

Acariasis

Mange

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& Public Health

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Etiology

Acariasis in animals is caused by a variety of mites (class Arachnida, subclass Acari). Due to the great number and ecological diversity of these organisms, as well as the lack of fossil records, the higher classification of these organisms is evolving, and more than one taxonomic scheme is in use. The zoonotic species include the following mites.

Family Sarcoptidae

Sarcoptes scabiei causes sarcoptic mange (scabies) in humans and more than 100 other species of other mammals and marsupials. There are several subtypes of this organism including *S. scabiei* var *hominis*, *S. scabiei* var. *canis*, *S. scabiei* var *suis*, *S. scabiei* var. *equi*, *S. scabiei* var *bovis* and *S. scabiei* var *ovis*. Some of these variants are host specific, some are not, and some have partial host specificity. The host-specific variants can cause temporary dermatitis in other hosts, but do not reproduce except on their preferred host. *S. scabiei* var *hominis* causes human scabies. Humans can also be infested by the scabies mites of dogs, pigs, cattle, goats, sheep, horses, ferrets, water buffalo, llamas, camels and some wild or zoo animals (e.g. the Australian wombat). The zoonotic scabies mites infest humans transiently. They are not thought to multiply on humans and the infestation is self-limiting. *Notoedres cati* causes notoedric mange (feline scabies) in the Felidae and also infests a variety of other species. It can cause self-limiting dermatitis in humans. The guinea pig mite *Trixacarus caviae* mainly affects guinea pigs, but infestations resembling scabies have been reported in children.

Family Psoroptidae

Most members of this family affect only domestic animals (e.g. psoroptic mange). Rare, self-limiting human infestations with the ear mite *Otodectes cynotis* have been reported.

Family Cheyletiellidae

Cheyletiella yasguri, *C. blakei* and *C. parasitovorax* cause cheyletiellosis in dogs, cats, rabbits, and some wild mammals. These parasites cause self-limiting dermatitis in humans, who are aberrant hosts.

Family Macronyssidae

Three mites from this family are known to cause dermatitis in humans. *Ornithonyssus bacoti* is found on rodents and small marsupials. It is often associated with black rats. *Ornithonyssus bursa* (tropical fowl mite) and *O. sylviarum* (Northern fowl mite) are found on birds.

Family Dermanyssidae

Two mites in this family will feed on humans, resulting in dermatitis. Both species spend most of their time in the environment, and drop off the host after feeding. *Dermanyssus gallinae* (chicken mite, red mite, roost mite, poultry mite) is a parasite of birds. *Liponyssoides sanguineus* is a parasite of small rodents.

Family Trombiculidae (chiggers, harvest mites)

The approximately 700 species of trombiculid mites are free-living as nymphs and adults, but are parasitic as larvae. Some species can affect animals or humans. Genera known to infest humans include *Eutrombicula*, *Neotrombicula*, *Schoengastia*, *Euschoengastia*, *Acomatacarus*, *Siseca* and *Blankaartia*.

Food storage mites

Other mites (including food storage mites) or their feces can cause allergic reactions and pruritus in humans. These mites are not discussed further in this outline.

Geographic Distribution

Notoedres cati, *Otodectes cynotis*, *Cheyletiella* spp., *Dermanyssus gallinae*, *Ornithonyssus bacoti* and chiggers are found worldwide. *Sarcoptes scabiei* is also found worldwide; however, its varieties are more limited in their distribution and may be rare or nonexistent in some countries. (e.g., *S. scabiei* var *equi* is rare in the U.S.) *Liponyssoides sanguineus* occurs in Asia, Europe, the U.S. and northern Africa. *Ornithonyssus*

bursa is seen mainly in tropical and subtropical areas, including parts of the U.S. *O. sylviarum* occurs in Australia, New Zealand, and temperate parts of the northern hemisphere.

Transmission and Life Cycle

Female mites lay their eggs either on the host or in the environment. The egg hatches into a larva, which generally passes through two nymphal stages to become an adult. All of the mites that cause acariasis are transmitted by direct contact. The importance of fomites in transmission varies with the species of mite and its survival in the environment.

Sarcoptidae

The Sarcoptidae are burrowing mites and live in tunnels in the skin. These mites complete their entire life cycle on the host, and do not survive for long periods in the environment.

