

Screwworm Myiasis

Last Full Review: December 2012

Minor Updates: January 2016

Importance

Screwworms are fly larvae (maggots) that feed on living flesh. These parasites infest all mammals and, rarely, birds. Two different species of flies cause screwworm myiasis: New World screwworms (*Cochliomyia hominivorax*) occur in the Western Hemisphere, and Old World screwworms (*Chrysomya bezziana*) are found in the Eastern Hemisphere. However, the climatic requirements for these two species are similar, and they could become established in either hemisphere. New World and Old World screwworms have adapted to fill the same niche, and their life cycles are nearly identical. Female flies lay their eggs at the edges of wounds or on mucous membranes. When they hatch, the larvae enter the body, grow and feed, progressively enlarging the wound. Eventually, they drop to the ground to pupate and develop into adults. Screwworms can enter wounds as small as a tick bite. Left untreated, infestations can be fatal. Screwworms have been eradicated from some parts of the world, including the southern United States, Mexico and Central America, but infested animals are occasionally imported into screwworm-free countries. These infestations must be recognized and treated promptly; if the larvae are allowed to leave the wound, they can introduce these parasites into the area.

Etiology

New World screwworm myiasis is caused by the larvae of *Cochliomyia hominivorax* (Coquerel). Old World screwworm myiasis is caused by the larvae of *Chrysomya bezziana* (Villeneuve). Both species are members of the subfamily Chrysomyinae in the family Calliphoridae (blowflies).

Species Affected

All warm-blooded animals can be infested by screwworms; however, these parasites are common in mammals and rare in birds.

Zoonotic potential

Humans can be hosts for screwworm larvae.

Geographic Distribution

Screwworms are very susceptible to freezing temperatures or long periods of near-freezing temperatures. These organisms are seasonal in some areas, and can spread into colder climates during the summer. The ideal environmental conditions for survival and activity are temperatures of 25-30°C and relative humidity of 30-70%.

New World screwworms are found only in the Western Hemisphere, primarily in the tropical and semitropical regions of South America and the Caribbean. They are rare above 7,000 feet. Eradication programs have eliminated these parasites from the North and Central America, Puerto Rico, the Virgin Islands, and Curacao. A sterile fly release program (see Prevention) is maintained at the Darien Gap, between Panama and Colombia, to prevent screwworms from spreading north from South America. However, screwworms occasionally pass this barrier and are detected in Panama. An eradication program is ongoing in Jamaica. New World screwworms were detected in Libya in 1988, but have since been eradicated.

C. bezziana, the Old World screwworm, can be found in parts of Asia, much of tropical and sub-Saharan Africa and some countries in the Middle East. Old World screwworms have never become permanently established in Europe, Australia, New Zealand or the Western Hemisphere.

Occasional cases or outbreaks are reported in screwworm-free countries.

Transmission

Although they are members of different genera, New World and Old World screwworms fill the same parasitic niche and have nearly identical life cycles. Screwworm larvae are obligate parasites of live animals. Infestations are transmitted when a female fly lays her eggs on a superficial wound or mucous membrane. Occasionally, Old World screwworms also lay their eggs on unbroken soft skin, particularly if it has blood or mucous on its surface. The larvae hatch and burrow into the flesh, where they feed on living tissues and fluids. Wounds infested by



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screwworms often attract other female screwworms, and multiple infestations are common. After feeding through two molts (5- 7 days), the larvae leave the wound and fall to the ground, then burrow into the soil to pupate. The adults that emerge feed on wound fluids and mate after 3 to 5 days. Female flies mate usually only once, but can lay more than one batch of eggs at intervals of a few days. New World screwworms usually deposit two masses of eggs, but are capable of laying 6-8 batches or more. The length of the life cycle varies with the temperature. At the high temperatures that occur in the tropics, it may be completed in less than three weeks; at low temperatures, maturation can take up to 2-3 months. Freezing or a soil temperature consistently below 8°C (46°F) will destroy the pupae. The lifespan of a male fly is up to 14 days; 10 days is common for a female, but some female flies may live up to 30 days or more.

Female screwworms are attracted to all warm-blooded animals. A fly may travel up to 10-20 km in tropical environments with a high density of animals (though 3 km is more usual). In arid environments, flies can travel 20-25 km in search of a new host, and journeys up to nearly 300 km have been documented. Flies tend to travel along river valleys and other bodies of water in dry regions.

Incubation Period

Screwworm larvae emerge from the eggs in 12 to 24 hours, but they are difficult to detect in wounds for the first day or two.

Clinical Signs

Screwworms can infest a wide variety of wounds, from tick bites to cuts and dehorning or branding wounds.. Infestations are very common in the navels of newborns, and the vulval and perineal regions of their dams. If a screwworm deposits its eggs on mucous membranes, the larvae may enter any orifice including the nostrils, sinuses, mouth, orbits of the eye, ears or genitalia.

In the first day or two, screwworm infestations are difficult to detect. Often, all that can be seen is slight motion inside the wound. As the larvae feed, the wound gradually enlarges and deepens. Infested wounds often have a serosanguineous discharge and sometimes a distinctive odor. By the third day, the larvae may be easily found; as many as 200 vertically oriented parasites can be packed deep inside the wound. Screwworm larvae do not generally crawl on the surface, and tend to burrow deeper when disturbed. Sometimes, there may be large pockets of larvae with only small openings in the skin. Screwworms may be particularly difficult to find inside the nasal, anal, preputial and vaginal openings. In dogs, the larvae often tunnel under the skin. Larvae from other species of flies, which feed on dead and decaying tissues, may also infest the wound. These larvae are often found more superficially than screwworm larvae. Secondary bacterial contamination is also common.

