

**New threats to Asian/European red squirrels (*Sciurus vulgaris*)
Incorrect supplementary feeding of red squirrels can promote local outbreaks of SQPV**

Abstract

In the last 20 years in some areas in the UK a pox virus called by scientists SQPV became a significant problem in red squirrel (*Sciurus vulgaris*) population. The studies about the causes of unnatural deaths of red squirrels in the last 20 years (Shuttleworth 2001, Dutton 2004, LaRose et al. 2010, Simpson et al. 2013, ICSRS 2015c) show that SQPV could be the cause of about 2% of unnatural deaths in red squirrel population. Scientists collected data about SQPV occurrence – and local outbreaks – from a big area of south Scotland in years 2001-2012 (White & Lurz 2014). The results show that between 2001 and 2005 – and earlier – **there were no pox (SQPV) cases among red squirrels and in that area.** At the same time the results from 2006-2008 and 2009-2010 show a huge unnatural increase in local pox outbreaks. We decided to examine what could have been the cause of this unnaturally big increase of pox infection in red and grey squirrels in the areas where the two species co-existed for a few decades **without the risk of pox outbreak.** We have managed to determine that in the areas where SQPV wasn't previously observed almost always pox outbreak and its wide distribution was preceded by the introduction of regular intensive supplementary feeding of red squirrels using shared feeders. Scientists already pointed earlier that there was a risk of disease transmission via shared feeders but all possible routes of disease transmission were not known yet (Huxley 2003, Duff 2012). From the most recent studies we know for example that red squirrels – unlike grey squirrels – are able to transmit the virus via droplet infection – via saliva (Warnock et al. 2012, Collins et al. 2014). The risk of disease transmission via droplet infection is increased dramatically if individuals of a given species have often contact with each other in a small area like for example shared feeder where exchange of saliva and parasites can be especially intensive. At the same time in the areas where there is no intensive feeding of red squirrels using shared feeders the problem practically does not exist even though the disease itself is present there among the red – 3 confirmed cases of disease in red squirrels within 100 years – and grey squirrels (Stritch et al. 2015). **Data collected by scientists about the places of the most frequent occurrence of SQPV between 2001-2012 in that area (White & Lurz 2014) overlap for the most part with data collected by us about the places where before the pox outbreak intensive supplementary**



feeding of red squirrels using shared feeders was introduced.

Considering the fact that grey squirrels co-existed in the area with red squirrels for a few decades and never before – prior to the

introduction of supplementary feeding using shared feeders – were there pox outbreaks noted like those that took place in recent years, it is more than likely that humans could have significantly promoted the spread of SQPV among squirrel population in the UK.

Editors note: We've received many e-mails asking "can grey squirrels be fed using shared feeders"?

Yes, grey squirrels can be fed using shared feeders because as research shows they don't transmit the pox virus via saliva*. The virus can be spread via droplet transmission (saliva) by European red squirrels* and for them "scatter feeding" should be applied – with no shared feeders.

*(Warnock et al. 2012, Collins et al. 2014, ICSRS 2015)

Hypotheses about possible SQPV transmission

The first hypothesis about the possibility of transmitting pox to red squirrels by grey squirrels was suggested by the same scientist who at the same time observed that in 10 of 14 counties where red squirrels had pox there were no grey squirrels present (Middleton, 1930). Because of the lack of logical evidence in this hypothesis it was contested many times in many studies (Reynolds 1985, Skelcher 1997, Sainsbury et al. 2008, Teangana et al. 2000, Huxley 2003). There are known numerous cases of pox outbreaks among red squirrels – including the biggest one so far – in the areas where there were no grey squirrels ever present (Reynolds 1985, Skelcher 1997, Sainsbury et al. 2008). At present there is no scientific evidence to confirm often repeated hypothesis that "*grey squirrels could be a sort of a host for spreading SQPV*". The most recent laboratory studies excluded the possibility of grey squirrels transmitting the virus via saliva (data from Warnock et al. 2012, Collins et al. 2014). The same research confirmed the possibility of transmitting the pox virus via saliva by red squirrels (data from Warnock et al. 2012, Collins et al. 2014). Considering the fact that droplet infection is one of the main transmission routes for

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diseases like pox, red squirrel infected with it is many times more dangerous to other squirrels than grey squirrel with the same infection. Research results also showed that red squirrels with SQPV had even 2500 times higher level of the virus in their blood than grey squirrels with the same infection. Grey squirrels exposed to pox virus recover from the infection easily and quickly (data from Warnock et al. 2012, Collins et al. 2014) and at the same time quickly gain immunity against it – antibodies protect them from another infection – and because of that they are not posing a threat to other members of grey and red squirrel populations in the area.

