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Original Paper

Natural infestation of the chewing lice (*Werneckiella equi*) on horses and treatment with imidacloprid and phoxim

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Abstract Infestation with the chewing louse (*Werneckiella (Damalinia) equi*) can be found on horses world-wide. Louse infestations, including clinical signs of louse-derived dermatitis, are known from Icelandic horses. A clinical field investigation was conducted in Iceland using horses with natural louse infestations to evaluate the efficacy of imidacloprid in a 10% solution in comparison with phoxim in a 0.05% solution. A total of 27 horses received a single imidacloprid treatment using 16 ml of the 10% solution along the mane and on the dorso-lateral trunk. A further 43 horses were treated twice, 14 days apart, with phoxim, using 2×50 ml solution applied along the mane and the dorso-lateral trunk. At the final evaluation on day 28, complete control of the lice was obtained for the imidacloprid treated horses and only a single moribund louse was found on two horses treated with phoxim .

Introduction

The order [Phthiraptera](#) is subdivided into the two suborders, the blood-sucking [lice](#) ([Anoplura](#)) and the chewing [lice](#) ([Mallophaga](#)) (Mehlhorn [2000](#)). Horses are parasitized by one species of a chewing louse, *Werneckiella equi*, and one species of a sucking louse, *Haematopinus asini* (Rommel [2000](#)). Louse infestations on horses are widespread and louse parasitism is of clinical significance in equine medicine. Infestations may cause irritation, [unthriftiness](#) and dermatological lesions. Clinical manifestations usually occur during the winter, while host animals are housed indoors, and treatment involves the use of pyrethroids, selenium sulphide shampoo or ivermectin (Rommel [2000](#)). Carbamates, especially phoxim (Sebacil Vet) has been used; however, limited information is available on its efficacy against [lice](#) on horses. Imidacloprid, a chloronicotynyl insecticide (CNI, synonym neonicotinoid) has been reported to be effective against [lice](#) on dogs (Hanssen et al. [1999](#)); however, no published data are available on [lice](#) or other ectoparasitic insects on horses.

The chewing louse *W. equi* is a common [ectoparasite](#) of horses in Iceland, whereas the sucking louse, *H. asini*, probably does not exist in Iceland, or is at least extremely rare. Dermatological manifestations associated with horse [lice](#) usually arise shortly after housing in early winter (November/December). The traditional way to prevent louse infestations practised in Iceland is shaving the hair just below the mane.

The aim of the present clinical survey was to determine the effect of imidacloprid, the active ingredient in Advantage 10% w/v spot on and phoxim, the active ingredient in Sebacil (50% concentrated solution), against naturally acquired louse infestations on horses.

Materials and methods

The survey was carried out on Icelandic horses housed in stables located in the suburbs of greater Reykjavík during the winter of 2002/2003.

A total of 11 stables with 92 horses were examined at the start of the clinical field trial, all suspected of being louse infested on veterinary inspection. Most of the stables were individual buildings located in so-called stable villages, typical for Iceland. Within these stables, one to three horses were housed in individual boxes or stalls. Physical contact

between the animals in adjacent boxes or stalls was possible head to head and full body contact between all horses was possible during exercise in an outdoor fenced yard once daily. None of the horses had been treated with [insecticides](#) for 8 weeks prior to the initiation of the survey. While imidacloprid is not licensed for food-producing animals, horses could only be included in this survey with written owner consent stating that the animals would be excluded from the food chain. The trial was performed with the permission of the Icelandic Medicine Control Agency.

Treatment

Horses from eight stables fulfilled the inclusion criteria. Three stables with 27 horses were treated using imidacloprid 10% spot on (group 1). [Lice](#) or [nits](#) were confirmed on 11 of these prior to treatment (Table 1). A total of 43 horses from the remaining five stables were treated with phoxim (group 2). Live [lice](#) or [nits](#) were confirmed on 14 of these prior to treatment (Table 1).

