Efficacy of the repellent DEET against tabanid flies on horses evaluated in a field test

Conny Herholz, Chris Kopp, Manuela Wenger; Alexander Mathis, Salome Wägeli, Nathalie Roth;
Introduction
Background of the study
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- According to the European law for products intended for use as a repellent on horses (recreational and sport horses), a field test is mandatory to demonstrate sufficient repellency.
- Currently, no agreed protocols are available.

- N,N-diethyl-3-methylbenzamide (DEET) is considered as the gold standard of insect repellent substances for the last 60 years (Frances, 2006; Katz et al., 2008).
- Few data are available on the efficacy of DEET when applied on horses (Palmer, 1969, Blume et al., 1971).
Aim of the study

To establish a protocol for a field test to investigate the efficacy of N,N-diethyl-3-methyl-benzamide (DEET, Brum®, Huebeli-Stud Horse Care AG) in a 15–17% oil-water emulsion against tabanid flies on horses up to four hours
Materials & Methods
Farms & study design

- Three farms (A–C) in the canton Bern (560–1000 m above sea level)
- Farm A: pre-test as well as main-test
- Data logger: temperature & humidity
- Pre-test: end of June 2015 to test the study protocol & the technical requirements (Farm A).
- Main tests: July & August 2015, Ø T = 34°C, humidity 32%

CROSS-OVER Design:

- On each farm four horses were tested on two consecutive days: two randomly selected horses were not treated on day one, but were treated on day two, and vice versa
- Counts of the tabanid flies with or without repellent application at the same time of the day
Fly trap & study design

- Fly trap (HORSE PAL® fly trap)
- Arthropods collected in the traps were packed in plastic bags, killed by deep-freezing
- The tabanids were morphologically sorted, and three specimens per morphotype genetically identified
A total of 12 horses were used for 16 field tests
four geldings & eight mares
mean age of 11 (range 3–20) years
Brown or dark brown horses
## Test protocol: time table

<table>
<thead>
<tr>
<th>Day with repellent treatment</th>
<th>Hour 1</th>
<th>Hour 2</th>
<th>Hour 3</th>
<th>Hour 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60min</td>
<td>120min</td>
<td>150min</td>
<td>180min</td>
</tr>
<tr>
<td></td>
<td>Box</td>
<td>lunting for 10 minutes until horses start to sweat</td>
<td>pasture</td>
<td></td>
</tr>
</tbody>
</table>

Horses are photographed in 30 sequences of ten seconds each during
Lunging until the horses start to sweat
Tabanid fly count

- Tabanid flies were photographed & directly counted on the right side of the horses
Treatment with the repellent DEET

- In total eight spray bursts of 0.2 ml / horse
Statistical analysis

- relative reduction of the number of tabanid flies after 3h and 4h
  \[ \text{rel.3 h} = \frac{\text{control.3 h} - \text{treated.3 h}}{\text{control.3 h}} \]
  \[ \text{rel.4 h} = \frac{\text{control.4 h} - \text{treated.4 h}}{\text{control.4 h}} \]

- Exact lower confidence bounds for the median of the distribution of the relative reductions were computed

- Statistical analysis was performed using R (version 3.0.2.)
Results
Prior to the tests the following arthropods species were caught in the HORSE PAL® fly traps:

- Farm A: Tabanus brominus (n = 3);
- Farm B: T. brominus (n = 4) and Haematopota pluvialis (n = 4)
- Farm C: T.brominus (n = 2) & other arthropods (n = 3)
Descriptive statistics

After 3 h the repellent treated horses have a lower
- median (0.5 vs. 5),
- mean (1.06 vs. 8.56)
- maximum (4 vs. 29)
number of counted tabanid flies than untreated horses

- Similar differences are found after 4 h

- In 16 of the 32 measurements no single tabanid fly was observed on repellent-treated horses
Tabanid fly counts
Tabanid fly counts after 3 h

Number of Tabanid flies after 180 minutes

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Tabanid fly counts after 4 h

Number of Tabanid flies after 240 minutes

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Relative reduction

- 100 % relative reduction in 8 of 16 horses after 3h & 4h
Diskussion
Repellent DEET

- In the study of Blume et al., 1971 horses were shown to be protected from certain tabanids for up to 3 h when sprayed with a 75% concentration of DEET.
- The horses of our study were protected from tabanids for as much as 4 h with a product containing a much lower DEET concentration of 15–17%.

Differences:
Concentration of repellent, tabanid fly species??
Study design

- The horses were lunged until sweating before tabanid flies were counted so that the study design simulated the practical conditions very well
- Differentiation of tabanid flies and other arthropods was facilitated by direct counting
Conclusion

- The efficacy of DEET in a 15–17% oil-water emulsion was at least 80% and 71%, respectively, three or four hours after application with a confidence of 89% and its use can be recommended.
- Follow manufacturer’s recommendations and treat the horses on a concrete surface to avoid contamination of the environment.
Short communication

Efficacy of the repellent N,N-diethyl-3-methyl-benzamide (DEET) against tabanid flies on horses evaluated in a field test in Switzerland

C. Herholz a,*, C. Kopp a, M. Wenger a, A. Mathis b, S. Wägeli a, N. Roth a

a Bern University of Applied Sciences, School of Agricultural, Forest and Food Science, Laenggasse 85, CH-3052 Zollikofen, Switzerland
b Institute of Parasitology, National Centre for Vector Entomology, Vetsuisse Faculty, University of Zurich, Winterthurerstrasse 266a, CH-8057 Zurich, Switzerland
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