Even though the survival of SQPV among red squirrels is at best 25% so far (Tompkins 2002) in case they recover from the infection – like grey squirrels they create antibodies protecting them – they are also no longer a threat (Chantrey et al. 2014).

To sustain the probability of the hypothesis saying that "grey squirrels can be the host of the disease" there was a return to a hypothesis contested earlier about "SQPV transmission by parasites". Although scientific studies state that interspecific contacts between red and grey squirrels are very rare (Wauters 2001a, Huxley 2003) if we take this doubtful hypothesis as probable we also have to accept the fact that the hosts of the disease can be all animals (mainly mammals and birds) living in the area affected by the disease who carry parasites. Accepting that hypothesis could partially explain the frequent occurrence of the disease among red squirrels in the areas where grey squirrels were never present (Middleton 1930, Reynolds 1985, Skelcher 1997, Huxley 2003). Indirectly supporting this hypothesis can be the fact confirmed in scientific research (Nour et al. 1993) that red squirrels are quite frequently present in birds nests where also interspecific exchange of parasites can take place. However all those hypotheses require further research to verify them.

The biggest pox virus outbreak among red squirrels in the UK

The biggest pox outbreak from those observed until this day in the UK was directly preceded by – supported financially from taxpayers money – wide cull of hundreds of thousands of red squirrels conducted for a few decades. Despite such huge losses in red squirrel population caused by killing them "to protect trees" the population had a chance to regenerate naturally. And it was at that time that there came the biggest known so far outbreak of pox among red squirrels in the UK that in short time reached 14 counties and caused massive population decline. **That outbreak could in no way be linked to the presence of grey squirrels because they were present in only 4**

out of 14 districts affected by the outbreak (Middleton 1930, Edwards 1960, Reynolds 1985, Skelcher 1997).

In later years – as well as earlier – no pox outbreak of such dynamics of distribution and range was ever noted in red squirrel population in the UK. Especially surprising is the speed with which the outbreak spread in those years into the areas distant from each other often by hundreds of miles (Middleton 1930). Today we know that after organising in one place the killing of squirrels – called "population control" these days – that area within several weeks is colonised by other animals of the same species coming from other, often distant, areas (Lawton & Rochford 1999, Harris et al. 2006). Such local decimation causes then artificial – driven by human activity – quick dispersal of squirrels from one area to another. If a disease like pox was locally present in one area, as a result of artificially promoted fast population dispersal it could have been very quickly brought into other areas. This could partially explain the speed of the disease spread at that time in – persecuted by humans – red squirrel population.

Squirrel pox occurrence in red squirrel populations in 1930-2001

Between 1930-2001 the disease was observed many times in red squirrel population in various places in the UK very often outside the geographical range of grey squirrels (Reynolds 1985, Skelcher 1997). It was also observed that local squirrel extinctions were sometimes preceded by pox occurrence in the population long before the appearance of grey squirrels in the area (Skelcher 1997, Huxley 2003). Also in thousands of various places in the UK and Ireland grey squirrels lived – and still do – in the same area as red squirrels for many decades –to over 100 years – before single cases of the disease were reported among mixed populations (Reynolds 1985, Sainsbury et al. 2008, Teangana et al. 2000, Huxley 2003).

Definition

Because even in environmental publications mistakes started to appear presenting animals which tested seropositive for the presence of SQPV antibodies as seriously threatening to other species members, we explain below what the concept used in scientific research of being seropositive for the presence of SQPV antibodies means.

Having SQPV antibodies means that the tested animal has antibodies against SQPV pox virus. In most tested cases such animal had SQPV infection earlier and currently poses no threat to other individuals in the population (Chantrey et al. 2014). We get vaccinated exactly to create

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antibodies and be immune against infection – and infecting others – with a given disease.

