , and other domestic animals. Since that period and up to the present time, there has probably not been any significant introduction of cattle from abroad. It is known, however, that a few animals were imported from Denmark and North Germany during the 19th century, and one beef bull was imported from Scotland in 1933 (Stefánsson 1935, Sigurðsson 1937). These importations have not had any noticeable effect on the Icelandic dairy cattle breed. Semen and embryos of beef breeds were imported respectively in the 1970s and 1990s (Íslensk búfjárkyn 2009).

The Icelandic cattle breed is a dairy breed, closely related to the old Norwegian landraces Doele, Telemark and Troender, and far more distantly related to the most frequently encountered cattle breeds in Europe (reviewed by Aðalsteinsson 1981). According to Icelandic Agricultural Statistics (2010), the total cattle stock in the winter of 2009/2010 was 73,498 animals, including 26,489 lactating cows. The most common cattle farming practices in Iceland are as follows: dairy cows are normally grazed, at least during daytime, in the summer (June-September), but housed during the winter. On organic farms dairy cows are let out daily throughout the year, weather permitting. In older buildings cows are tied in stalls whereas in new buildings they are not tethered but have free access to stalls. Calves, heifers for replacement, and bullocks are usually grazed throughout the summer, even into October, but kept loose indoors in winter in small groups, in pens or cubicles. Bulls are normally housed all the year and fed indoors except those running with cows at summer pasture, especially where suckler cows are kept for beef, mainly for the production of crossbred calves with faster growth rates and better carcass conformation. (Ó. R. Dýrmundsson, The Farmers Association of Iceland, pers. comm.).

The only ectoparasite species previously reported from cattle in Iceland (Lindroth 1931, Overgaard 1942) is the chewing louse, *Bovicola bovis* L. (syn. *Trichodectes scalaris*). During past decades suspected mange samples or lice from cattle have occasionally been sent to the Institute for Experimental Pathology, University of Iceland, Keldur. In these samples, *B. bovis* has been identified several times. The little blue sucking louse *Solenopotes capillatus* Enderlein, was verified on four cattle farms during 1988-2001, always in connection with clinically affected dairy cows. Parasitic mites have never been reported from cattle in Iceland and have never been found in samples examined at the institute at Keldur.

It is well documented that ectoparasite infestations can have a pronounced negative impact on cattle health, productivity and hide quality (e.g. Gibney et al. 1985, Byford et al. 1992, DeVaney et al. 1992, Gjerde 1996, Nafstad & Grønstøl 2001b, Coles et al. 2003).

The aim of the present study was to survey lice and mite species infesting cattle in Iceland; to evaluate their prevalence on farms; their prevalence and site preferences on the animals; and their correlation with dermatological symptoms.

MATERIALS AND METHODS

Combing study (searching for lice and non-burrowing mites)

The study included 50 calves (4-15 months of age) and 50 dairy cows (when known, 2-9 years of age) of the Icelandic cattle breed. The animals came from 10 farms, selected at random in Southwest Iceland, 5 calves and 5 dairy cows selected at random from each farm. The

farms had to fulfil the following criteria: 1) The dairy cows had not been treated against lice for at least a year prior to sampling. 2) The calves had never been treated against lice. 3) History of skin disorders was not known beforehand by the researchers. The calves had never been clipped, but all, or some cows on 6 farms, had been clipped 1-6 months prior to sampling. Calves were always kept separated from the cows.

Samples were collected during December 2006-April 2007 and October 2007-March 2008. Five preselected sites on one side of each animal, that is the head (approx. 400 cm^2), the lateral neck (approx. 600 cm^2), the front leg (approx. 300 cm^2), the posterior back and rump (approx. 700 cm^2), and the upper part of the tail (approx. 150 cm^2) were combed for approx. 2 minutes each, and a sample of the long hairs closer to the tail end were cut and included in the examination. Separate combs were used for each site. A standard lice detection plastic comb („Prioderm®“, KSL Consulting, Denmark) was used, applying the methods described by Mencke et al. (2004) and Larsen et al. (2005). The samples (containing hair, debris and combs) from each site were put in separate plastic bags, and examined within 24 hours under a dissecting microscope in the laboratory. Adult lice and nymphal stages from each sample were counted. Lice were cleared and mounted according to the method of Smit (1954) and examined under a microscope for species differentiation. Identifications were according to Lapace (1968). Nits were registered, but not counted. Nits of the chewing louse *B. bovis* and sucking lice (Anoplura) were differentiated under a microscope based on their size and shape, as well as the structure of their opercula. Any signs of dermatological lesions seen on the combed animals were recorded at the time of sampling.