Table 1 Live [lice](#) or [nits](#) found on horses prior to treatment and the number of live, moribund and dead [lice](#) found 7 and 28 days after imidacloprid and phoxim treatment. Clinic indicates skin lesions as clinical signs present

| Stable and horse | Before treatment | | | Days post treatment | | | | | | |
|-----------------------|---------------------------|---------------------------|--------|---------------------|----------|------|------|----------|------|----|
| | | | | 7 | | | 28 | | | |
| | Live lice | Lice nits | Clinic | Live | Moribund | Dead | Live | Moribund | Dead | |
| Group 1: imidacloprid | | | | | | | | | | |
| 1 | 1 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | | | No | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 5 | | + | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6 | + | | Yes | 0 | 0 | 16 | 0 | 0 | 0 |
| | 7 | + | | Yes | 0 | 1 | 7 | 0 | 0 | 19 |

| | | | | | | | | | | |
|-----------------|----|---|---|-----|---|---|-----|---|---|---|
| 2 | 8 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9 | + | | Yes | 0 | 6 | 143 | 0 | 0 | 0 |
| | 10 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 11 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| Group 2: phoxim | | | | | | | | | | |
| 4 | 1 | | + | No | 0 | 0 | 4 | 0 | 0 | 1 |
| | 2 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 3 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 5 | | + | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6 | | + | No | 0 | 0 | 0 | 0 | 0 | 0 |
| | 7 | + | | No | 2 | 0 | 0 | 0 | 0 | 1 |
| | 8 | + | | Yes | 0 | 5 | 17 | 0 | 1 | 3 |
| 7 | 9 | + | | No | 0 | 1 | 1 | 0 | 0 | 0 |
| | 10 | + | | Yes | 0 | 1 | 4 | 0 | 0 | 0 |
| | 11 | + | | Yes | 0 | 0 | 1 | 0 | 0 | 0 |
| | 12 | + | | Yes | 0 | 8 | 73 | 0 | 1 | 1 |
| 8 | 13 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |
| | 14 | + | | Yes | 0 | 0 | 0 | 0 | 0 | 0 |

Group 1

On day 0 of the survey, the horses were treated with a 10% imidacloprid spot on solution with twice 4 ml under and along the mane and twice 4 ml on the dorso-lateral trunk. A single treatment was given.

Group 2

Horses were treated on day 0 and day 14 with phoxim using the Sebacil concentrate. Two areas under and along the mane and on the dorso-lateral trunk were wetted using a 0.05% solution of phoxim (10 ml of Sebacil concentrate in 10 l of water). On each horse, 50 ml was applied twice on each of the two treatment days. There was no untreated control group for animal welfare reasons, with the pretreatment count for each horse serving as its own

control.

Louse examination

Of the 92 horses presented, only 62 could be included in the trial with the owners' consent. The inclusion criteria were either lice observable by eye on the horses or live lice or louse eggs (nits) found by combing. Inspection by eye included a parting hair method along the neck and over the trunk. A large comb was used to part the hair at several spots under the mane and on the neck in order to reveal lice close to the skin. If lice were not found by inspection with the naked eye, the trunk surface was combed intensively using a fine louse comb (conventional human louse comb) on both sides of the neck and the area under the mane. Combing (Fig. 1) was continued for approximately 5 min on each body side and hair samples examined for live lice and louse eggs in the laboratory using a stereo-microscope. Skin lesions were subject to veterinary examination before treatment and on days 7, 14 and 28 post-treatment. Louse counts were performed prior to treatment and on days 7 and 28 after treatment.