Sarcoptes scabiei mites burrow in the upper layers of the skin, as deeply as the stratum granulosum and stratum spinosum of the epidermis. Female mites, which live for 1 to 2 months, construct the characteristic long serpentine tunnels and deposit their eggs as they move through the skin. Hatched larvae migrate to the surface of the skin. Molting to the nymphal and adult stages takes place in short burrows called molting pouches. Impregnated female mites extend their molting pouches into tunnels. Males die after mating and are rarely seen.

Sarcoptic mange is mainly spread by the impregnated female mites. Most animals and humans infested with *S. scabiei* carry few mites and prolonged contact is usually necessary for transmission. Some people and animals, particularly those that are immunosuppressed, carry extremely large numbers of mites and transmit them easily.

The length of time *S. scabiei* can survive in the environment, and the importance of fomites in transmission, is controversial. This mite is very sensitive to desiccation. Although some variants have been shown to survive outside the host, in an optimal environment, for up to 2 to 3 weeks, they may remain infective and able to burrow into the skin for only half to two thirds of that time. In a pig sty, *S. scabiei* var *suis* survives for less than 12 days at 7-18°C (45-64°F) and a relative humidity of 65-75%. In one study, pigs did not become infested if they were placed in pens vacated 24 hours earlier by pigs with acute scabies, but did become infested if the previous occupants had chronic hyperkeratotic scabies. Other estimates of the survival time for *S. scabiei* range from less than 24 hours to five days.

Notoedres cati is a burrowing mite with a life cycle similar to that of *Sarcoptes scabiei*. Notoedric mange is mainly transmitted by the nymphs and larvae, which move freely about the surface of the skin. *N. cati* may live for a few days off the host.

Psoroptidae and Cheyletiellidae

Members of the families Psoroptidae and Cheyletiellidae are non-burrowing mites. They remain on the surface

of the skin, and feed on skin scales or suck tissue fluids or blood. The zoonotic members of these families must complete their life cycle on the host, but can survive for a short period of time in the environment.

Cheyletiella spp. are non-burrowing mites that feed on keratinized skin cells and occasionally suck lymph. Their eggs are attached to the hair shafts by a web of threads. Females and eggs can survive in the environment for at least 10 days, and fomites are important in transmission. Nymphs, larvae and adult males die in approximately two days in the environment. In addition to being spread on objects such as leashes and grooming tools, *Cheyletiella* spp. can be transmitted on larger arthropods such as fleas, lice and flies.

Otodectes cynotis feeds on epidermal debris inside the ear. It can also survive in the environment for a period of time.

Macronyssidae

The Macronyssidae are non-burrowing mites. The three zoonotic species can survive for a period of time in the environment, and can be transmitted on fomites.

Ornithonyssus sylviarum spends its entire life on its avian hosts. The nymphs and adults feed on blood; the larvae, which molt into nymphs in approximately eight hours, do not feed. *O. sylviarum* can survive for up to 3 to 4 weeks in the environment.

The life cycle of *O. bursa* resembles that of *O. sylviarum*, but *O. bursa* lays some of its eggs in birds' nests. This species does not survive for more than 10 days in the environment. It is a common pest in the southern U.S., and can migrate into homes from abandoned nests, birdhouses or empty poultry facilities.

O. bacoti (also known as *Liponyssus bacoti*) lays its eggs in the burrows, nests and cages of rodents and small marsupials. It feeds on blood and drops off the host after each meal. *O. bacoti* adults can survive in the environment for up to two months. These mites can also invade homes if their rodent hosts are exterminated.

Dermanyssidae

The Dermanyssidae are non-burrowing mites. The two zoonotic species spend most of their time in the environment, and drop off the host after feeding.

Dermanyssus gallinae spends much of its life in the environment. It feeds on birds' blood and tissue fluids at night and hides in nearby cracks and crevices during the day. The eggs are laid in the environment. *D. gallinae* adults can survive in the environment for prolonged periods without feeding; poultry houses can remain infested for six months after all of the birds are removed.

The life cycle of *Liponyssoides sanguineus* is similar to that of *D. gallinae*. The adults can survive in the environment for up to two months.

Trombiculidae

Chiggers are parasitic only in their larval stage. The free-living nymphs and adults live on invertebrates (or their eggs) and decaying plant material. These mites lay their eggs on the ground or on low bushes or grass. The hatched larvae feed on the tissue juices of birds, reptiles, mammals or invertebrates, then drop to the ground to develop into nymphs. Humans and domestic animals can act as hosts for the larvae of some species.

Disinfection

A wide variety of insecticides and acaricides are used for disinfection. Bedding and other fomites should be washed in hot water and dried in a hot dryer.

