**Lynxacarus radovskyi** mites in feral cats: a study of diagnostic methods, preferential body locations, co-infestations and prevalence

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**Background** – *Lynxacarus radovskyi* (fur mites) are ectoparasites found on the hair shafts of cats living in tropical environments. Diagnosis is via microscopic examination of hairs. Various anatomical areas have been reported to harbour these mites.

**Objectives** – To assess adhesive tape impressions and trichograms for detecting *L. radovskyi* and co-infestations; to determine host body predilection sites and affected gender; to determine prevalence of *L. radovskyi* in a feral cat population.

**Animals** – 121 feral cats in a trap, neuter and release programme.

**Methods** – After cats were premedicated for surgical sterilization, hairs from seven to nine body sites were removed from each cat using adhesive tape impression and trichogram techniques. Samples were examined at 10–100× magnification using compound or stereo microscopes.

**Results** – The prevalence of *L. radovskyi* was 71% (86 of 121) within the feral cat population. Tape impressions identified 75 cats; trichograms identified 56 cats. There were fewer false negative results with tape impressions. Caudal body sites were more likely to be positive, with the perianal area being the most commonly affected. Males and females were infested equally. Tape impressions identified more Cheyletiella blakei infestations and both methods identified some Felicola felis infestations.

**Conclusions and clinical importance** – Tape impressions were easier to perform and identified more *L. radovskyi* positive cats and more co-infestations. Hairs from the perianal area and other caudal body sites are most likely to harbour *L. radovskyi* within this feral cat population. *L. radovskyi* was a common infestation.

**Introduction**

*Lynxacarus radovskyi*, the cat fur mite, is a non-follicular mite that clings to hair shafts resulting in dull and dry, “salt and peppered”, or rust coloured hair coats.1–3 For heavily infested cats, mites may be visualized directly on hair shafts using magnification.2,4 However, for definitive identification, microscopic examination of hairs is required. Although some reports have recommended using adhesive tape impressions to diagnose *L. radovskyi*, no studies have evaluated its utility for that purpose.1 For cats without overt haircoat changes, knowing where mites are most likely to be found may increase the chances of detecting these mites.

The primary objective was to investigate the use of adhesive tape impressions and trichograms to diagnose *L. radovskyi*. Secondary objectives included documentation of the prevalence of *L. radovskyi* and other ectoparasites in a feral cat population, to determine preferential body sites and the gender of affected cats.

**Materials and methods**

The study group comprised 121 feral cats captured for a trap, neuter and release (TNR) programme from 1 January to 3 July 2015. All procedures were conducted under protocols approved by the Institutional Animal Care and Use Committee. Cats were assigned to categories of kitten, young adult or adult based on appearance and teeth. Sex was obtained from the TNR records.

Hair samples were collected after sedation for surgical sterilization. Sedation was accomplished using: ketamine hydrochloride (3–5 mg/kg) (Ketalar, Pfizer Inc.; New York, NY, USA); buprenorphine hydrochloride (0.01–0.016 mg/kg) (Buprenex, Reckett Benckiser Healthcare; Hull, UK); and dexmedetomidine hydrochloride (11–20 μg/kg) (Dexdomitor manufactured by Orion Pharma, Finland; distributed by Zoetis Inc.; Kalamazoo, MI, USA) administered intramuscularly.

Hair samples were collected from seven sites on 121 cats: tail tip, dorsal tail head, perianal area, distal rear limb at lateral hock, proximal rear limb at cranial aspect of quadriceps muscle, top of head between the ears, and dorsal midline between the scapulae. For 103 of 121 cats, hairs also were collected from two additional cranial sites: distal rear

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Cats for trichograms.

For adhesive tape impressions, the adhesive side of a 2.0 × 4.5 cm strip of transparent tape was pressed to a site and gently pulled in the direction of hair growth which removed the tape and usually greater than 20 hairs. The adhesive side was pressed to a glass microscope slide and examined with a compound microscope at 40–100×. Samples of <20 hairs were recorded.

For the trichogram, a haemostat was used to pluck an estimated ≥20 hairs from the same general site (but not the exact location) as the tape impression. Care was taken to avoid creating alopecia from the removal of too many hairs. Collected hairs were placed in a petri dish with a drop of mineral oil and examined with a stereo microscope at 10×–20×. Samples of <20 hairs were noted.