Study of skin samples (searching for burrowing and non-burrowing mites)

The study included 27 bullocks (20-33 months old) and 28 dairy cows (3-9 years of age). The animals came from 10 farms, selected at random in SW Iceland, with a maximum of 3 bullocks and 3 dairy cows from each farm. One of the farms was also included in the combing study.

Samples were collected in a slaughterhouse during February 2009-February 2010. Immediately after slaughter, samples were taken from five preselected sites on each animal: Hide samples (6-8 cm^2) were taken from three sites (dorsal neck, groin and dorsal tail base). In addition, the edges of both eyelids of one eye (including the meibomian glands) and a sample from one ear (consisting of scrapings from the inside of the ear and a cotton swab sample from the outer ear canal) were collected. The samples were then refrigerated for later examination. In the laboratory the samples were thawed, cut into small pieces and boiled for 5-10 minutes in 10% NaOH aqueous solution, centrifuged at 2100 rpm (500G) for approximately 7 minutes. The supernatant was discarded and the sediment was examined under a microscope at 50 x magnification. The cotton swab was examined when soaked in 10% NaOH aqueous solution under a dissecting microscope. Species identifications were according to Bukva (1986). Samples were also examined for gross dermatological lesions.

The use of ecological terms is in accordance with Margolis et al. (1982) and Bush et al. (1997).

RESULTS

Combing-study (searching for lice and non-burrowing mites)

Two species of lice were found: The chewing cattle louse *Bovicola bovis* and the little sucking cattle louse *Solenopotes capillatus* (Figure 1). No mites were found.

Lice were found at 7 (70%) of the farms. *B. bovis* was found at 50% and *S. capillatus* at 40% of the farms; both species occurred at 20% of the farms. Prevalence of infection was as follows: *B. bovis* was found on 14 calves (28%) and one cow (2%) and *S. capillatus* was found on 8 calves (16%) and one cow (2%). Two calves had both lice species. Species identification was based on nymphs and adult

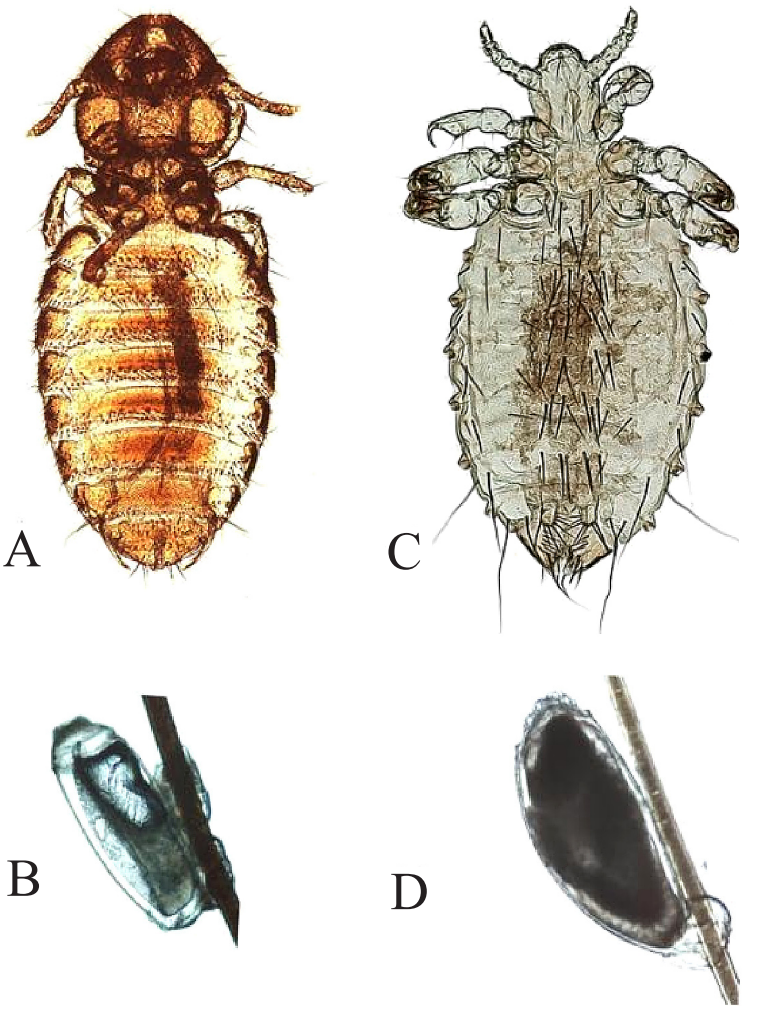

Figure 1. A) A female chewing louse *Bovicola bovis* (length 1.6 mm). B) *B. bovis* nit (length 0.65 mm). C) A female sucking louse *Solenopotes capillatus* (length 1.6 mm). D) *S. capillatus* nit (length 0.80 mm).

lice, except that *B. bovis* infestation of two calves on one farm was ascertained by finding nits only (other calves on the same farm had adult *B. bovis* lice) and *S. capillatus* infestation of one and two calves respectively on two farms was ascertained by finding nits only (adult *S. capillatus* lice were found on cattle on both farms).

