



Protecting Virginia Pigs Raised Outdoors from Biting Insects and Arachnids

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Arthropods, such as insects and arachnids, function as ectoparasites of swine when they live on the outside of a pig's body and feed on its skin, blood, or tissue fluids. Insects have three body segments: a head, a thorax, and an abdomen, and six legs arranged in three pairs. Examples are muscid flies and mosquitoes. In contrast, arachnids have just two body parts, a cephalothorax and an abdomen, and eight legs arranged in four pairs. Examples include ticks and spiders. Historically, external parasites including the hog louse (an insect) and the mite (arachnid) that causes mange were the primary concern of pig farmers. However, awareness is rising regarding risks posed by other biting insects and arachnids. Biting insects have the potential to negatively impact the health, well-being, and productivity of swine as well as the profitability of pork production. For example, in upper Midwest packing plants, insect bites on market hogs cause skin lesions resulting in trim losses of \$6 to \$15/head (Rademacher et al. 2024).

Of the more than 700,000 hogs and pigs annually produced in Virginia, over 94% are raised indoors in confinement on fewer than 60 large-scale operations, each selling more than 1,000 head per year (Estienne 2023). The remaining hogs and pigs are raised on over 900 small-scale and niche market type farms, many of which use outdoor production systems. Although pigs kept in indoor facilities are not immune to the risks associated with biting insects and arachnids, animals kept outdoors are particularly vulnerable (fig. 1). The purpose of this fact sheet is to raise awareness of both the well-known and newly emerging insects and arachnids that can negatively impact outdoor pig production in Virginia. It also aims to explain practical management strategies that farmers can use to reduce the risks these pests pose to pig health, welfare, and productivity.



Figure 1. Swine raised outside may be more vulnerable to biting insects and arachnids than those raised indoors. (Photograph by Ayrshire Farm used with permission.)

Biting Insects that Affect Swine

Hog Louse

Because of the development of effective parasiticides and strict biosecurity protocols, problems caused by hog lice are exceedingly rare in large commercial swine operations. However, lice infestations on small pig farms are still occasionally observed. In a survey of 1,494 small swine operations in 38 states, including Virginia, 5% of farms reported external parasites (lice and/or mange-causing mites) as responsible for sickness or death during the study period (USDA 2022).

The hog louse (*Haematopinus suis*, fig. 2) is approximately one-quarter inch long and grayish brown in color, although it may appear bluish when engorged with blood. It is highly host-specific, living its entire life on swine and surviving only a few days off the host. The louse feeds on the blood of the hog by piercing the skin

with its mouthparts. The female louse lives 23 to 30 days and lays three to four eggs (“nits”) daily that are attached near the base of hair shafts. Eggs hatch in 12 to 20 days.



Figure 2. Hog lice are still occasionally seen on some small pig farms in Virginia. (Photograph by Kansas Department of Agriculture, Bugwood.org.)

All ages of swine are susceptible to lice, which are spread primarily through direct pig-to-pig contact. This is facilitated when animals crowd together for warmth, shade, or comfort. Heaviest infestations occur in the winter when cold weather prompts pigs to huddle tightly together. During the summer, the louse population is suppressed due to direct exposure to intense sunlight and because hogs have shorter hair coats. The lice prefer to feed on the neck, jowl, flank, and inner sides of the legs and ears. As they pierce the skin to take a blood meal, infested hogs rub and scratch, often resulting in hair loss. Because lice feed several times a day, infestations can cause significant irritation from skin damage, itching, and allergic reactions to louse saliva. Heavy infestations may lead to blood loss and severe anemia, particularly in nursing pigs. Parasitized pigs are restless and may exhibit poor growth rates and feed conversion efficiency. Lice can also serve as vectors for swine diseases such as swine pox, characterized by the acute appearance of round-to-oval skin lesions that heal in three to four weeks.

Flies

The primary fly pests on swine farms include the house fly (*Musca domestica*), which is a nuisance but does not bite, as well as several biting flies. These biting pests include the stable fly, biting midges, black flies, and mosquitoes, all of which can irritate pigs, reduce comfort and productivity, and contribute to health problems.

