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First Reports of Pseudorabies and Winter Ticks (*Dermacentor albipictus*) Associated with an Emerging Feral Swine (*Sus scrofa*) Population in New Hampshire

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ABSTRACT: The expansion of feral swine (*Sus scrofa*) populations into new geographic regions is of concern not only due to increased range but also because they carry diseases and parasites that pose a threat to humans, livestock, and wildlife into new areas. Recently, emerging feral swine populations have been reported in the northeastern US and due to their adaptive nature will likely continue to spread. During 2009–2012, 49 feral swine were removed from three counties in New Hampshire. Of these, serum samples were submitted from 34 for disease surveillance testing. One of the feral swine was antibody-positive for pseudorabies virus (PRV) making it the first documented infection in feral swine in New Hampshire. Infestations of winter tick (*Dermacentor albipictus*) were also documented on two of the feral swine which had only been reported previously on feral swine in Texas. Feral swine may not only serve as an important host for an economically important commercial swine pathogen like PRV, but they could also increase host diversity for parasites such as the winter tick, a species that can regionally impact moose (*Alces alces*) survival. These findings warrant further investigation of expanding and established feral swine populations in New Hampshire as pathogen hosts and support continued effort to reduce numbers or regionally eradicate feral swine.

Key words: Disease, feral swine, gB ELISA, New Hampshire, pseudorabies, winter tick.

Feral swine (*Sus scrofa*) are a nonnative species in the US with free-ranging populations reported in at least 38 states (Wyckoff et al. 2009) with much of their expansion occurring in the past 10 yr. In the northeastern US, there are known populations of feral swine in New Hampshire, New Jersey, New York, and Pennsylvania (Pedersen et al. 2012). Although some of these populations are relatively new, feral swine reports in New Hampshire date back as early as 1895. It is believed that the States' free-ranging feral swine population originated from Eurasian wild boar or hybrid escapees of high-fenced hunting operations (Mayer and Brisbin 1991). Today most feral swine reports are concentrated in Sullivan County and are becoming more frequent with sightings now occurring statewide (US Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services [USDA/APHIS/WS], unpubl. data).

Feral swine are reservoirs of 30 viral and bacterial diseases (Davidson and Nettles 1997; Samuel et al. 2001; Williams and Barker 2001), as well as 37 parasites, with many that can infect humans, livestock, pets, and wildlife (Forrester 1991). Of great concern to the commercial swine industry are diseases such as swine brucellosis and pseudorabies, which could severely impact production and lead to economic losses. Although these diseases have been eradicated from the commercial swine industry, they are considered endemic in feral swine, making them an important potential source of reinfection. Feral swine are also important hosts for ticks and tick-borne pathogens (Allan et al. 2001; Perez de Leon et al. 2012) and may serve as maintenance or amplifying hosts, not only of arthropod vectors but also of zoonoses (Sanders 2011). Although feral swine populations in the northeastern US appear to be relatively sparse compared to other parts of the country, their range expansion into new areas and increasing populations mean increased opportunities

for transmission and dispersal for pathogens and parasites.

As part of the USDA/APHIS/WS's National Wildlife Disease Program (NWDP), feral swine blood samples were collected and tested for classic swine fever (CSF), pseudorabies (PR), swine brucellosis (SB), and various other diseases. The WS-New Hampshire Program has assisted with collection of 49 feral swine from three counties in New Hampshire, from 2009–2012, with most activity occurring in Sullivan County. Surveillance blood samples ($n=34$) were collected opportunistically from feral swine that were causing property damage or presenting a disease threat. Animals were removed by capturing with baited corral traps or shooting over baited sites. Blood samples were collected primarily by cardiac puncture with the use of an 18- gauge needle and 60-mL syringe. Blood was placed in Vacutainer® tubes (BD, Franklin Lakes, New Jersey, USA) and once clotted, it was centrifuged and serum transferred into Cryovials® (Corning Incorporated, Lowell, Massachusetts, USA) where it was stored at 4 C. Within 3 days pseudorabies virus (PRV) serum samples were sent to the NWDP in Fort Collins, Colorado, USA, and then batched shipped alternately to the Wisconsin Veterinary Diagnostic Laboratory, Barron, Wisconsin or Washington Animal Disease Diagnostic Laboratory, Pullman, Washington, for testing. Samples were evaluated with the PRV glycoprotein B enzyme-linked immunosorbent assay (gB ELISA; IDEXX Laboratories, Inc., HerdCheck, Westbrook, Maine, USA). Testing was considered complete regardless of the result.