Infections in Humans

Incubation Period

Scabies (sarcoptic mange) has a shorter incubation period if it is caused by zoonotic mites. The human sarcoptic mite, *Sarcoptes scabiei* var. *hominis*, causes pruritus only after an allergic reaction develops to the mite. The infestation is usually mild or asymptomatic for the first 2 to 6 weeks. In later infestations, the symptoms usually appear within 1 to 4 days. The incubation period for zoonotic scabies varies from less than 24 hours to four days. Chigger bites usually become symptomatic within 12 to 24 hours. The incubation periods for other mite infestations are not available.

Clinical Signs

Human (non-zoonotic) scabies

The most prominent symptom of human scabies (*Sarcoptes scabiei* var. *hominis*) is severe pruritus, particularly at night. The head and neck are usually spared, except in infants and young children. There may also be a papular rash, particularly on the shoulder blades, webbed spaces of the fingers, feet, belt line, scrotum, penis, breast, or the folds of the wrist, elbow or knee. Pink, red, tan or brown nodules, ranging in size from 2-20 mm, may also be seen. Burrows (thin, slightly elevated, pinkish-white or grayish-brown, 2-5 mm long straight or curved lines) are pathognomonic. A dot at one end of the burrow indicates the presence of a mite. Complications may include secondary bacterial infections.

A more severe form of scabies (Norwegian or crusted scabies) is found sometimes in immunocompromised persons, the elderly, and mentally incompetent individuals. In this form, there are large numbers of mites, discrete vesicles and extensive thick crusts on the skin, but pruritus may be slight or absent. Nail dystrophy and scalp lesions may also be seen.

Secondary lesions, the result of scratching, may include scratches, generalized eczematous dermatitis, erythroderma (generalized exfoliative dermatitis) and hyperpigmentation.

Zoonotic scabies

Zoonotic scabies is also highly pruritic but the lesions usually occur on the arms, chest, abdomen and thighs. In humans, the zoonotic varieties of *Sarcoptes scabiei* are generally believed to cause vesicles, papules and other symptoms of dermatitis, but not classic burrows. However, in one case, burrows caused by *S. scabiei* var. *canis* were found in the skin by histopathology. Zoonotic scabies is almost always self-limiting; the mites usually disappear within a few days, and the clinical signs resolve in 1 to 3 weeks unless the person becomes reinfested.

A few atypical cases have been documented. There is one report of Norwegian scabies in a child caused by *S. scabiei* var. *canis*. There is also an unusual case, thought to be caused by a canine scabies mite, where the lesions continued to spread for several weeks in a human after animal contact stopped. In this case, mites and their eggs (which were capable of hatching) were found on the person. It is possible that the mite was misidentified and this was actually a case of human scabies that had been transmitted to a dog, then back to a human.

Other acariases

Other mites can also cause transient dermatitis in humans. *Notoedres cati* causes typical scabies signs in humans. The infestation is self-limiting within several weeks. *Trixacarus caviae*, a parasite of guinea pigs, can cause pruritic skin lesions on the hands, arms or neck similar to scabies.

Cheyletiella spp. can cause a pruritic, mild dermatitis, mainly on the abdomen, chest, arms and legs. In long-term cases, the lesions may also be found on the face. The initial rash is usually macular, but may be followed by erythematous plaques, vesicles, papules, pustules or crusts. Central necrosis in older lesions is highly suggestive of cheyletiellosis, but is not always seen. Some lesions may resemble hives, erythema multiforme or herpes. Bullae have been reported in rare cases. The lesions are self-limiting within 3 to 6 weeks.

The bites of *Dermanyssus gallinae*, *Liponyssoides sanguineus*, *Ornithonyssus bacoti*, *O. sylviarum* and *O. bursa* can be painful or pruritic and may cause irritation and localized dermatitis. In some cases, the dermatitis can become severe and the area may remain swollen for days. Most of the mites cause papules, but vesicles, urticaria and hemorrhagic necrosis are also reported with *O. bursa*. *L. sanguineus* can transmit *Rickettsia kauri*, which causes human vesicular rickettsiosis (rickettsialpox).

Chiggers can cause severe dermatitis, followed by allergic reactions. The first symptom is usually a tiny red papule, with intense and painful pruritus. A wheal develops soon afterward, often with extravasation of blood. Excoriations from scratching, serous exudates and pustules may develop. Some of these bites can remain painful for a week or longer. Some species of chiggers can transmit scrub typhus.

