Veterinærinstituttet
Norwegian Veterinary Institute

Annual Report

The surveillance programme for *Angiostrongylus vasorum* in red foxes (Vulpes vulpes) Norway 2019

Comissioned by

Mattilsynet

The surveillance programme for *Angiostrongylus vasorum* in red foxes (*Vulpes vulpes*) in Norway 2019

Content

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Summary

The pathogenic cardio-pulmonary nematode *Angiostrongylus vasorum* (*A. vasorum*) was detected in eight of 300 (3%; 1.3 - 5.4%, 95% confidence intervals) red foxes (*Vulpes vulpes*) examined by serological analysis during the hunting season in 2019. During three year surveillance (2016, 2018 and 2019), a total of 501 samples have been examined, detecting 14 positive samples.

Introduction

In recent years, prevalence studies of the French heartworm, *A. vasorum,* began in several European countries due to its apparent emergence and geographical spread throughout Europe. This snail-borne parasite can infect domestic dogs and wild canids and cause potentially fatal, verminous pneumonia and coagulopathy in addition to neurological and gastrointestinal symptoms (1, 2).

First discovered in France more than a century ago, the bordering countries also detected the parasite in well-defined endemic foci. In addition to the south-west of France, endemic foci in the Copenhagen Metropolitan Region of Denmark, in Ireland, parts of Wales and in England are well known. However, it is only within the past few decades, a majority of European countries including Sweden have reported the discovery of this parasite. In Sweden, *A. vasorum* was first identified on the island of Sydkoster in 2003 and has since been diagnosed in dogs and foxes on the mainland (3). Numerous likely factors for the ongoing geographical spread are climatic change, altered distribution and dynamics of the intermediate hosts, increased urbanisation of red fox populations and migratory movements of dogs within and between countries (4, 5, 6).

A. vasorum was first detected in Norway in 2016, in two foxes from Eastern and Western Norway, respectively (7).

Aims

Following the first detection of *A. vasorum* in Norway, the aim of the current programme is to monitor the prevalence and geographical distribution of *A. vasorum* in red foxes in Norway.

Materials and methods

Whole blood samples were collected from red foxes (*Vulpes vulpes*) from January to March 2019. During fall in 2018, volunteer hunters participated in sampling of red foxes for the *Echinococcus multilocularis* (the dwarf fox tapeworm) surveillance program. In 2019, these hunters were invited to also submit blood samples of hunted foxes for the *A. vasorum* screening during the hunting seasons. Hunters who had previously submitted high-quality samples (i.e. adequate blood in vacuum tubes with complete labelling) were selected. Sampling containers and pipettes with detailed instructions for sampling were send to those hunters who accepted the invitation to participate in the program. The hunters collected whole blood samples directly from the heart or from the abdomen of the foxes. The samples were labelled with information on origin of the fox, date of the hunt, sex (male or female) and estimated age of the animal (juvenile or adult), before submitted to the laboratory in pre-paid envelopes. Upon arrival at the Norwegian Veterinary Institute, sera from centrifugation of the blood samples were frozen at -20 ^{o}C until analysis.

Of the 302 blood samples from red foxes submitted during January – March 2019, 300 were analysed for *A. vasorum* infection. Geographical locations of the sampled foxes are listed in Table 1. Presence or absence of *A. vasorum* antigen in the blood samples was tested using the commercially available "Canine *A. vasorum* antigen test kit" (Angio Detect Test, IDEXX Laboratories) according to the manufactures instructions.

Table1. County of origin of red foxes (*Vulpes vulpes*) (n=300) from mainland Norway tested for *Angiostrongylus vasorum* during the red fox licensed hunting season in 2019.

County	No. of foxes tested for *A. vasorum*	No. of positive foxes
Østfold	16	1
Akershus	21	2
Oslo	0	0
Hedmark	47	1
Oppland	19	1
Buskerud	21	0
Vestfold	5	0
Telemark	28	0
Aust-Agder	15	0
Vest-Agder	4	0
Rogaland	7	0
Hordaland	13	1
Sogn og Fjordane	9	0
Møre og Romsdal	7	1
Trøndelag	30	0
Nordland	32	0
Troms	20	1
Finnmark	6	0
Total	300	8

Results and Discussion

Blood samples from red foxes in all regions of Norway were submitted for the *A. vasorum* screening in 2019 (Figure 1). Of the 300 samples that were suitable for laboratory analysis, eight tested positive for *A. vasorum* (Figure 1) corresponding to a prevalence of 3% (1.3 - 5.4%, 95% confidence intervals).

The eight positive samples originated from seven different counties: Østfold (1 positive), Akershus (2 positives), Hedmark (1 positive), Oppland (1 positive), Hordaland (1 positive), Møre og Romsdal (1 positive) and Troms (1 positive). Five of these foxes were located in Eastern Norway, the region with the highest human population density (27.4/km^2 (8)). Similarly, in 2018 *A. vasorum* was detected in the counties of Buskerud and Oslo, both in Eastern Norway.