Stable Flies

The stable fly (*Stomoxys calcitrans*, fig. 3) is a common pest on pig farms, especially in outdoor production systems where conditions often favor its development. Because it has a predictable life cycle, understanding

each stage helps farmers apply control measures more effectively. Stable flies are particularly troublesome because both males and females take one or two blood meals each day, increasing irritation and stress on pigs. Since adults feed repeatedly and breeding sites are common around pigs, populations can build quickly if not managed. Female flies lay 80 to 100 eggs in moist, decaying organic material such as wasted feed, fermenting weeds, or mixtures of manure and wet bedding. The eggs hatch within one or two days, and the larval stage lasts 10 to 15 days. After feeding, larvae move to a drier area to pupate, and adult flies typically emerge 6 to 8 days later.



Figure 3. The stable fly is commonly found on pig farms in Virginia. (Photograph by Whitney Cranshaw, Colorado State University, Bugwood.org.)

Stable fly bites cause irritation and stress to pigs, and in severe cases may account for much blood loss and reduced feed intake. Wounds from bites may become infected. Based on a review of scientific literature from North America and Europe, Makovska et al. (2025) suggested that stable flies “likely” transmit at least eight bacterial pathogens, including *E.coli* and *Staphylococcus aureus*, and “potentially” transmit several viruses including those that cause porcine circovirus type 2 (PCV2) and porcine reproductive and respiratory syndrome virus (PRRSV).

Biting Midges and Black Flies

Biting midges (insects in the *Ceratopogonidae* family, fig. 4) are commonly called “no-see-ums” because of their small size. These tiny flies are especially common near coasts and wetlands. They are particularly active at dawn and dusk, causing itchy bites. Their habitat is wet mud, salt marshes, and stagnant water. Approximately seven days after their first bloodmeal, female midges deposit their eggs in wet habitats such as manure-polluted mud, moist soil around streams, ponds, and marshes, or in or around swine waste lagoons. They prefer damp, shady spots and can survive even in small puddles that may result from leaky water troughs. Eggs hatch in seven days, and the larvae take 14 days or more to completely develop into adults (Watson 2012).



Figure 4. Biting midges are called “no-see-ums” because of their small size. (Photograph by Charles Olsen, Charles Olsen Insect Collection, USDA APHIS PPQ, Bugwood.org.)

Black flies (insects in the family *Simuliidae*, fig. 5) are a significant pest in Virginia in spring and early summer. Their bites are painful and can cause stress and irritation for pigs. They deposit eggs in clean, fast-moving water, such as streams, and, depending on the species, produce one to three batches of more than 100 eggs each. The larvae attach themselves to submerged substrates (such as rocks, sticks, or plants under water) and feed by filtering out small organic particles, algae, and bacteria that are carried in the flowing water; they will not breed in stagnant (still) water. Black flies pupate underwater and then emerge in a bubble of air as flying adults. Only females take blood meals, and adults may disperse more than 10 miles from the breeding site in search of a host (Watson 2012).



Figure 5. Black flies in the family *Simuliidae* deposit eggs in moving water, like streams. (Photograph by Darren Blackford, USDA Forest Service, Bugwood.org.)

Both black flies and biting midges can bite swine, resulting in welts, bumps, and swelling that can cause intensely itchy skin, leading to scratching,

biting, and rubbing. The irritation and annoyance can reduce feeding and interfere with rest. However, these black flies (*Simulium* spp.) and biting midges (*Culicoides* spp.) are key vectors of vesicular stomatitis virus (VSV), which affects pigs and other livestock (Scroggs et al. 2024). In pigs, signs include high fever (106–107 degrees F; normal temperature in pigs is 102.5 degrees F); excessive salivation; blisters on the nose, lips, teats, and feet; lameness; and possible slowed growth. Mortality is low, and most animals recover within two weeks, but it can impact animal movement and international trade, resulting in economic losses for livestock producers (USDA 2026). The VSV lesions in livestock are clinically indistinguishable from foot-and-mouth disease. Although foot-and-mouth disease was eradicated from the U.S. in 1929, any blister-like lesions are treated as a foreign animal disease emergency until laboratory testing confirms otherwise. Virginia is considered free of VSV, and suspected vesicular diseases must be reported immediately to state or federal animal health officials. Livestock entering the state from areas with confirmed VSV cases within the previous 14 days, or from premises under VSV quarantine, must have a Certificate of Veterinary Inspection stating that all animals were examined and found free of clinical signs of VSV, as required by 2 Va. Admin. Code § 5-141-40.