Communicability

Human scabies is transmitted from person to person during close contact or on fomites. This disease can be highly contagious in some settings and in the Norwegian form.

The zoonotic mites do not reproduce on humans; however, some of these mites can survive for prolonged periods in the environment, and humans may act as fomites.

Diagnostic Tests

Human (non-zoonotic) scabies

Human scabies is usually diagnosed by the appearance of the rash and the presence of burrows. Burrows can be revealed by applying topical tetracycline, which is retained by the burrows and fluoresces under a Woods lamp. They can also be localized with ink. This disease can be confirmed by the demonstration of the mites, eggs or feces in a skin scraping (or by the removal of a mite from a burrow), under 40X magnification.

Zoonotic mites

Zoonotic scabies and other mite infestations are also diagnosed in humans by identifying the mites; however, finding any mites is often difficult. Transparent tape can be used to pick up mites from the skin. A diagnostic video system (Vetscope video system©, MedRx Inc) was used successfully in at least one case of human cheyletiellosis, when other diagnostic methods failed. An important diagnostic clue is the presence of mites on animals.

Dermanyssus gallinae and other avian and rodent mites sometimes appear as red dots on the skin when they are feeding, and may be visible in the environment. They can be found in homes by vacuuming the area and examining the dust by flotation (the mites will float to the surface).

Treatment

Human (non-zoonotic) scabies

Acaricides used to treat human scabies include topical lotions containing permethrin, lindane or crotamiton, as well as ivermectin. Pruritus can persist for 1 to 2 weeks after successful treatment. Oral antihistamines and topical antipruritics/ anesthetics can be used for the pruritus. Antibiotics may be necessary for secondary infections.

Zoonotic acariases

Human infestation with zoonotic mites requires only symptomatic therapy such as anti-pruritic or anti-inflammatory medications. Treatment of the affected animals and/or the environment will eliminate the infestation in human contacts.

Prevention

Zoonotic acariases can be prevented by treating the infested pets, livestock, fowl or laboratory animals. Gloves, boots and protective clothing can decrease the risk of transmission when handling affected animals. Insect repellents and protective clothing may be helpful in environments infested with poultry mites.

The mites from wild birds and rodents are best controlled by eliminating nests and roosting areas for birds near the home, and by controlling rodent pests. Insecticides and foggers can treat current infestations around the home.

Insect repellents can help prevent infestation by chiggers. Avoidance of forested and swampy areas, particularly during the late summer and early fall, will also reduce the risk of exposure.

Morbidity and Mortality

Human (non-zoonotic) scabies

Human scabies is most common in children under 15 years, sexually active persons, and debilitated or immunocompromised individuals. Before the discovery of antibiotics, secondary bacterial infections could result in serious or fatal sequelae including septicemia, glomerulonephritis and acute rheumatic fever. With modern medicines, scabies is unlikely to result in long-term morbidity or mortality in healthy people, but untreated infestations can last for weeks to years. Norwegian scabies may be impossible to fully eradicate in immunocompromised individuals.

Zoonotic acariases

Zoonotic mites do not reproduce on humans, and produce a self-limiting rash. The only morbidity is the temporary pruritus and discomfort, and infestations are not fatal.

Infections in Animals

Species Affected

Sarcoptidae

More than a hundred species of mammals and marsupials can be infested by *Sarcoptes scabiei*. Humans can be temporary hosts for the scabies mites of dogs, pigs, ferrets, cattle, goats, sheep, horses, water buffalo, camels, llamas and some wild or zoo animals (e.g. the Australian wombat). The hosts for *S. scabiei* subtypes include the following:

- *S. scabiei* var *hominis* causes scabies in humans.
- *S. scabiei* var. *canis* causes scabies in dogs. It can also infest other mammals, including cats, pigs, foxes, rabbits and guinea pigs, for varying periods of time.
- *S. scabiei* var. *suis* causes scabies in pigs. In one study, this variant could be transferred to dogs or rabbits only transiently.
- *S. scabiei* var *bovis* causes scabies in cattle.
- *S. scabiei* var. *equi* causes scabies in horses
- *S. scabiei* var *ovis* causes scabies in sheep. This parasite can also affect goats and camels.
- *S. scabiei* var *caprae* causes scabies in goats. This parasite can also affect cattle, sheep and dogs.