Veterinary students, trained in ectoparasite identification by the investigators, evaluated slides and petri dishes within minutes to 2 h after collection. Positive identifications by students were confirmed by at least one investigator. For each cat with all negative results from one technique, one investigator examined 50% or more of samples to confirm the negative result.

The number, up to 20, of *L. radovskyi* nymphs and adults (not differentiated) and larvae were recorded per sample. Counts over 20 were recorded as ≥20. The presence, but not number, of other parasites (*Cheyletiella blakei* and *Felicolia felis*) were recorded. Although egg numbers were recorded, results were not included in the statistical analyses because *L. radovskyi* eggs were not conclusively differentiated from those of other parasites.

For identification of positive cats and assessment of the two techniques, a cat was nominated as positive if live or dead larvae, nymph or adult *L. radovskyi* were seen. A chi-square test was used to determine if differences existed in sex or age of positive cats.

**Results**

Of the 121 cats, 55 were female and 66 were male; there were seven kittens, 56 young adults and 56 adults. The prevalence of *L. radovskyi* was 71% (86 positive cats of 121 cats). Of the 86 positive cats, five were kittens, 41 were young adults and 40 were adults. An equal number of male and female cats (43 each) were infested. There were no statistically significant differences between infested and noninfested cats based on age or sex ($P = 0.995$ and $P = 0.1703$, respectively).

<table>
<thead>
<tr>
<th></th>
<th>Total samples</th>
<th>Positive samples</th>
<th>Percentage positive (%)</th>
<th>Positive samples</th>
<th>Percentage positive (%)</th>
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<tbody>
<tr>
<td>Cats</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Positive cats</td>
<td>121*</td>
<td>75</td>
<td>62</td>
<td>56</td>
<td>46</td>
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<tr>
<td>Mean <em>L. radovskyi</em></td>
<td>†</td>
<td>6.1</td>
<td></td>
<td>7.5</td>
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<tr>
<td>Mean positive sites</td>
<td>†</td>
<td>2.3</td>
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<td>1.8</td>
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<td>Body sites</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Tip of tail</td>
<td>121</td>
<td>22</td>
<td>18</td>
<td>12</td>
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<tr>
<td>Dorsal tail head</td>
<td>121</td>
<td>21</td>
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<td>Distal rear leg</td>
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<td>26</td>
<td>21</td>
<td>13</td>
<td>11</td>
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<tr>
<td>Proximal rear leg</td>
<td>121</td>
<td>26</td>
<td>21</td>
<td>13</td>
<td>11</td>
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<tr>
<td>Dorsal head</td>
<td>121</td>
<td>16</td>
<td>13</td>
<td>1</td>
<td>0.8</td>
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<td>12</td>
<td>10</td>
<td>2</td>
<td>1.7</td>
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<tr>
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<td>9</td>
<td>9</td>
<td>3</td>
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<tr>
<td>Proximal forelimb</td>
<td>103</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

* Of the 121 cats, 86 were positive with one of the two methods. Trichograms identified 11 cats as positive that were negative via tape impressions. Tape impressions identified 30 cats as positive that were negative via trichograms.

† Mean *L. radovskyi* and mean positive sites are based on the number of positive cats identified with each method (75 for tape impressions and 56 for trichograms).

A total of 1057 samples were evaluated; 1012 samples had >20 hairs for evaluation. Of the 45 samples with <20 hairs (4.0%), 25 were from trichograms and 20 from tape impressions.

With the tape impression technique, 75 cats were identified as having a *L. radovskyi* infestation, whereas with the trichogram technique 56 cats were identified as positive (Table 1). Forty five cats were positive with both techniques and each technique identified cats as positive that were not detected using the other technique. There were 11 false negative results with the tape impression technique and 30 with the trichogram technique. The mean number of *L. radovskyi* mites seen was larger with the trichogram technique (7.48) than for the tape impression technique (6.08). However, more sites were positive with the tape impression technique (Table 1).

Table 1 reports that more *L. radovskyi* mites were found on caudal body sites than on cranial ones for both techniques. Likewise, both techniques found more *L. radovskyi* mites at the perianal region than at other sites.

Within this feral cat population, 50% (61 of 121) were positive for *C. blakei*, whereas only 15% were positive for *F. felis* (18 of 121) (Table 2). Tape impressions yielded more *C. blakei*-positive cats; however, four cats negative for *C. blakei* via tape impressions were positive via trichogram.