Mosquitoes

Mosquitoes are biting flies, notable for having scales on their narrow wings and long, distinct piercing-sucking mouthparts. Both sexes feed on nectar and function as pollinators, but only the female feeds on blood. After a blood meal, the female mosquito lays eggs on or near standing water, which is necessary for hatching. From hatched eggs, worm-like “wigglers” emerge and thrash around in water, feeding on organic matter. Wigglers develop into pupae that somersault through water and are called “tumblers.” Tumblers ultimately develop into flying adults, emerging from water. The life cycle typically takes two weeks but can range from four days to one month, depending on the species and ambient temperature. Wigglers live in stagnant water and are not found in streams, rivers, ponds, or fast-moving water because they breathe air through a siphon (they do not have gills) and depend on the surface tension of the water to support them. Moving water makes it difficult for them to reach the surface and remain there (Dellinger et al. 2021).

At least 50 species of mosquitoes can be found in Virginia, and the bites of several distinct types can negatively affect pigs by causing stress, allergic reactions, anemia (from excessive biting), potential transmission of pathogens, and a decrease in

productivity measures such as average daily weight gain. Mosquitoes are known vectors of many viruses (Faw and Eastwood 2023), including West Nile virus (WNV) and Eastern equine encephalitis virus (EEEV).

EEEV is responsible for a disease that cycles between wild bird hosts and mosquitoes in freshwater hardwood swamps. The primary vector of EEEV is the black-tailed mosquito (*Culiseta melanura*, fig. 6), which feeds almost exclusively on birds (CDC 2024). The spread of EEEV to other hosts, such as humans, horses, and swine, requires it to use other mosquito species as a “bridge.” In other words, mosquitoes other than the black-tailed species feed on EEEV-infected birds, become infected themselves, and then spread the virus to a secondary population of animals. Most bridge species belong to the genera *Aedes*, *Coquilleltidia*, and *Culex*. Outbreaks that extend beyond the swamp often occur after heavy rain events, which increase mosquito breeding in the resulting standing water. EEEV can infect swine, causing severe neurological disease and high mortality. For example, on a farm in Georgia in 1991, 280 of 350 two-week-old pigs were diagnosed with EEEV, with a history of weight loss, incoordination, and paddling (Elvinger et al. 1994).

WNV is maintained in a cycle between primarily *Culex* mosquitoes such as the northern house mosquito (*Culex pipiens*, fig. 7) and wild birds. Infection in other hosts, including swine, results from enzootic spillover, which means the transmission of a pathogen (in this case, WNV) from its usual animal group (in this case, wild birds) where the disease constantly circulates, into a new, susceptible population of animals (Ciota 2017). *Culex* mosquitoes favor stagnant, fresh water and can use habitats such as catch basins, retention ponds, ditches, agricultural drains, and flooded fields. In swine, most WNV cases are asymptomatic. Platt (2004), however, reported results of a small-scale study showing that, in weanling pigs, daily weight gain was reduced during the period when WNV was detected in blood. Moreover, brain and spinal cord lesions caused by the virus had the potential to cause neurological symptoms.



Figure 6. The black-tailed mosquito is the primary vector for Eastern encephalitis virus in Virginia. (Photograph by C. Roxanne Connelly, UF/IFAS. Used with permission.)



Figure 7. The northern house mosquito is the primary vector for West Nile virus in Virginia. (Photograph by Ary Faraji, SLCMAD, Bugwood.org.)

Although it has never been detected in the United States, the mosquito-borne Japanese encephalitis virus (JEV) is considered an emerging risk to pork producers (APHIS USDA 2023). The virus is found throughout Asia, Australia, and the Western Pacific Islands, including Papua New Guinea, and is spreading. From 2021 to 2022, approximately 80 swine farms across four Australian states were impacted by JEV. Clinical signs in sows include abortion, birth of stillborn or mummified pigs, delayed farrowing, and poor conception rates. Boars display abnormal sperm and infertility and/or inflammation of the testicles. Young pigs may be unable to stand and suckle or be born with deformed limbs, edema, or reduced/absent brain tissue. Newborn pigs experiencing a disease outbreak may display 100% mortality rates. Growing pigs up to 6 months old may exhibit neurological symptoms.