Notoedres cati causes notoedric mange (feline scabies) in members of the Felidae including domestic cats, lynxes,

cheetahs, leopards, ocelots and bobcats. It can also affect non-Felidae including dogs, rabbits, foxes, civets, rodents, bats, coatis, and raccoons. Humans are an aberrant host.

Trixacarus caviae is mainly found in guinea pigs but has been reported in humans.

Psoroptidae and Cheyletiellidae

Cheyletiella spp. have a predilection for certain hosts, but can readily infest other species. Humans are an aberrant host. *C. yasguri* is most often found on dogs but can affect cats that are in close contact with an infested dog. Rabbits have been infected experimentally. *C. blakei* is the predominant species in cats. *C. parasitovorax* causes cheyletiellosis in rabbits and cats.

Otodectes cynotis affects many species of carnivores including dogs, cats, ferrets, and wild animals. There are very few reports of human infestation.

Macronyssidae

Ornithonyssus bursa is found on birds including chickens, turkeys, ducks, pigeons, sparrows, starlings and myna birds. It will feed on mammals if birds are not available. *O. sylviarum* infests chickens, turkeys and many other birds. It can be found on mammals including rats, mice and humans, but reproduces only on birds.

O. bacoti is found on rodents and small marsupials including mice, rats and hamsters.

Dermanyssidae

Dermanyssus gallinae is found on birds including chickens, turkeys, pigeons and canaries. Dogs, cats and humans are accidental hosts. *Liponyssoides sanguineus* is normally a parasite of small rodents such as mice.

Trombiculidae

Chiggers can affect many species of mammals including humans, and birds.

Incubation Period

The incubation period for *S. scabiei* var *canis* in dogs is 10 days to 8 weeks. Pigs experimentally infected with *S. scabiei* var *suis* become symptomatic in 2 to 11 weeks. Most of the symptoms of sarcoptic mange are caused by allergic reactions to the parasite, and the incubation period is generally longer the first time an animal is infested.

In newborn guinea pigs infested with *Trixacarus caviae*, pruritus may become evident within 72 hours of birth and skin lesions within 3 to 4 weeks of birth. In mature guinea pigs, the symptoms develop in 10 to 50 days. The incubation periods for other mite infestations are unavailable.

Clinical Signs

Many of the symptoms of mite infestation are due to an allergic reaction to the parasites. Infestations may be more severe in debilitated or immunosuppressed hosts.

Sarcoptic mange (scabies)

The hallmark of sarcoptic mange is intense pruritus. The mites prefer relatively hairless parts of the body, and the initial lesions often occur in these locations. As the alopecia spreads, the rash often becomes generalized. Severe untreated cases can be fatal, particularly in wild-life; deaths are usually the result of secondary bacterial infections.

In dogs, the lesions are often found first on the ventral chest and abdomen. Other common locations are the ears, periorbital region, elbows and legs. The typical lesion is an intensely pruritic papular rash with thick yellowish crusts. Scratching and rubbing can lead to a variety of lesions, including erythema, ulcers, bleeding and hemorrhagic crusts. Peripheral lymphadenopathy can be seen and emaciation can occur in severe cases. Secondary bacterial infections are common. Asymptomatic carriers may exist.

Scabies incognito can be seen in meticulously groomed dogs. This form is characterized by constant pruritus but few or no lesions other than mild erythema and occasional excoriations.

In pigs with acute scabies, the lesions usually appear first on the head, particularly around the eyes, nose and ears. They quickly spread to the hind legs due to scratching and may become generalized. The affected skin is erythematous and inflamed, and may have macules, papules, scabs, erosions, abrasions, ulcers or cracks. It can eventually become roughened, wrinkled and thickened. The bristles are stiff and stand upright. The appetite may be depressed, and decreased growth and productivity have been reported. Secondary bacterial infections and myiasis can occur. In many pigs, the symptoms disappear within 12 to 18 weeks without treatment.

Pigs that recover from acute scabies can carry mites in the ears. These animals may be asymptomatic or they may have small hyperkeratotic, crusted lesions in the ear canal.

In chronically infested animals, the skin becomes thickened and crusty, with asbestos-like scabs, particularly around the eyes and on the ears, snout, hocks, pasterns, crutch and tail. Skin folds develop on the thickened skin, which loses its sheen and becomes discolored by a brownish-grey scruffiness. The hair may become long and curly in some animals and, in severe cases, there may be a foul odor. Some pigs become stunted and unthrifty. Pruritus is often less severe than in acute scabies, and mites are far more numerous.