Interestingly, in 2019 *A. vasorum* was detected in Northern Norway for the first time and the parasite has now been detected in ten counties in Norway: Østfold, Akershus, Oslo, Hedmark, Oppland, Buskerud, Rogaland, Hordaland, Møre og Romsdal and Troms.

The number of samples collected in Norway is currently insufficient to document the true prevalence of *A. vasorum* in foxes. Establishment of the true prevalence would also require random selection of samples throughout the whole country. Previous studies from other parts of Europe have found uneven geographical distributions of the parasite with higher prevalence in “hotspots”. From these “hotspots”, this parasite may expand into previously uninfected areas. The capital region of Denmark, for example, is known as a “hotspot” for *A. vasorum.* The recent establishment of the parasite in Central and Southern Sweden (9) as potential hotspots present increasing risk for higher prevalence and further spread into Norway via pet-travel or migrating wildlife. Hence, continued surveillance of *A. vasorum* in wild canids is important to monitor the geographical spread and true prevalence of the parasite in Norway.

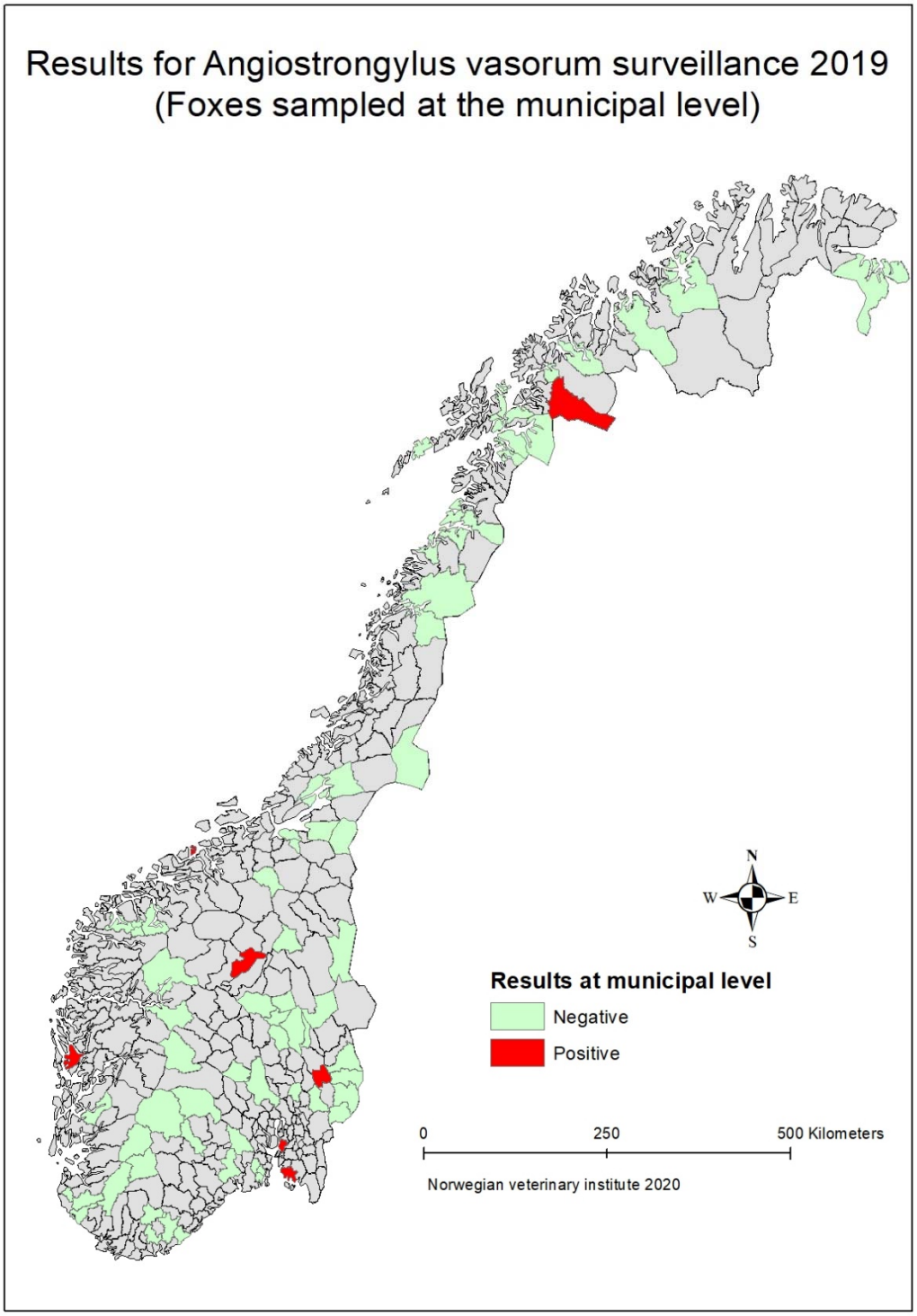
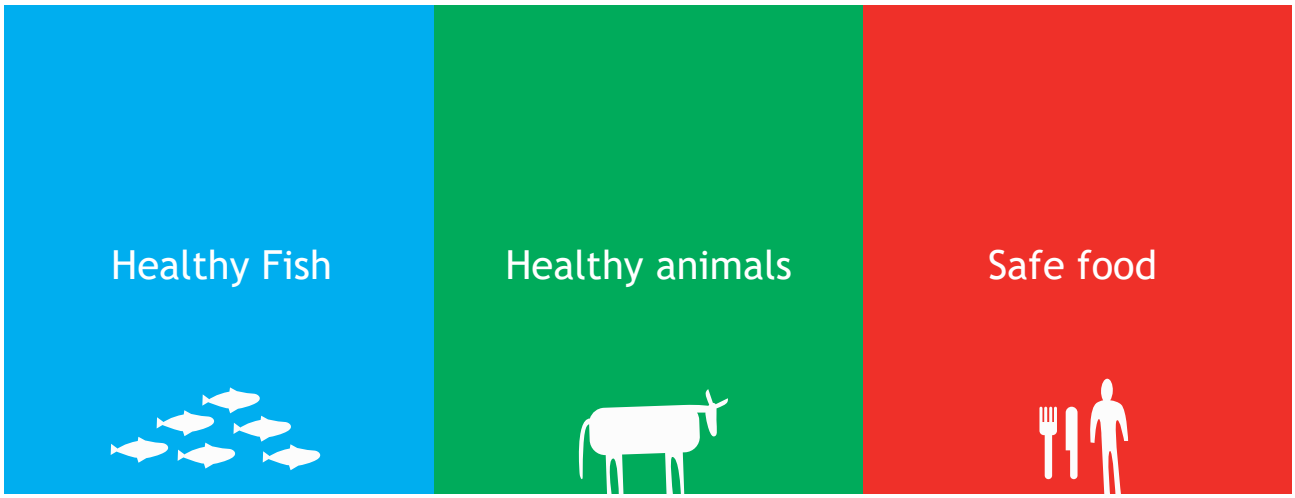