Mosquitoes infected with JEV are most likely to enter the United States via aircraft or cargo ships. Once in the United States, it is not too far-fetched to believe JEV-infected mosquitoes would feed on domestic or feral swine. Pigs are the primary amplifying host of JEV, exhibiting high and prolonged circulation of the virus in the blood and a natural infection rate of 98% to 100%. Many mosquito species could potentially become infected with JEV, sustain the infection, and transmit the virus. Mosquito species in Virginia that could become JEV transmitters include the northern house mosquito and the Asian tiger mosquito (*Aedes albopictus*, fig. 8), a species that first came to the United States in the mid-1980s in shipments of used tires from northern Asia and that invaded Virginia in 1991. Emergence of JEV in the United States would cost the pork industry between \$302 million and \$600 million (Shike 2025). Although the risk of JEV introduction into the U.S. is high, the risk of establishment is still considered low (Monath 2024). Nevertheless, given the potential effect of JEV on the swine industry, continued monitoring should remain a priority.



Figure 8. If Japanese encephalitis virus emerged in the United States, the invasive Asian tiger mosquito would become a likely vector. (Photograph by Susan Ellis, Bugwood.org.)

Biting Arachnids that Affect Swine

Mange Mites

Sarcoptic mange (*Sarcoptes scabiei* var *suis*) and demodectic mange (*Demodex phylloides*) are primary types of mite-induced skin diseases that affect swine. While demodectic mange is uncommon in modern production systems, sarcoptic mange is the most economically significant form, particularly for small-scale and backyard operations. As mentioned above, in a survey of nearly 1,500 small swine operations in 38 states, including Virginia, 5% of farms reported that external parasites (lice and/or mange-causing mites) caused sickness or death during the study period (USDA 2022).

Sarcoptic mange is caused by a parasitic mite that burrows into the skin, secretes digestive enzymes that break down tissue, and forms tunnels in which the mite feeds and reproduces. Soon after mating with a male on the surface of the skin, the fertilized female constructs a new tunnel in which she lays up to three eggs per day over a two-to-three-week period. Eggs hatch in three to five days. Larvae expand the tunnels. Within two to four days, they become nymphs, and in four to six more days they become eight-legged adults. This rapid life cycle allows infestations to build quickly in susceptible herds.

Mite transmission is primarily by direct contact with infested pigs. However, mites can survive off the host for several days, allowing transmission from bedding, pens, and transport vehicles. Infestation generally starts on the inner side of the ear before spreading to the head, neck, and body (fig. 9). Animals scratch, rub, and experience severe hair loss. The skin of infested animals becomes inflamed, cracked, and thickened, with encrusted lesions developing on the ears and face. Mange infestation in pigs negatively impacts growth rates and feed conversion efficiency, and skin lesions decrease the carcass value. Because they are more restless, sows may crush more newborn pigs.



Figure 9. Pig with mange. Mite infestation usually starts on the inner side of the ear before spreading to other parts of the body. (Photograph by National Pork Board, Des Moines, Iowa. Used with permission.)

Ticks

Ticks are divided into two families: *Ixodidae* (hard ticks) and *Argasidae* (soft ticks). Hard ticks have a firm shield just behind the mouthparts and look like flat seeds before they feed. In Virginia, common hard tick species include the American dog tick, blacklegged (deer) tick, lone star tick, and Asian longhorned tick (Dellinger and Day 2021). Soft ticks lack the hard shield and, when unfed, resemble a large raisin. Ticks can become a problem when hogs are raised outdoors. Most commonly, ticks are introduced into outdoor swine operations through interactions with wildlife, including wild hogs, which carry ticks into pastures and pig housing. Ticks can also come from wooded or brushy environments or be transferred from other livestock or pets. Bites cause inflammation, itching, and swelling, and wounds may become infected (fig. 10).