**Discussion**

The diagnosis of *L. radovskyi* has commonly been made using trichograms; hairs for microscopic examination have also been collected via scraping, combing and shaving. This is the first report using the tape impression technique to diagnose *L. radovskyi*. Although neither technique identified all of the positive cats, the tape impression technique identified more positive cats than the trichogram technique. One explanation for higher positive results with tape impressions is that infested *L. radovskyi* hairs may epilate more easily, which may increase the chances of finding the parasite with the tape impression technique.
Table 2. Other parasites detected in feral cats using the tape impression and trichogram techniques

<table>
<thead>
<tr>
<th>Method</th>
<th>Cat louse</th>
<th>Fur mite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape impression</td>
<td>19/121</td>
<td>61/121</td>
</tr>
<tr>
<td>Trichogram</td>
<td>11</td>
<td>57</td>
</tr>
<tr>
<td>Total number of positive cats</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Four cats were positive by both methods; seven cats were positive by one method only.
†Four cats detected for parasites with the trichogram were not detected by tape impression.

Tape impressions also likely remove hairs from a broader area compared to trichograms.

In this study, we chose pre-selected sites from which to collect hairs; these sites had no obvious signs of ectoparasite infestation. In prior studies, *L. radovskyi* was reported to occur commonly along the top line, the epigastic region, the back, neck, thorax and hindlimbs.1,3 Some studies have indicated that the tail head, tail tip and perineal areas are commonly affected.2,4 Our results indicated that the caudal half of the cat’s body harboured more *L. radovskyi* than the cranial sites.

A previous study indicated that females may be more susceptible to *L. radovskyi* infestation, whereas another study suggested males.4,3 In our study, males and females were equally infested, as seen in another larger study.5

Because we did not distinguish between *L. radovskyi* and *C. blakei* eggs, a possible limitation to our statistics was the exclusion of egg counts. Nine cats had only positive egg counts. When these were included in the *L. radovskyi* analyses, prevalence increased from 71% to 79%.

Another possible limitation to our study was that the number of hairs removed for each technique could not be quantified other than to note when <20 were microscopically observed. For the 45 samples with <20 hairs, it is possible that *L. radovskyi* and other ectoparasites could have been missed; however, because 14–18 samples were evaluated from each cat, it is unlikely that positive *L. radovskyi* cases were missed due to insufficient hair collection.

In the present study of a feral cat population, tape impressions found more positive cases of *L. radovskyi* than did trichograms. Tape impressions also found more *C. blakei*, whereas both techniques found similar numbers of *F. felis*. In screening programmes (e.g. feral cat populations or at intake to an animal shelter), ideally both techniques could be used to identify the most positive cats. However, in situations where only one technique can be used, tape impression would be more effective and practical, based on this study. The tape impression technique identified more positive cats, had fewer false negative results and identified more co-infestations. Also, it was easy to perform and easy to train staff in the technique. Caudal body sites and particularly the perianal area were more likely to be positive than other areas examined and, therefore, might be the preferred locations on which to focus sampling.

For any cat that has excessive dandruff or discoloured hair coat, tape impressions can be used to examine affected areas for *L. radovskyi* and other ectoparasites. For asymptomatic cases, the perianal, tail head, tail tip and hindlimbs are the best areas to remove hairs for examination for *L. radovskyi*.

Acknowledgements

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References

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Méthodes – Après une prémédication des chats pour stérilisation chirurgicale, les poils de sept à neuf sites corporels ont été prélevés sur chaque chat à l’aide de cellophane adhésive et de trichogramme. Les échantillons ont été examinés au microscope et au grossissement 10-1009.

Résultats – La prévalence de *L. radovskyi* était de 71% (86 sur 121) au sein de la population féline testée. Les tests par impression étaient positifs pour 75 chats et les trichogrammes, pour 56 chats. Il y avait peu de résultats faux négatifs avec des tests par impression. Les sites corporels postérieurs étaient plus fréquemment positifs avec les zones péri-anales les plus fréquemment atteintes. Les mâles et les femelles étaient infestés de la même façon. Les tests par impression ont identifiés davantage d’infestations par *Cheyletiella blakei* et les deux méthodes ont identifié des infestations par *Felicia felis*.