Figure 1. The geographical origin of all red foxes (n = 300) tested for *Angiostrongylus vasorum* during the red fox licensed hunting season in 2019. The municipality where the red foxes (n = 8) that tested positive for *A. vasorum* antigen by serological analysis were hunted is marked with red colour.

Generally, the prevalence of *A. vasorum* is considerably higher in foxes than in dogs. Risk of cross species infection by this parasite is a concern for dogs living in areas with dense fox populations and/or in areas with close contact with foxes e.g. suburban areas (10).

References

1. Helms JR, Morgan ER, Jackson MW, Wotton P, Bell R (2010). Canine angiostrongylosis: an emerging disease in Europe. Journal of Veterinary Emergency and Critical Care 20, 98-109.
2. Elsheikha HM, Holmes SA, Wright I, Morgan ER, Lacher DW (2014). Recent advances in the epidemiology, clinical and diagnostic features, and control of canine cardio-pulmonary angiostrongylosis. Veterinary Research 45: 92.
3. Åblad B, Christenson D, Osterman Lind E, Ågren E, Mörner T (2003). *Angiostrongylus vasorum* established in Sweden. Svensk Veterinær Tidning 55, 11-15 (in Swedish).
4. Morgan ER, Tomlinson A, Hunter S, Nichols T, Roberts E, Fox MT, Taylor MA (2008). *Angiostrongylus vasorum* and Eucoleus aerophilus in foxes (Vulpes vulpes) in Great Britain. Veterinary Parasitology 154, 48-57.
5. Morgan ER, Jefferies R, Krajewski M, Ward P, Shaw SE (2009). Canine pulmonary angiostrongylosis: the influence of climate on parasite distribution. Parasitology International 58, 406-410.
6. Morgan ER, Shaw S (2010). *Angiostrongylus vasorum* infection in dogs: continuing spread and developments in diagnosis and treatment. Journal of Small Animal Practice 51, 616-621.
7. Enemark HL, Hansen H, Madslien K, Jonsson ME, Henriksen K, Mohammad SN, Albin-Amiot CJJ, Hamnes IS. The surveillance programme for *Angiostrongylus vasorum* in red foxes (*Vulpes vulpes*) in Norway 2016.
8. Wikipedia, the free encyclopedia. Eastern Norway "https://en.wikipedia.org/wiki/Eastern_Norway" (accessed on 25.06.2019)
9. Grandi G, Lind EO, Schaper R, Ågren E, Schnyder M (2017). Canine angiostrongylosis in Sweden: a nationwide seroepidemiological survey by enzyme-linked immunosorbent assays and a summary of five-year diagnostic activity (2011-2015). Acta Veterinaria Scandinavica 59:85.
10. Koch J & Willesen JL (2009). Canine pulmonary angiostrongylosis: An update. The Veterinary Journal 179, 348-359.



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