Figure 10. Tick on a 9-day-old pig. (Photograph by Ayrshire Farm. Used with permission.)

Ticks are also important because they can spread diseases. For example, soft ticks in the genus *Ornithodoros* can transmit the virus that causes African swine fever (ASF) in many parts of the world. The United States has never had a case of ASF, designated as a foreign animal disease, but its risk of emergence and spread is a threat to the pork industry. Emergence of ASF in the United States could cost the pork industry in excess of \$50 billion over a 10-year period (Carriquiry et al. 2020). Wild pigs can function as reservoirs for other tick-borne pathogens, such as *Borrelia*, *Anaplasma*, and *Rickettsia* species, though it is not yet clear how much these affect domestic pigs.

The Asian longhorned tick (*Haemaphysalis longicornis*) was first detected in the United States in 2017 on a sheep in New Jersey and has since been confirmed in at least 15 states, including Virginia (Dellinger and Day 2023). This invasive tick species has demonstrated the ability to infest a wide range of livestock and wildlife hosts, including swine. Heavy infestations can lead to significant animal welfare and production issues such as stress, reduced weight gain, decreased productivity, and, in severe cases, death due to extensive blood loss. Although the longhorned tick can transmit several pathogens in other parts of the world, no evidence currently shows it transmits any diseases to pigs in the United States.

A Note on Feral Swine as a Threat to Virginia Pig Farmers

Pigs were first brought to the continental United States by Hernando de Soto during the Spanish exploration of Florida in 1539. De Soto's herd increased to over 700, serving as a mobile food supply (in other words "food on hoof"). Over the next three years, de Soto and his army traveled more than 3,100 miles through areas that are now parts of 14 states. Along the way, many pigs escaped into the wild while others were given to or taken by Native American groups encountered by the expedition. Subsequent Spanish, English, and French explorers and colonists also brought hogs with them. Many of these pigs also escaped, leading to the establishment of wild populations in a variety of areas in the southeastern and southwestern United States.

Beginning in the 1890s, the pure Eurasian wild boar was introduced into several areas of the United States (including North Carolina) to provide a new big game species for wealthy sportsmen to hunt. Many releases were made into unfenced areas, and interbreeding with already established wild pig populations occurred. Feral

swine (also called wild pigs or wild boar) are a mix of escaped domestic pigs, Eurasian wild boars, and their hybrids.

Today, over 6 million feral pigs inhabit at least 35 states. Most counties in North Carolina have feral pigs, as do several Virginia counties (Tsang and Parkhurst 2022) in the Southeast, Southwest, and Central regions of the state. Feral swine are a destructive, invasive species, and the rapidly growing herd costs United States agriculture over \$1.5 billion each year by damaging property, crops, and livestock (Pimentel 2007). Many diseases are harbored by feral swine, including brucellosis, pseudorabies, trichinosis, and toxoplasmosis. The spread of these diseases, as well as those previously mentioned in this fact sheet, is a very real threat to pig farms, particularly outdoor operations on which feral and domestic swine could potentially come into direct contact.

Mitigation Strategies

Hog Louse, Mange Mites, and Ticks

Table 1 contains commercial products labeled for treatment and prevention of lice and mange mite infestations in swine. Depending on the product and method of application, these treatments may provide additional benefits. For example, the permethrin product SwineGuard also aids in the control of biting flies, including mosquitoes. Avermectin products will also kill ticks (Kerr 2014) and, in one experiment, treatment of pigs with subcutaneous injections of ivermectin caused 100% mosquito mortality eight days after administration (Pasay et al. 2019). In that mosquito experiment, however, ivermectin was administered extra-label at twice the labeled dose.

It is imperative that product labels be read and instructions carefully followed to ensure proper dosing and withdrawal times, that is, the required time between the last drug treatment and the slaughter of the animal. Pig farmers are encouraged to consult with a veterinarian regarding lice and mange control strategies. Some farms have eradicated lice and mange by strategic use of ivermectin. This is accomplished by injecting all swine on the farm (including newly farrowed pigs) with ivermectin at the labeled dosage within one or two days. Fourteen days later, all swine are treated again. Pigs born between the two initial injections (and therefore not present for the initial dose) are treated when all other swine receive their second injection, followed by a second dose 14 days later. In this way, all swine will

have medication in their system for a continuous 28-day period (McKean et al. 2006).