Supplementary feeding of red squirrels using shared feeders

Since early 1990ies there started to appear various groups providing intensive supplementary feeding of red squirrels using shared feeders. The number of such groups started to increase especially dynamically at the beginning of this century when red squirrels became "fashionable".

Scotland

In 2000 a project Red Squirrels in South Scotland has started in south Scotland. The project in years 2000-2008 saw creation of 24 red squirrels priority woodlands. Data from 2001-2005 shows that single cases of seropositive squirrels were extremely rare and limited to a small location (White & Lurz 2014). However as the creation of the above mentioned "red squirrel priority woodlands" continued – with providing shared feeders – the number of SQPV occurrences among squirrels living in the area increased several times. This significant increase in the number of records of seropositive squirrels can be already seen in data from 2006-2008 (White & Lurz 2014). The most atypical SQPV outbreak that occurred in red squirrel population was in Thornhill. The outbreak took place sixty miles from the place where in previous years only single cases of seropositive squirrels were noted. Even more surprising is the fact that in the years preceding the outbreak in that area the population of grey squirrels – monitored regularly for years – always gave clear seronegative results for SQPV antibodies (White & Lurz 2014).

As the "conservation works" continued and more woodlands were equipped with shared feeders the SQPV outbreaks – and their range – among squirrels in that area started multiplying on a scale never seen there earlier:

Before the start of the project with the goal of "red squirrel conservation" in the area where the program was launched pox virus didn't exist or occurred rarely not causing losses in red squirrel population. After 12 years of "conservation work", done among other actions by using shared feeders that area became a place where SQPV occurs most frequently in the red squirrel population in the UK.

Other cases showing the correlation between SQPV occurrence and feeding red squirrels using shared feeders

England Cumbria

One of the first such groups was formed in Cumbria in 1994. In that area **grey squirrels lived with red squirrels since at least 1964 and never before in at least 30 years of coexistence was there even a single case of SQPV noted earlier among red squirrels** (Sainsbury et al. 2008). The first cases of pox in red squirrel population in that area were reported in the same year as the group was formed – 1994 – (Sainsbury et al. 2008) and after four years since the introduction of intensive feeding using shared feeders the disease started to be a serious problem in the area (Sainsbury et al. 2008). **In subsequent years the number of shared feeders in that area increased several times** (ICSRS 2015c). **In 2010 another pox outbreak occurred on a huge scale** (TGW 2010). Despite more outbreaks – and the confirmation by laboratory studies that red squirrels as opposed to grey squirrels can transmit SQPV via saliva (Warnock et al. 2012, Collins et al. 2014) – the supplementary feeding using shared feeders is still common in the area as a tourist attraction (CWT 2015). Feeding – using shared feeders – was provided in the area even during the pox outbreak – that people were aware of – among red squirrels SIC! (TWG 2010).

Durham

Organised group providing intensive supplementary feeding of red squirrels using shared feeders was started in Durham in early 2007 (PRS 2007, Sainsbury et al. 2008). Pox outbreaks in red squirrel population in the area were recorded in 2011 (The Journal 2011). In Durham and the area grey squirrels co-existed with red squirrels since 1914. For 85 years – until 1999 – there was not even a single case of pox among red squirrel population noted in that area (Sainsbury et al. 2008). Since 1990 to early 2000ies there were intensive grey squirrel culls performed in the

Year	Area of SQPV occurrence	SQPV occurred earlier	Notes
2006-2008	Thornhill	No	
2006-2008	Ecclefechan	No	
2006-2008	Langholm	No	
2009-2010	Thornhill	Yes	Feeding continues First outbreak 2006-2008
2009-2010	Ecclefechan	Yes	Feeding continues First outbreak 2006-2008
2009-2010	Newcastleton / Old Castleton	No	
2011	Thornhill	Yes	Feeding continues First outbreak 2006-2008
2011	Moniaive	No	
2011	Langholm	Yes	Feeding continues First outbreak 2006-2008
2011	Berwick upon Tweed	No	
2012	Sanquhar	No	

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area (DBDS 2015) often linked with more or less regular supplementary feeding of red squirrels using shared feeders (ICSRs 2015d).

