

# Ectoparasites of red fox *Vulpes vulpes* with peculiar focus on ticks in the subcutaneous tissues

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**INTRODUCTION.** Increasing number of parasitological studies have been carried out on red fox (*Vulpes vulpes*) underlining its possible role as an epidemiological link between rural and urban/anthropogenic habitats. In present study we determined the ectoparasites community of red fox in three regions of Poland, covering the old endemic and newly inhabited areas of *Dermacentor reticulatus* occurrence and area free of this tick species (gap).

**AIM.** The main aim of present study was to determine the role of fox as a host for juvenile (nest-dwelling) and adult (exophilic) *D. reticulatus* ticks to assess its contribution to the spread of this important *Babesia canis* vector. Additionally, we compared ectoparasites community between adult foxes hunted in autumn/winter season and fox pups, live-trapped in late spring/early summer. Finally, systematic search for subcutaneous ticks determining tick prevalence and abundance was performed. Molecular typing was conducted to determine tick species involved in this phenomenon.

**MATERIALS AND METHODS.** Foxes originated from three regions of Poland, including adults (n=366) acquired during legal hunting in autumn/winter season of 2016–2018 and 25 pups, live-trapped in breeding season (May-June) in the same time period. Foxes were examined for ectoparasites and then carcasses were skinned to detect parasites in subcutaneous tissues while juvenile foxes were released at the place of trapping. Ectoparasites were identified accordingly to keys. 440 bp long fragment of mitochondrial 16S rDNA was amplified and sequenced for selected specimens of ticks to enable species identification, especially for damaged specimens derived from subcutaneous nodules. Phylogenetic tree was constructed to confirm species identification. Statistical analyses were performed to compare prevalence and abundance of parasite infestation between three regions or between adult and juvenile foxes.

**Results:** Excluding scabies and ticks found in subcutaneous tissues, 765 ectoparasites of 16 species were collected. Five tick species, seven flea species, scabies, one species of Anoplura, Felicola and Lipoptena each were detected on examined foxes. Mean species richness was twice higher for juvenile foxes compared to adults ( $1.23 \pm 0.20$  and  $0.49 \pm 0.05$ ). Total prevalence of ectoparasites, including ticks in subcutaneous tissues was higher in pups (68%) than in adults (62.8%). In pups, *I. ricinus* was dominant tick species (56%), followed by *I. canisuga* (16%) and no *D. reticulatus* ticks were collected. In adults, *D. reticulatus* and *I. ricinus* were the most common. Subcutaneous ticks were common (38%) and abundant ( $2.63 \pm 0.40$ ) in examined foxes. *I. ricinus* females constituted majority of subcutaneous ticks, only five specimens were identified as *D. reticulatus*. Fleas constituted large part of collected ectoparasites with total prevalence of 21.6%.

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The most common and abundant flea species was *Chaetopsylla globiceps*, but few synantropic flea species were also recorded (*Ctenocephalides canis*, *Ctenocephalides felis*, *Pulex irritans*). There were significant differences in ectoparasites prevalence and abundance between different regions.

CONCLUSIONS. Although prevalence of infestation with *D. reticulatus* was the highest of all tick species in adult foxes, no ticks of this species were found on pups, thus the role of red fox in spread of *D. reticulatus* seems minor. Ectoparasite community differed between adult individuals hunted in winter season and pups trapped in late spring/early summer. Systematic search for subcutaneous ticks revealed high frequency of tick occurrence in subcutaneous tissues, but mechanism of tick penetration under the skin remained not recognized.

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