In cattle, the lesions may start on the head and neck, or above the scrotum or udder and on the inner surface of the thighs. The lesions may include papules, crusts and alopecia, and the skin thickens and develops large folds. Pruritus is severe. In sheep, the lesions affect the non-woolly skin, and typically start on the head and face.

In horses, the earliest symptom is severe pruritus, particularly of the head, neck and shoulders. The initial lesions are papules and vesicles, which later form crusts. Alopecia, crusting and lichenification, with skin folds, are

seen as the infestation progresses. Although untreated infestations can spread to the rest of the body, parts of the body protected by long hair and the lower extremities are not usually affected. Emaciation, weakness and anorexia can be sequelae.

Notoedric mange (Feline scabies)

Notoedric mange is intensely pruritic, with the possible exception of infestations in bobcats, lynxes and ocelots. The lesions typically start on the pinna of the ear, and quickly spread to the face, eyelids, back of the neck, and paws. Perineal lesions are also common, as the result of the cat's habit of sleeping in a curled position. The initial papular rash may progress to erythema, areas of partial or complete alopecia, dense tightly adherent yellow-to-gray crusts, and thickened, wrinkled hyperkeratinized skin. The lymph nodes may be enlarged. Severe untreated cases can be fatal, particularly in wildlife.

Trixacarus caviae

T. caviae can cause alopecia, pruritus and severe dermatitis in guinea pigs. Commonly affected areas include the trunk, inner thighs, neck and shoulders. The skin in affected areas may be dry or oily, with yellow scales and crusts, and the hair is easily removed. Infertility, abortions, seizures and deaths have been reported. Some infestations can be asymptomatic, and may become clinical if the animal is stressed by pregnancy, transport or other factors.

Cheyletiellosis

Cheyletiellosis most often affects the back. In cats and dogs, the typical lesion is a dry, scaly dermatitis with dandruff. Pruritus is usually mild or moderate, but can be severe. In some cases, there may also be erythematous, excoriated lesions, hair loss or generalized lesions. Cats may develop miliary dermatitis. A form characterized by multiple areas of crusting, scabs and alopecia, which resembles a dermatophyte infection, has also been described. *C. yasguri* causes clinical signs mainly in puppies, but adult dogs can be asymptomatic carriers. Cats can also carry *Cheyletiella* spp. asymptotically.

Rabbits may be asymptomatic or there may be loose hair, which can be pulled out in clumps, and oily, scaly, erythematous, alopecic patches on the back and head. Dandruff is usually visible in the fur. *Cheyletiella parasitovorax* can serve as a vector for the rabbit myxoma virus.

Otodectes cynotis

Otodectes cynotis mainly causes a highly pruritic otitis externa, and is associated with thick reddish-brown crusts in the ear canals. Its activity can lead to secondary bacterial or fungal infection, or vestibular signs including torticollis. Cats can sometimes tolerate moderate numbers of mites without clinical signs. Occasionally, the infestation spreads to the skin, particularly the head and neck, base of the tail and paws. On the skin, *O. cynotis* causes a pruritic dermatitis with redness, scaling and crust formation.

Dermanyssus gallinae

In poultry, *D. gallinae* can result in anemia and lower productivity including decreased weight gain in young birds, reduced egg laying in hens and decreased reproductive potential in males. Restlessness, anemia, excess preening, pruritus and deaths have been reported in cage birds. This mite also carries *Borrelia anserina*, which causes fowl spirochetosis.

Infestations are rare in dogs and cats. The symptoms may include erythema, papules and crusts, especially on the head, back and legs. Red mites may be seen on the animal. The lesions are usually but not always intensely pruritic in mammals.

Ornithonyssus bursa* and *O. sylviarum

Ornithonyssus bursa and *O. sylviarum* result in blackened "dirty-looking" feathers, and may cause cracks and scabs around the cloaca. Productivity may be decreased. *O. bursa* can carry the Western equine encephalitis virus.

Ornithonyssus bacoti

In laboratory and pet rodents, *O. bacoti* can cause anemia, debility, weakness, decreased reproduction and deaths. Pruritus may be severe. This mite is a vector for murine typhus, Q fever and plague.

Trombiculidiasis (chiggers)

Chiggers are usually found on parts of the animal that have been in contact with the ground. The symptoms in dogs and cats are variable. The bites usually result in intensely pruritic papules, followed by alopecia, scales, crusts and scabs. In some cases, the rash may be non-pruritic. On horses, wheals may also be seen. The yellow, orange or red larvae may be visible in the lesions. Large numbers of trombiculid mites on birds may result in depression, anorexia, and deaths from starvation and exhaustion.