Ticks found on a pig can be sprayed with an insect repellent containing pyrethrin or a pyrethroid, twice at 10-minute intervals. The tick will likely drop off within 24 hours. To manually remove ticks, use fine-tipped tweezers to grasp the tick as close to the skin as possible and twist the head counterclockwise (the feeding tube will be embedded in the skin with reverse hooks). Avoid squeezing the tick's body. To prevent secondary infections, wash the site with rubbing alcohol, soap and water, or iodine scrub.

Table 1. Examples of commercially available products labeled for prevention and treatment of lice infestation and mange in swine.

Class of substance	Trade name ^a	Manufacturer	Method of application
Avermectin	Agri-mectin	AgriLabs	SQ injection
	Dectomax	Zoetis, Inc.	IM injection
	Ivermax	Aspen Veterinary Resources	SQ injection
	Ivermectin	Durvet, Inc.	SQ injection
	Ivomec	Boehringer Ingelheim	SQ injection
	Noromectin	Norbrook	SQ injection
Phosmet	Prolate/ Lintox-HD	Wellmark International	Coarse spray
Permethrin	Atroban 11% EC	Merck Animal Health	Spray
	SwineGuard ^b	Y-TEX	Pour-on

^aTrade names or proprietary products listed are only to be used as examples, and their inclusion does not constitute a guarantee or warranty of the product by the authors, nor does it imply its approval to the exclusion of other suitable products.

^bAlso aids in control of biting flies, including mosquitoes.

Biting Flies

Fly control is most successfully approached by sound sanitation and good management (Rademacher et al. 2024). The larvae of stable flies and biting midges require a moist breeding medium. Piles of spilled feed, moist and fermented weeds, and mixtures of manure and soggy bedding material should be removed. Compost piles should be evaluated for excessive moisture and, if necessary, should be turned and layered in with dry materials. Dead swine should be disposed of promptly.

As previously mentioned, treatment of swine with pour-on permethrin products such as SwineGuard aids in control of biting flies. Some additional control can be accomplished by spraying or direct wiping of appropriate areas (such as sheds or shelters) and feeders with permethrins. ClariFly Larvicide 267 (Wellmark International), which is added to swine feed, is labeled for the prevention of the emergence of houseflies, stable flies, and other manure breeding flies.

Mosquitoes

To control mosquitoes, the farm should be well maintained. Mow tall grass and weeds because adult mosquitoes rest in these areas. The most critical step is eliminating standing water since mosquitoes lay eggs and larvae develop in stagnant water. Grade uneven land and fill depressions or potholes that collect water. Dispose of debris that may provide shelter or hold water for breeding sites for mosquitoes, such as old farm equipment, scrap metal heaps, old drums, buckets, and unused tires. Water troughs for pigs should be emptied and refilled at least weekly so that larvae do not have the time necessary to develop. If standing water cannot be effectively drained, consider using products containing *Bacillus thuringiensis* (Bt), such as Mosquito Dunk (Summit Chemical Company), or an insect growth regulator, such as Altosid Briquets (Zoecon), that prevent mosquito larvae from developing but are safe for swine.

Controlling Feral Swine

Feral swine in Virginia are defined as “any swine that are wild or for which no proof of ownership can be made” (see the [Virginia Administrative Code, 4VAC15-20-160](https://law.lis.virginia.gov/admincode/title4/agency15/chapter20/section160/), <https://law.lis.virginia.gov/admincode/title4/agency15/chapter20/section160/>). Any loose hogs or potential feral swine should be reported to the Virginia Wildlife Conflict Helpline at 1-855-571-9003. Feral swine are a nuisance species with no closed harvest season, no daily or seasonal bag limits, and an allowance for hunting over bait. Determination of whether free-roaming swine are truly feral and not pets (for example, pot-bellied pigs) or domestic swine that

have escaped from captivity is important. Killing of a hog for which legal ownership can be shown may result in a need to compensate the owner (Tsang and Parkhurst 2022).

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