Introduction

*Ixodes ricinus* (see fig 1) is the principal vector of *Borrelia burgdorferi sensu lato*, see fig 2 (agent of *Lyme borreliosis*) across much of Europe. *I. ricinus* is one of several main vectors of Tick-borne encephalitis virus as well as a known and potential vector of a number of other pathogens such as Babesia, Anaplasma, Rickettsia, *Borrelia* spp and loosing tick virus. The distribution of *I. ricinus* has increased a lot over the last 25 years. In Scandinavia it has been observed farther and farther to the north and in central Europe the ticks are reported at higher and higher altitudes. Since 1980 *I. ricinus* is a vector of diseases, the spread of *I. ricinus* is a health issue. Therefore, monitoring of *I. ricinus* is considered very crucial. Since 1980 *I. ricinus* are commonly found on migrating birds, migrating birds might facilitate the latitudinal spread to northern isolated islands (e.g. Faroes). The present paper investigates possible latitudinal spread of *I. ricinus* in northern Europe/Faroe Islands.

The tick *Ixodes ricinus* (Acari, Ixodidae), is a parasite on vertebrates. Its lifecycle has three main stages that each depend on a bloodmeal from a vertebrate host. Hosts are typically small rodents (e.g. mice), lizards, medium sized rodents (e.g. hares), larger animals (e.g. canids) and many different bird species (the thrushes (e.g. *Turdus*), blackbirds and birds belonging to the Muscicapidae family. When ticks are searching for a host they climb vegetation to reach the hosts by grabbing to them. It is during questing that the ticks may attach to people and bite. This happens during different outside activities when we come in close contact with the vegetation.

In June 2015 Jøllyon M. Medlock, Kayleigh Hamford and Alexander G.C. Vans from Public Health England, together with William Simonsen (National Hospital of the Faroe Islands) and Janus Hansen (National History Museum) conducted a survey covering 38 sites, see fig 2c. Sampling was conducted by flagging (shagging) – a 1 m² cotton cloth was dragged 5 meters on the vegetation, this was done at 45 sites and the corners of this rectangle tick species were treated. Possible questing ticks might attach to the cloth, which gives an estimate of the presence of ticks - this is active surveillance. Effort was also spent on gathering and registering all recorded *I. ricinus* in the Faroe Islands – this is passive surveillance.

**Fig. 1.** Location of Faroe Islands.

**Fig. 2.** Location of tick sites on Northern Faroe Islands of Vagar, Streymoy, Eysturoy, Borðoy, Kunoy and Nólsoy.

**Fig. 3.** List of all records including historical records of *I. ricinus* on the Faroese Islands. First five records are previously published records in *vegetation* we have surveillance. All other records were collected by the authors through passive surveillance in March 2015 and identifying additional unpublished historical records. Those latest are "unknown" represent no information provided. The table also includes some ticks registered after June 2015.

**Fig. 4.** Flaggering with cotton cloth.

**Fig. 5.** Northern wheatear - Oenanthe oenanthe This is a possible route for *I. ricinus* to the Faroe Islands, because *I. ricinus* larval have been found on them. Pic. A. Treplev.

**Fig. 6.** Tick surveillance in the Faroe Islands.

*Results*

Passive surveillance gave 33 ticks and active surveillance gave 3 ticks, see table 1. These are in addition to those described by Jaenson and Jensen, 2007.

**Table 1.** List of all records including historical records of *I. ricinus* on the Faroese Islands. First five records are previously published records in *vegetation* we have surveillance. All other records were collected by the authors through passive surveillance in March 2015 and identifying additional unpublished historical records. Those latest are "unknown" represent no information provided. The table also includes some ticks registered after June 2015.

Regarding environmental constraints on *I. ricinus* in the Faroe Islands, the winters are not too cold and the summers are not hot enough for the ticks to survive and reproduce. Regarding habitat native woodlands are rare and only consist of Salix sp. and Juniperus communis, these do not provide a suitable habitat. A number of public woodlands are found throughout the islands. These do provide suitable habitats, but have fewer herbs that are considered important to ticks in nearby countries; also many of the trees are evergreen which causes little litter, an important microhabitat for tick survival between periods of questing.

The small diversity of vertebrate hosts is another limiting factor. Small mammals, that are important to feeding larva in nearby countries, are absent. The possible role of rat (*Rattus norvegicus*) and mouse (*Mus musculus domesticus*) is worth considering. However, one of the authors (Jens-Kjeld Jensen) has investigated between 200 and 300 mice and 80 rats, and found no *I. ricinus* on them. Potential hosts like birds known to host larval and nymphal *I. ricinus* – blackbird (*Turdus merula*) and robin (*Erithacus rubecula*) – are among the local birds, but there are no records of *I. ricinus* from them. Across Europe deer populations are important in maintaining *I. ricinus* populations. No deer populations exist in the Faroes, but there are numerous sheep. Sheep are important tick hosts in Scotland, but no ticks have been found on sheep in the Faroe Islands. This can be because the outfield areas are heavily grazed giving no habitat to the ticks and also the sheep are treated for sheep ked which might kill *I. ricinus*. Sheep share their habitat with hares (*Lepus timidus*) which are important hosts in Scotland. No *I. ricinus* have yet been recorded from hares in the Faroes.

Questing populations of *I. ricinus* are most likely to be found around villages, where woodland birds, companion animals (e.g. cats), and possibly house mice and rats can provide a good population. Humans may then be exposed to these ticks whilst in public activities. A number of *I. ricinus* larvae have been found throughout the islands. After drop off from migratory birds (larvae have been found on wheatear, fig 5 and chiffchaff) questing ticks were found confirm tick activity. Also reports of engorged ticks from dogs and cats in the islands suggests that there are local populations. Except for the migratory bird this is one route to the Faroes. Although occasional reports of *I. ricinus* on many of the islands there is insufficient evidence to suggest that there are local populations. Except in contrast in the southernmost island there is evidence of *I. ricinus* being active around the village of Tvangoy, because nymphs and adults have been found questing there. This could suggest that *I. ricinus* have established there in low densities. However, no questing or engorged larvae have been found. The presence of larvae would show that adult ticks were mating. Additional reports of engorged ticks from dogs and cats in the islands during the same summer that questing ticks were found confirm tick activity. Also the finding of engorged female *I. ricinus* in early spring 2016 in Streymoy on a cat that have not been abroad confirms overwintering.