Predilection sites for *B. bovis* and *S. capillatus* are shown in Table 1. *B. bovis* was most prevalent on the posterior back and rump, where 69% of all lice were found. *S. capillatus* was most prevalent on the anterior part of the body; 87% of all *S. capillatus* lice were found on the head and ventral neck. Both species were found on all sites examined, except that *B. bovis* was never detected on the front legs.

The mean number of lice found per infested host from all combed sites combined was 5 lice (range 1-11) for *B. bovis* and 6 lice (1-18) for *S. capillatus*. Nits of both species were found at all sites where the respective louse species were found, but their number was very variable, from none to hundreds per sample.

Table 1. Prevalence of *Bovicola bovis* infested cattle (n = 15) and *Solenopotes capillatus* infested cattle (n = 9) having lice and/or nits at each site examined and relative abundance of lice recovered.

	Bovicola bovis		***Solenopotes capillatus***	
	Prevalence	**Relative abundance**	**Prevalence**	**Relative abundance**
Head	15%	16%	33%	42%
Lateral neck	23%	8%	67%	45%
Front leg	0	0	33%	5%
Posterior back and rump	85%	69%	17%	5%
Tail	23%	6%	17%	3%

No obvious relationship was observed between number of lice and number of nits.

Macroscopic skin disorders, commonly known to be associated with lice infestations, were negligible on cattle at farms where lice were found; signs of focal alopecia were noticed on two calves and crusts on one calf. One cow had signs of focal alopecia and one had polyps at the base of the tail, the latter being the only cow found infested with *B. bovis*. One cow showed signs of pruritus. There was a previous history of lice infestations with pruritus and/or irritation on three of the seven farms where lice were found. However, all the farmers were unaware of the presence of lice in their herds at the time of examination. No dermatological symptoms were noticed on farms where lice were not found, and there was no previous history of lice or animals being affected by pruritus.

Study of skin samples (searching for burrowing and non-burrowing mites)

A single cattle follicle mite *Demodex bovis* Stiles (Figure 2) was found in the hide sample from the dorsal neck of one bullock (prevalence 1.8%). An examination of additional hide samples of the same size from the dorsal neck, groin and dorsal tail base of this animal revealed tens of mites at the neck, but no mites were found at the groin and dorsal tail base. No macroscopic skin disorders were observed on the samples from any of the animals in this study which could be associated with *Demodex* mites.

Figure 2. The hair follicle mite *Demodex bovis* (upper) and an egg containing the larval stage (lower). From a digested hide sample (mite length 0.2 mm, egg length 0.11 mm).

Voucher specimens

Specimens of the following species have been deposited in The Icelandic Institute of Natural

History, Reykjavik, Iceland: *Bovicola bovis* (Catalogue number: NI-4556), *Solenopotes capillatus* (Catalogue number: NI-4557) and *Demodex bovis* (Catalogue number: NI-4558).

DISCUSSION

The origin of the Icelandic cattle breed is considered to be mainly from Norway and the British Isles, with minor imports later from Denmark and North Germany. Consequently the lice and mites occurring on cattle in Iceland have most likely originated from cattle in those countries. In Norway, Denmark and the British Isles collectively, three sucking lice species (Anoplura), one chewing louse species (Mallophaga) and six mite species (Acari) have been reported or observed.

Lice

Only two species of lice, the chewing louse *B. bovis* and the sucking louse *S. capillatus*, were found in the present study. In Norway, *B. bovis*, and the sucking lice *Linognathus vituli* (L.), *Haematopinus eurysternus* (Nitzsch) and *S. capillatus*, have been reported or observed from cattle (Mehl 1970, Nafstad & Grønstøl 2001a, B. Gjerde, Norwegian School of Veterinary Science, pers. comm.). In Denmark, *B. bovis*, *L. vituli* and *H. eurysternus* have been observed (J. Monrad, University of Copenhagen, pers. comm.). In the British Isles, *B. bovis, L. vituli, H. eurysternus* and *S. capillatus* have been found (Titchener 1983, Milnes & Green 1999).