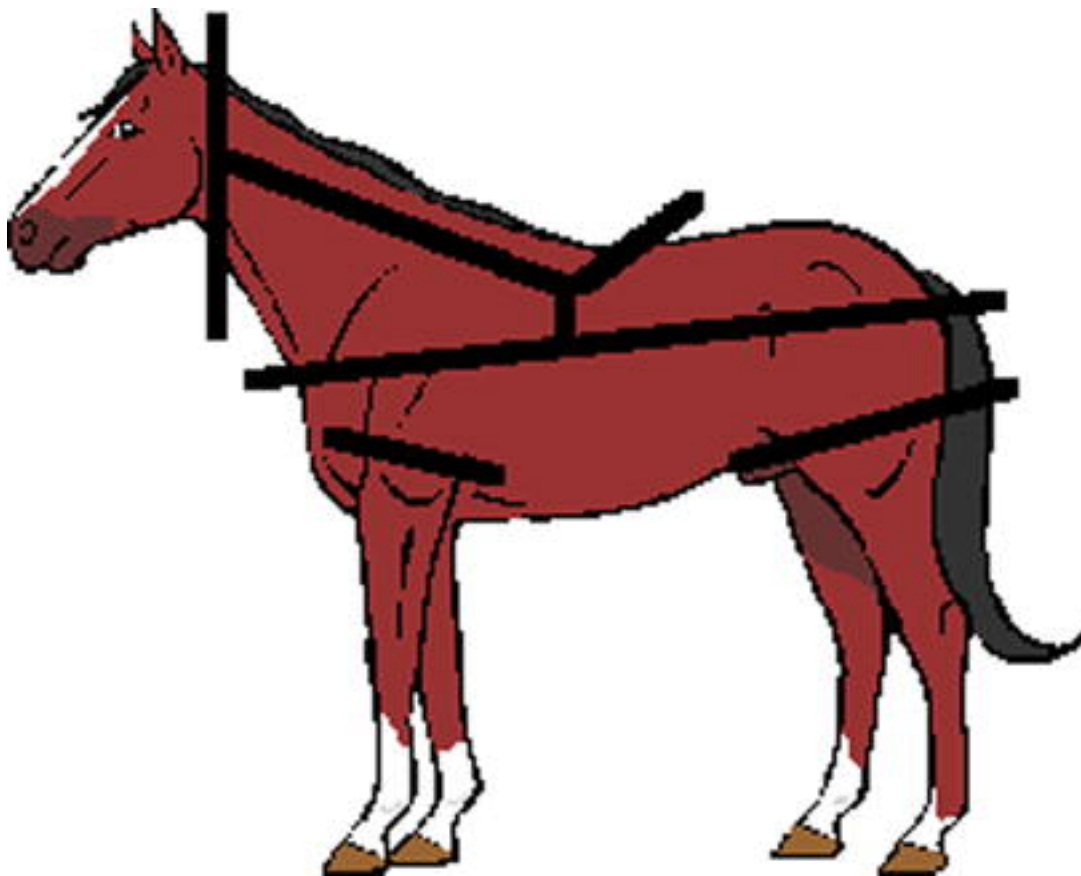


Fig. 1 Comb counting technique performed on horses with natural lice infestations

Results

The weight of adult Icelandic horses at 6 years or older (up to 12 years) ranges from 350 kg to 420 kg (S. Björnsdóttir, personal communication). The dosage of imidacloprid per treatment used on horses of group 1 ranged from 4.57 mg/kg to 3.81 mg/kg for horses of 350 kg and 420 kg, respectively. An average horse weighing 380 kg received 4.21 mg/kg imidacloprid. The dosage per treatment of phoxim in group 2 ranged from 0.14 mg/kg to 0.12 mg/kg for horses of 350 kg and 420 kg, respectively. An average horse weighing 380 kg received 0.13 mg/kg phoxim.