Infested animals usually separate from the herd and lie down in shady areas. Fawns with screwworms in their navels may stand in water up to their abdomen. Discomfort, decreased appetite, and lower milk production are common. Untreated animals may die in 7 to 14 days from toxicity or secondary infections. Because repeated infestations can occur, up to 3,000 larvae have been found in a single wound.

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

Screwworms may be found post-mortem in any wound.

Diagnostic Tests

Laboratory diagnosis is by identification of the parasites under the microscope. Any eggs on the edge of the wound should be carefully removed with a scalpel. The samples of eggs, larvae, or flies should be placed in 70% alcohol (not formalin) and transported to the laboratory. New World screwworm eggs are creamy and white, and are deposited in a shingle-like array on or near the edges of superficial wounds. The egg masses of Old World screwworms are similar but larger. The eggs from other species of flies are usually not well organized.

Larvae should be collected from the deepest parts of the wound; more superficial larvae may be other parasites and not screwworms. The second and third instar larvae of screwworms resemble a wood screw. They are cylindrical, with one pointed end and one blunt end, and have complete rings of dark brown spines around the body. Younger larvae are creamy white, while fully mature third-stage larvae may have a reddish-pink tinge. In third-stage *C. hominivorax* larvae, dark tracheal tubes can be found on the dorsum of the posterior end. Field diagnosis of screwworm larvae, even with a microscope or magnifying glass, is difficult.

Female screwworm flies are larger than a housefly. The thorax of a New World screwworm is metallic dark blue to blue-green and the head is reddish-orange. On the back of the thorax, there are three longitudinal dark stripes. The Old World screwworm is metallic blue, bluish-purple or blue-green, with two transverse stripes on the thorax. Adult screwworms are uncommonly seen. They are also difficult to distinguish from other flies.

Other techniques used mainly in research laboratories include cuticular hydrocarbon analysis, analysis of mitochondrial DNA, and random amplified polymorphic DNA polymerase chain reaction (RAPD-PCR) assays. Serology is not used.

Treatment

Screwworm infestations can be treated in both endemic and non-endemic regions; euthanasia of the animal is not usually required. Although some wounds may be surgically excised, most are treated with a suitable larvicide and allowed to heal without closure. Treatment is usually repeated at intervals until the wound has healed. Removal of necrotic tissue may be necessary, and antibiotics may be given when secondary bacterial contamination is present. In

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non-endemic regions, the animal is quarantined until treatment is complete and the wound has healed. Treatment of the environment may also be necessary. Larvae that are removed from the wound must be placed in alcohol preservative or destroyed. If any larvae leave an infested wound and mature into adults, screwworms can become established in an area.

Control

Disease reporting

Veterinarians who encounter or suspect screwworms should follow their national and/or local guidelines for disease reporting. In the U.S., screwworm infestations should be reported to state or federal authorities immediately upon diagnosis or suspicion of the disease.

Prevention

Screwworms can enter non-endemic areas in infested animals or as adult flies. Vehicles that may contain adults or immature screwworms should be sprayed with insecticides. Imported animals (including pets) must be inspected for infestations, and treated if necessary, before they are allowed to enter. As a precaution, wounds that do not appear to be infested may be treated with an insecticide. Animals may also be sprayed or dipped. Any infestations that become apparent after an animal enters the country must be treated promptly.

In endemic areas, animals must be inspected for screwworms every few days. Livestock can also be protected by regular spraying or dipping with insecticides, or by subcutaneous injections of ivermectin and related compounds. Insect growth regulators have also shown good results. Organophosphate insecticides are effective against newly hatched larvae, immature forms and adult flies. Other insecticides, such as carbamates and pyrethroids have also been used. Acaricide resistance can be an issue. In areas where screwworms are seasonal, breeding can be scheduled to avoid births when these flies are numerous. Whenever possible, procedures that leave wounds should not be performed during screwworm season, and sharp objects should be removed from livestock pens. No vaccine is available.

Screwworms can be eradicated from a region by repeatedly releasing sterile male flies that mate with wild female screwworms to produce unfertilized eggs. (Because it is usually impractical to separate irradiated male and female flies, both males and females are usually released.) This technique leads to a reduction in screwworm numbers and eventually results in eradication. In addition, infested animals are treated and their movements are controlled.

Morbidity and Mortality

The morbidity from screwworms varies, but it can be very high when the ecological conditions are favorable. In some areas, screwworms may infest the navel of nearly every newborn animal. A single deposition of eggs, or a

treated infestation, is not usually fatal; however, deaths may occur in smaller animals or from secondary infections. Untreated wounds usually develop multiple infestations and may be fatal within 7 to 10 days. Deaths seem to be more common with New World than Old World screwworms. In the 1950s, when screwworms were still endemic in south Texas, the annual mortality rate in fawns on one ranch varied from 20% to 80%.

Public Health

Humans can be affected similarly to animals. The disease can quickly become debilitating if it affects the eyes, mouth, nasal or frontal sinuses, or the ears.

Internet Resources

The Merck Veterinary Manual.

<http://www.merckvetmanual.com/mvm/index.html>

World Organization for Animal Health (OIE)

<http://www.oie.int>

OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals

<http://www.oie.int/international-standard-setting/terrestrial-manual/access-online/>

OIE Terrestrial Animal Health Code

<http://www.oie.int/international-standard-setting/terrestrial-code/access-online/>

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*Link defunct as of 2012