Communicability

All of the acariases are highly contagious for susceptible species. Close contact may be required if the mites are few and do not survive well in the environment (e.g. some forms of sarcoptic mange), but transmission occurs readily if large numbers of mites are present. Animals with sub-clinical infestations can also spread mites.

Post Mortem Lesions [Click to view images](#)

Mites are parasites of the skin, and the lesions seen at necropsy resemble those in live animals. Secondary bacterial infections or signs of wasting may be seen in severe infestations with the Sarcoptidae.

Diagnostic Tests

Acariasis is usually diagnosed by identifying the mites in skin scrapings or by other collection techniques; the mites are often found at the edges of the lesions. Living mites can be observed by warming them to 25-30°C (77-86°F), which stimulates them to move. Dead mites, and live mites from the smaller species, are more easily

found after 10% potassium hydroxide (KOH) digestion of the sample. A flotation technique can also be used to concentrate the mites. Mites can be identified under the microscope (40X) by their shape, size and morphology, using published illustrated keys. Lignin pink or chlorazol black staining can help to highlight parasite structures or identify mites that are embedded in the tissues. Some mites can be difficult to identify by non-specialists. Mites not readily identified using a dermatology textbook or other source can be submitted to the laboratory for identification by an entomologist.

Scrapings for sarcoptic or notoedric mange are taken from areas of alopecia, or where papules are seen. Scabies mites can be very difficult to find, and numerous scrapings may be necessary. *Notoedres cati* mites are more abundant than *Sarcoptes scabiei*.

Cheyletiella spp. can be found in dandruff and hair tufts, as well as in skin scrapings. The mites can be found by brushing the fur, combing it with a flea comb, collecting skin debris with a vacuum cleaner, plucking hairs, or by examination of the material that adheres to a piece of transparent adhesive tape.

Ear mites can be observed directly, using an otoscope.

Ornithonyssus bacoti, *O. sylviarum*, *Dermanyssus gallinae* and chiggers may be seen with the naked eye when they are engorged. *D. gallinae* is found in the environment during the day and on the birds at night. *O. sylviarum* mites are found on the eggs, or on the birds by parting the feathers in the vent region.

A vacuum cleaner technique has been used to collect *Cheyletiella* spp., *Sarcoptes scabiei* and other mites.

Other diagnostic techniques are also used occasionally. Mites or their eggs are sometimes found in the feces of pruritic animals, particularly cats, by fecal flotation. *Sarcoptes scabiei* and *Notoedres cati* can also be seen in skin biopsies by histopathology. An enzyme linked immunosorbent assay (ELISA), available in some countries, can diagnose sarcoptic mange by serology in some countries. Serology is also used in research.

Treatment

Mite infestations are treated with acaricides including lime sulfur, amitraz, phosmet, pyrethrins, coumaphos, malathion, rotenone or carbaryl. The animal may be bathed first with an antiseborrheic shampoo to remove crusts and debris. Ivermectin is used to treat some mites, and doramectin has been used for sarcoptic mange in pigs. Selamectin has recently been reported to be effective for sarcoptic mange and cheyletiellosis. Sarcoptic mange in cattle is a reportable disease in the U.S. and treatment is performed under official supervision.

Acaricide treatment is sometimes done in cases where acariasis is suspected, but mites cannot be found. This method is not foolproof, as treatment failures and relapses are possible. If the mites can survive for more than a few

days in the environment, the animal's surroundings must also be treated with an insecticide or acaricide.

Infestations with chiggers are self-limiting and are not always treated with acaricides. The pruritus can be controlled with glucocorticoids.

Prevention

Sarcoptes scabiei, *Notoedres cati* and *Trixacarus caviae* do not survive for long periods in the environment. Most often, these mites are introduced on infested animals and prevention relies on identifying and treating such carriers. Control of fomites may also be necessary.

Sarcoptic mange in cattle is subject to federal controls, including herd quarantine and restrictions on interstate movement from scabies-affected areas.

Herd control programs, with periodic maintenance treatment, are used to control sarcoptic mange in pigs. New additions should also be treated before allowing them to enter the herd. Eradication is possible with strict biosecurity, isolation of newly introduced animals for at least 3-4 weeks, and regular monitoring and treatment of the herd. Depopulation and restocking has also been used for eradication.