Conclusions et importance clinique – Les tests par impression étaient plus faciles à réaliser et identifiaient plus de chats positifs à *L. radovskyi* et plus de co-infestations. Les poils de la zone péri-anale et des autres sites corporels postérieurs sont plus probablement porteurs de *L. radovksyi*. Au sein de cette population de chats errants, *L. radovskyi* était un parasite fréquent.

Resumen

Introducción – *Lynxacarus radovskyi* (ácaros de la piel) son ectoparásitos que se encuentran en los pelos de gatos que viven en ambientes tropicales. El diagnóstico se realiza mediante el examen microscópico de los pelos. Varias áreas anatómicas se han descrito albergando estos ácaros.

Objetivos – Evaluar impresiones de cinta adhesiva y tricogramas para detectar *L. radovskyi* y coinfestaciones; determinar las zonas de predilección en el hospedador y el género afectado; determinar la prevalencia de *L. radovskyi* en una población de gatos callejeros.

Animales – 121 gatos asilvestrados en un programa de captura, esterilización y liberación.

Métodos – Después de que los gatos fueran premedicados para la esterilización quirúrgica, pelos de siete a nueve sitios del cuerpo se obtuvieron de cada gato utilizando técnicas de impresión de cinta adhesiva y tricogramas. Las muestras fueron examinadas con factores de 10-1009 de ampliación mediante microscopios de bajo o altos aumentos.

Resultados – La prevalencia de *L. radovskyi* fue del 71% (86 de 121) dentro de la población de gatos asilvestrados. Las impresiones de cinta identificaron 75 gatos; los tricogramas identificaron 56 gatos. Hubo menos resultados falsos negativos con impresiones de cinta adhesiva. Las zonas caudales del cuerpo eran más propensas a ser positiva, con la zona perianal siendo la más afectada. Los machos y las hembras estaban infestados por igual. Las impresiones de cinta adhesiva identificaron más infestaciones con *Cheyletiella blakei* y ambos métodos identificaron algunas infestaciones con *Felicia felis*.

Conclusiones e importancia clínica – Las impresiones de cinta adhesiva fueron más fáciles de realizar e identificaron más gatos positivos a infestación con *L. radovskyi* y más coinfestaciones. Los pelos de la zona perianal y otras partes del cuerpo caudal son más susceptibles de albergar *L. radovskyi*. Dentro de esta población de gatos asilvestrados, *L. radovskyi* era una infestación común.

Zusammenfassung


Tiere – 121 Streunerkatzen aus einem Fallen-/Kastrations-/Wiederfreilassungsprogramm.


**Resumo**

**Contexto** – *Lynxacarus radovsky* (ácarios do pelo) são ectoparasitas encontrados nas hastes pilosas de felinos que vivem em regiões tropicais. O diagnóstico se dá pela avaliação microscópica dos pelos. Há relatos de diversas regiões anatomicas que albergam estes ácaros.

**Objetivos** – Avaliar o uso dos exames parasitológico por fita adesiva e tricograma para a pesquisa de *L. radovskyi* em uma população de gatos selvagens.

**Animais** – 121 gatos em um programa de captura, castração e soldura.

**Métodos** – Após aplicação de medicação pré-anestésica para a castração, foram removidos pelos de sete a nove áreas corpóreas de cada gato, utilizando-se de técnicas de exame parasitológico por fita adesiva e tricograma. As amostras foram examinadas em um aumento de 10-1009 em microscópios compostos ou estereoscópicos.

**Resultados** – A prevalência de *L. radovskyi* foi de 71% (86 em 121) dentro da população de gatos selvagens. Os exames parasitológicos por fita adesiva identificaram 75 gatos, os tricogramas identificaram 56. Houveram menos resultados falsos negativos com o exame parasitológico por fita adesiva que com o tricograma. As regiões caudais apresentaram maior probabilidade de se obter exames positivos, sendo a região perianal a mais frequentemente afetada. Machos e fêmeas encontraram-se igualmente infestados. Exames parasitológicos por fita adesiva identificaram mais infestações por *Cheyletiella blakei* e ambos os métodos identificaram algumas infestações por *Felicola felis*.

**Conclusões e importância clínica** – O exame parasitológico por fita adesiva foi mais fácil de ser realizado e identificou melhor os gatos positivos para *L. radovskyi* e mais co-infestações. Os pelos da região perianal e outras regiões corpóreas caudais foram prováveis de albergar *L. radovskyi*. Dentro da população de gatos selvagens, a infestação por *L. radovskyi* apresentou-se comum.