Lice or nits were confirmed on 11 of the 27 horses in group 1 prior to treatment (Table 1). In group 2, live lice or nits were confirmed on 14 of the 43 horses (Table 1). *W. equi* was the only louse species found in hair samples from all horses. In group 1, on day 7 after treatment, no lice were found on 8 of the 11 horses with a positive pre-treatment lice count. The remaining 3 horses had 7, 16 or 143 dead lice and 0, 1 or 6 moribund lice (Table 1). Fourteen of the 43 phoxim treated horses in group 2 had lice confirmed pre-treatment. Six of these were free of lice on day 7 post-treatment. Only two lice found on one horse were alive and unaffected. Dead lice were recorded from seven horses, four of which also had moribund lice (Table 1). In group 1, at the final evaluation on day 28 post-treatment, 10 of the 11 horses were free of lice. A total of 19 dead lice were recorded from one horse. In group 2 on day 28 post-treatment, 10 of the 14 horses with pre-treatment lice were louse free. On the remaining four horses, moribund lice were recorded, strongly effected with very little or slow reactions to tactile stimuli.

Pre-treatment skin lesions were recorded mainly on the neck, but also on the head and under the mane. Loss of hair and skin lesions were a typical sign, due to pruritus and rubbing of the horses at the box wall and fence. The horses were restless and overall unthrifty, dependent on the severity of the infestation. The pruritus resulted in secondary alopecia, scaling and excoriation. Remission of the generalized dermatitis was first recorded 2 weeks after treatment. The horse owners reported that remission of pruritus began as early as 3 days post-treatment. Hair regrowth was recorded on day 28 after treatment from horses in both of the groups which had clinical signs, mainly alopecia prior to treatment. Regrowth of hair was recorded as a thin layer of hair, still distinct from the long winter coat of the horses.

The skin at these sites was undamaged, without any lesions.

Discussion

It was the aim of this survey to evaluate two [insecticides](#), imidacloprid and phoxim, against [lice](#) under field conditions using naturally infested horses. Phoxim is indicated for louse treatment on horses and has a known high efficacy. The minimum effective dosage is 125 ppm active against [lice](#) on a large range of host animals (Anonymous [1992](#)). The dose used here for phoxim application on horses is well tolerated and highly effective against a wide range of [ectoparasites](#), especially [mange mites](#) (*Psoroptes equi*) (Liebisch et al. [1980](#)). Louse infestations on horses have been reported from Australia (Arundel [1985](#)), Nigeria (George et al. [1992](#)), Russia (Egri et al. [1995](#)), the United States (Perris [1995](#)), as well as Canada (Wright [1999](#)), and infestation with both chewing and sucking [lice](#) is regarded as a problem in horses world-wide. These case reports lack clear treatment recommendations for the suggested compounds.

The clinical manifestations recorded in this survey were [alopecia](#) self-barbering and [pruritus](#) in light infestations as well as [excoriation](#) and secondary infections in heavily infested horses. Many of the infested horses also had abnormal behaviour, such as frequent rubbing due to the intensive [pruritus](#), know from louse infestation in other animals (Hanssen et al. [1999](#)). The most heavily louse-infested horses showed severe clinical signs. However, in many cases it was difficult to detect [lice](#) on the horses, even if they had typical clinical signs of infestation, and in some cases we failed to detect any [lice](#). In contrast, in a few cases [lice](#) were detected on individuals with no obvious clinical signs. Horses in this trial, housed indoors under favourable temperature and humidity with a thick winter coat, fulfilled all criteria for louse development as reported by Moreby ([1978](#)) and Arundel ([1985](#)). Eggs of *W. equi* hatch after about 8-10 days (Arundel [1985](#)), followed by a 2-week development period to become adults (Rommel [2000](#)). Thus the egg-to-egg development time, important for any treatment recommendations, is about 4 weeks. [Insecticides](#) to control louse infestations on horses need to persist for 4 weeks or they have to be reapplied, as there is no reported ovicidal efficacy for any insecticide currently used. Even if veterinary parasitology textbooks recommend various [insecticides](#) for louse treatment on horses, especially in winter, baths, washes or sprays (Polozowski et al. [2001](#)) in particular remain an unfavourable application form. The results of this clinical field trial suggest that phoxim and imidacloprid are suitable for the treatment of horses with natural louse infestation.

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