To prevent *T. caviae* infestations in guinea pigs, autoclaved, laboratory grade bedding should be used and should be changed regularly. Cages and other areas should be cleaned and rinsed with a dilute bleach solution.

Fomites are important in the transmission of mites such as *Cheyletiella* spp., *Otodectes cynotis*, *Ornithonyssus sylviarum*, *Ornithonyssus bursa*, *Ornithonyssus bacoti*, *Dermanyssus gallinae* and *Liponyssoides sanguineus*, which can survive for a longer period of time in the environment without feeding. Susceptible animals should not be allowed to contact infested animals or potential fomites that have not been decontaminated. Sanitation and treatment of the environment with acaricides may also be important in prevention.

Heavy *Dermanyssus gallinae* and *Ornithonyssus sylviarum* infestations are prevented by buying mite-free birds, and by sanitation. Routine flea control usually works as a preventative for cheyletiellosis.

Chiggers are acquired from the environment. Insect repellents may help prevent infestations by chiggers. Avoidance of forested and swampy areas, particularly during the late summer and early fall, will also reduce the risk of exposure. These mites can be controlled on free range birds by keeping grass cut short and by dusting with sulfur or malathion.

Morbidity and Mortality

Sarcoptidae

Sarcoptic and notoedric mange can occur as sporadic cases or as epidemics, particularly in social animals. In addition to domestic animals such as pigs, epidemics have been reported in wild foxes, coyotes, wolves and lions. Asymptomatic carriers also exist.

Sarcoptic mange is a common condition in pigs. From 20-95% of swine and 70-90% of swine herds are affected worldwide. In the U.S., 43% of the pigs examined in packing plants in 1998 were infested with *S. scabiei* var *suis*. These mites are mainly introduced into herds in infested animals. In pigs, the prevalence of sarcoptic mange increases in the winter. In many pigs, the symptoms disappear within 12 to 18 weeks without treatment. Chronic scabies can affect up to 15% of infested pigs.

All ages of dogs are susceptible to sarcoptic mange. In this species, untreated sarcoptic mange may last for weeks to years. Notoedric mange is rare to infrequent in domestic cats. It does not have a predilection for cats of any age, sex or breed.

Sarcoptic and notoedric mange cause little morbidity when they are localized to small areas, but widespread lesions can result in emaciation, weakness and secondary bacterial infections, which may be fatal. Fatal infestations are mainly seen in wild animals. Sarcoptic mange may have played a role in the decrease in the lynx population in Sweden in the 1980s. Fatal infestations with *Trixacarus caviae* have also been reported in guinea pigs.

Psoroptidae and Cheyletiellidae

Cheyletiellosis and ear mites usually cause only morbidity; deaths are not seen. Young animals tend to be more severely infested with *Cheyletiella* spp., while adult dogs and cats often have light infestations. *Otodectes cynotis* is particularly common in kittens. Some cats may be able to tolerate small colonies without symptoms.

Macronyssidae and Dermanyssidae

Dermanyssus gallinae and *Ornithonyssus bursa* are mainly a problem on small rural poultry farms and in breeder flocks. They are uncommon in commercial poultry layer operations where the birds are raised in cages. *O. sylviarum*, which completes its life cycle on the birds, is more common on modern poultry farms and is an important parasite of poultry in the U.S. These mites may all lower productivity in poultry. Deaths have been reported in cage birds parasitized by *D. gallinae*. Debility and deaths have also been reported in laboratory and pet rodents infested by *O. bacoti*.

Trombiculidae

In most mammalian species, chiggers result in temporary pruritus and dermatitis, but deaths are not seen. In birds, large numbers of chiggers can cause death from starvation and exhaustion.

Internet Resources

- Bornstein S. Sarcoptic Mange in Pigs.
<http://www.animalscience.com/pdfs/reviews/PNIra194.pdf>
- Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/ncidod/dpd/parasites/scabies/default.htm>
- International Veterinary Information Service (IVIS)
<http://www.ivis.org>

- OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals
http://www.oie.int/eng/normes/mmanual/a_summry.htm
- Purdue University Cooperative Extension Service.
Control of Swine Pests.
<http://www.entm.purdue.edu/Entomology/ext/targets/e-series/EseriesPDF/E-9.pdf>
- The Merck Manual
<http://www.merck.com/pubs/mmanual/>
- The Merck Veterinary Manual
<http://www.merckvetmanual.com/mvm/index.jsp>
- World Organization for Animal Health (OIE)
<http://www.oie.int/>

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