In the present study, the herd prevalence of *B. bovis* in Iceland was found to be 50%, whereas 94% herd prevalence has been reported in Norway and 48% in the British Isles. The herd prevalence of *S. capillatus* was found to be 40% in this study, but has been reported as 7% in the British Isles, and the species is rare in Norway. *L. vituli* was not found in this study, but a prevalence of 42% has been reported in cattle herds in Norway and 56% in the British Isles. *H. eurysternus* was also not found in this study; it is infrequent in Norway, while herd prevalence of 11% has been reported in the British Isles (Titschener 1983, Nafstad & Grønstøl 2001a, B. Gjerde, pers. comm.). Thus, the herd prevalence of the chewing louse *B. bovis* is relatively high in all three countries, whereas the prevalence of the three sucking lice species is variable. Notably the prevalence of *S. capillatus* is relatively high in Iceland but low in the British Isles, and the species is rare in Norway, and has not been observed in Denmark in recent times. Of interest is also the fact that the prevalence of *L. vituli* is fairly high in the British Isles and Norway, but is not found in Iceland. A possible explanation for the relatively high prevalence and abundance of *S. capillatus* on Icelandic cattle is that it does not have to compete with *L. vituli* and *H. eurysternus.*

The prevalence of infection of *B. bovis* and *S. capillatus* in the present study was much higher for the calves, 28% and 16%, respectively, than for the cows, 2% and 2%. There are limited published data regarding differences in lice infestations between younger and older cattle. Nafstad (1998a) reported a somewhat higher prevalence of *B. bovis* in young cattle than in older cattle, but found a profound difference for the sucking louse *L. vituli.* No reports could be found regarding age-related lice infestations for *S. capillatus*. Factors that could possibly have induced the differences in prevalence of lice infestations between the calves and the cows in the present study were crowding of calves in pens, clipping of dairy cows and acquired immunity. Chemotherapeutic control of ectoparasites of cattle is not a common practice in Iceland.

The predilection sites of the two lice species differed markedly (Table 1). *B. bovis* was most prevalent and most abundant on the posterior part of the body, whereas *S. capillatus* was most prevalent and abundant on the anterior part. Watson et al. (1997) mapped the distribution of four lice species, including *B. bovis* and *S. capillatus*, on the hides of six steers in the USA. Their study revealed that the chewing lice (*B. bovis*) were distributed more or less all over the body, but occurred in greatest concentrations in the mid-dorsal region. Sucking lice (*S. capillatus*) were located primarily (88% of

all lice) on the head, whereas in our study, they were most abundant on the neck (45%) as well as on the head (42%). Milnes et al. (2003) studied cattle in Britain and observed that *B. bovis* was mainly found on the trunk, whereas *S. capillatus* predominantly occurred on the face, under the jaw and on the underside of the neck.

In the present study, the total number of lice per infested host from all combed sites combined was 1-11 for *B. bovis* and 1-18 for *S. capillatus,* which indicates light or moderate infestations. This is probably the reason why no significant macroscopic skin disorders associated with lice infestations were observed, and also why the farmers were unaware of the infestations.

Clipping has been reported to reduce lice populations temporarily (Allen & Dicke 1952, Nafstad 1998b). Cows kept free with access to stalls during housing have been shown to have a significantly lower prevalence of lice than those tied to stalls (Nafstad 1998b). Since lice were only found on two cows in the present study, the influence on the infestations of clipping and of being tied during housing on stalls versus free with access to stalls could not be evaluated.

The combing method used in the present study was originally described for evaluation of lice infestations on horses (Mencke et al. 2004, Larsen et al. 2005), and this is to our knowledge the first time the method has been employed on cattle. A study by Mumcuoglu et al. (2001) showed that diagnosis of head louse infestation on humans using a louse comb was four times more efficient than direct visual examination. In previous studies on lice infestations of cattle, different techniques have been used, including on site visual examinations. Results from earlier studies, regarding prevalence and site preferences, might therefore not be quite comparable with the present study.

Mites

Only one mite species, the hair follicle mite *D. bovis*, was found in this study and this is the first record of this species in Iceland. Five further mite species are known to infest cattle in neighbouring countries. In Norway, the mites *D. bovis, Chorioptes bovis* (Hering) and *C. texanus* Hirst have been reported or observed from cattle (Gjerde 1996, Nafstad 1998a, B. Gjerde, pers. comm.); in Denmark, *Sarcoptes scabiei* (L.), *C. bovis* and *Psoroptes ovis* (Hering) (Henriksen et al. 1995); and in the British Isles, *D. bovis, C. bovis, C. texanus, P. ovis, S. scabiei* and *Psorobia* (*Psorergates*) *bos* (Johnston) have been recorded (Urquhart et al. 1996, Andrews et al. 1997, R. Wall, University of Bristol, pers. comm.). Information on the prevalence of infestation with these species in these three countries is scarce, but in the British Isles *Demodex* nodules have been observed in 17% of cattle hides (Urquhart et al. 1996) and in Denmark *C. bovis* has been found in approx. 50% of herds (Andersen 1992). The mite *D. bovis* was only found on one bullock in the present study (prevalence 1.8%). Since this species is mainly found in clusters (nodules), and the skin samples examined were small, the prevalence in Iceland might be higher than observed in this study.

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