

# Screwworm Myiasis

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## 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, 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.

## 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.

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. These parasites were once widespread, but eradication programs have eliminated them from the United States, Mexico, Puerto Rico, the Virgin Islands, Curacao and all of Central America. Screwworms were last reported in Panama in 2005. 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 Southeast Asia, the Indian subcontinent, much of tropical and sub-Saharan Africa and some countries in the Middle East. The situation is changeable in the Middle East; while Kuwait reported its last case in 1998, infestations have recently occurred in Iraq and Iran. Old World screwworms have never become established in Europe, Australia, New Zealand or the Western Hemisphere.

Occasional cases or outbreaks of screwworm 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 screwworms often attract other female screwworms, and multiple infestations are

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common. After feeding through two molts (5 to 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 three to five days. Female flies mate only once, but lay several batches of eggs at intervals of a few days. 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 to 3 months. Freezing or a soil temperature consistently below 8°C (46°F) will destroy the pupae. The lifespan of a male fly is approximately 14 days; 30 days is common for a female.

Female screwworms are attracted to all warm-blooded animals. A fly may travel up to 10-20 km (6.2-12.4 miles) in tropical environments with a high density of animals, or as far as 300 km (186 miles) in arid environments.

## 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 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. 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.

## 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 seven to 10 days. Deaths seem to be more common with New World than Old World screwworms. In the 1950s, when screwworm was still endemic in south Texas, the annual mortality rate in fawns varied from 20% to 80%.

## Diagnosis

### Clinical

Screwworm myiasis should be suspected in animals that have draining or enlarging wounds with symptoms of infestation. 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.

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 difficult to distinguish from other flies.

### Differential diagnosis

The differential diagnosis includes all other blowfly larvae that may infest wounds.

### Laboratory tests

Laboratory diagnosis is by identification of the parasites under the microscope. Other techniques used mainly in research laboratories include cuticular

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hydrocarbon analysis, analysis of mitochondrial DNA, and random amplified polymorphic DNA polymerase chain reaction (RAPD-PCR) assays. Serology is not used.

## Samples to collect

**Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease. Screwworms can infest humans; samples should be collected and handled with all appropriate precautions.**

Larvae should be removed from the wound with tweezers before the wound is treated. The larvae should be collected from the deepest parts of the wound; more superficial larvae may be other parasites and not screwworms. 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 80% ethanol and transported to the laboratory. Formalin should not be used.

## Recommended actions if screwworm is suspected

### Notification of authorities

Screwworm infestations should be reported to state or federal authorities immediately upon diagnosis or suspicion of the disease.

#### **Federal: Area Veterinarians in Charge (AVIC):**

[www.aphis.usda.gov/animal\\_health/area\\_offices.htm](http://www.aphis.usda.gov/animal_health/area_offices.htm)

#### **State Veterinarians:**

[www.aphis.usda.gov/vs/sregs/official.html](http://www.aphis.usda.gov/vs/sregs/official.html)

## Control

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 are 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. Organophosphate insecticides are effective against newly hatched larvae, immature forms and adult flies. Carbamates and pyrethroids may also be used. 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.

Screwworm infestations are treated in both endemic and non-endemic regions; the animal is not euthanized. Although some wounds may be surgically excised, most are treated with a suitable larvacide 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 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, screwworm can become established in an area.

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.

## Public Health

Humans can be hosts for screwworm larvae.

## Internet Resources

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The Merck Veterinary Manual.

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

United States Animal Health Association.

Foreign Animal Diseases

[http://www.vet.uga.edu/vpp/gray\\_book02/fad/index.php](http://www.vet.uga.edu/vpp/gray_book02/fad/index.php)

World Organization for Animal Health (OIE)

<http://www.oie.int>

OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals

[http://www.oie.int/eng/normes/mmanual/a\\_summry.htm](http://www.oie.int/eng/normes/mmanual/a_summry.htm)

OIE Terrestrial Animal Health Code

[http://www.oie.int/eng/normes/mcode/A\\_summry.htm](http://www.oie.int/eng/normes/mcode/A_summry.htm)

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