Northern Ireland and Republic of Ireland

Until recently it was believed that SQPV was absent from Northern Ireland and Republic of Ireland even though grey squirrels lived there with red squirrels for over 100 years. **That hypothesis was supported by scientific research that showed that seroprevalence among grey squirrels in Ireland (Northern and Republic) was zero** (Teanganna et al. 2000). The greater shock it was for scientists when first cases SQPV among red squirrels were noted. Those cases like in other areas in the UK were preceded by creation of various "red squirrel conservation" groups providing among other activities supplementary feeding using shared feeders. Until recently it was attempted to explain the very low number of SQPV among red squirrels by zero and later "almost zero" seroprevalence of grey squirrels living in Ireland. The most recent research shows however that seroprevalence of grey squirrels can be locally the same as it occurs in the UK (Stritch et al. 2015).

In the Republic of Ireland (ROI) there is no organised supplementary feeding of red squirrels using shared feeders on such a scale as it takes place in the UK for almost 20 years. Marginal number of cases of red squirrels infected with pox in ROI observed in the last 100 years supports the hypothesis that supplementary feeding of red squirrels using shared feeders promotes the spread of SQPV in squirrel population. In many places in Ireland populations of red squirrels grow even though they have lived for a long time in the same area as grey squirrels. The increase is mainly seen in ROI where instead of culling grey squirrels the focus was on the improvement of habitats of red squirrels (Conserve Ireland 2015).

Tollymore, Northern Ireland (UK)

In Tollymore grey squirrels co-existed with red squirrels in the same area since mid 1990ies (Mourne Heritage Trust 2010) even though smaller populations of grey squirrels were seen there even several years earlier (ICSRs 2015d). Until 2011 not a single case of SQPV was noted there (Naulty et al. 2013).

A group providing supplementary feeding for red squirrels using shared feeders was started in Tollymore in 2004 (TRSG 2015). In 2009 already 16 shared feeders were operational (NISF 2009). The first case of SQPV was noted in 2011 (Naulty

et al. 2013). Since the red squirrel numbers in that area decreased by 90% (TRSG 2015). Supplementary feeding using shared feeders is continued in that area. Feeders are cleaned once a week (TRSG 2015).

Dublin, Republic of Ireland

Also in the same year as in Tollymore first case of SQPV was noted over 100 miles south in Dublin area near Wicklow reserve (Naulty et al. 2013). In that area grey squirrels co-exist with red squirrels since 1978 (Naulty et al. 2013) and not only has pox in red squirrel population never occurred there but also their population – thanks to the good forest management – has increased in the last years (Lawton 2015). Close to the reserve between 2009 and 2013 there was a small group providing feeding for red squirrels (ICSRs 2015d). In that last case there is no certainty if the shared feeder could have facilitated the host transmitting the disease due to the small number of fed individuals of the same species (the feeder was initially visited by four and in subsequent years by two red squirrels).

Final notes

We can clearly see that there is a strong positive correlation between the start of supplementary feeding of red squirrels using shared feeders and the occurrence within a short period of time of pox outbreak in the population fed this way. The magnitude of the problem is even greater because there were cases of continuing feeding red squirrels using shared feeders during the outbreak (TWG 2010, The Journal 2011, ICSRs 2015d).

Considering the fact that "shared feeders" are visited in one day usually by a few to tens of red squirrels (and that often the same squirrel uses in one day a few different shared feeders in the area), **chemical cleaning of feeders done "even once a day" only to a very limited extent can decrease the risk of transmitting the virus this way. That's why in the areas where European red squirrels live in the UK the way of feeding them should be changed to "scatter feeding"** (In short, it's about placing several nuts near trees – as many as the squirrel has a chance to quickly eat and/or bury) **to significantly reduce the possibility of "exchanging body fluids" and insects in a small area by many red squirrel within one day.**

References and more about squirrels: www.i-csrs.com/new-threats-red-squirrels

Visit the Facebook page and sign the petition to stop grey squirrel cull:

www.facebook.com/StopSquirrelCull

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