In August 2011, a subadult female trapped in Sullivan county was found positive for PRV antibodies, the first documented infection in feral swine in New Hampshire. As a follow-up, USDA/Veterinary Services (VS) and the New Hampshire Department of Agriculture, Markets & Food surveyed four local farms maintaining domestic swine within a 16-km radius of the collection site for the positive feral swine sample. All local domestic swine tested were antibody negative (Nicole Giguere, USDA/VS, pers. comm.). This was not surprising because there has been no known contact between free-ranging feral swine and the domestic herds at the facilities where testing was conducted. Because of the limited sampling of feral swine in New Hampshire the prevalence of PRV infection is unknown; however, feral swine are considered to be persistent reservoirs of PRV and therefore represent a potential avenue for infection of domestic swine (Corn et al. 2004). Although currently absent in commercial swine herds in the US, PRV circulates among feral swine in at least 27 states (Pedersen et al. 2013). Although there is not a substantial commercial swine industry in New Hampshire, there are backyard operations and small-scale facilities where a higher biosecurity risk exists. Although not a zoonotic disease, PRV presents a threat to domestic swine, other livestock, domestic animals, and native wildlife such as black bears (*Ursus americanus*).

In February 2012, two adult feral swine were euthanized in Sullivan County. During examinations of the carcasses prior to blood collection, tick infestations were observed on both animals. Samples of ticks collected from each animal were placed in separate vials of 80% ethyl alcohol and submitted for identification to the USDA/APHIS/VS/National Veterinary Services Laboratories (NVSL), Ames, Iowa. The NVSL identified the 17 specimens submitted that included adult female, adult male, and nymphal ticks as the winter tick (*Dermacentor albipictus*). Although the first documented reports of winter ticks on feral swine in the US were recently reported in Texas (Sanders 2011; Schuster 2011), this record is unique to feral or domestic swine in the northeastern US.

The winter tick is widely distributed from British Columbia, Canada, to Mexico, and ungulates are the primary hosts

(Samuel 2004). Moose (*Alces alces*) populations in parts of the northern US and Canada are the most severely affected hosts from infestations of winter ticks because of hair loss and excessive grooming (Mooring and Samuel 1999), chronic weight loss (Addison et al. 1994), and metabolic impact on protein and energy balance associated with blood loss (Musante et al. 2007). Although some parasites may not cause morbidity in a specific host species, some have the ability to cause high pathogenicity. Substantial moose mortality in North America has been associated with severe winter tick infestations (Samuel 2004) and winter ticks are thought to be a substantial factor in the decline of New Hampshire's moose population (Kris Rines, NHFG, pers. comm.). In a recent study in New Hampshire, winter tick infestation was responsible for 41% of radio-collared moose mortality with calves representing 88% of deaths (Musante et al. 2010). Feral swine appear to influence the distribution of multiple tick species by transporting them to new areas, which increases the probability of pathogen transmission (Sanders 2011) and feral swine may also serve as an additional host in the maintenance and distribution of some parasites, including winter ticks.

If feral swine populations continue to expand in the northeastern US they will increase host diversity for parasites and potentially serve as a reservoir for emerging or reemerging diseases that could pose a risk for humans, livestock, or wildlife. We recommend further efforts to reduce the feral swine population in New Hampshire and additional disease and parasite studies to understand more fully the effects of introduction of this invasive species in the state.

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