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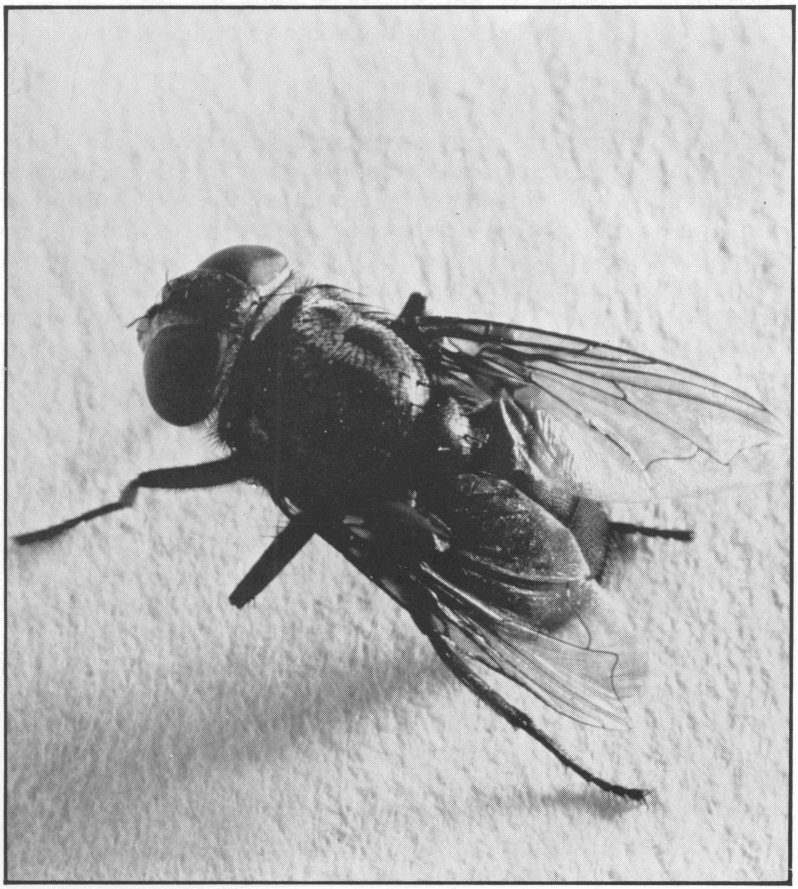

Texas Agricultural Extension Service, The Texas A&M University System,
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New Advances Against The Screwworm

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The screwworm is the maggot of a species of blow fly which can infest the living flesh of most wild and domestic, warm-blooded animals. New advances made in the screwworm eradication program have almost eliminated this pest from Texas.

History

It is not known when the screwworm fly and its flesh-eating maggot arrived in North America. The ancient Aztecs of Mexico were probably subject to ravages of this pest. The Spanish conqueror Cortez brought domestic livestock into what is now Mexico during the early 1500s. The livestock were transported steadily northward by expeditions of Spanish explorers. If screwworms were not already in Texas, they were introduced by the domestic Spanish herds. From the 1500s to the 1700s livestock numbers increased throughout New Spain (Mexico) and its Texas territory. By the middle 1700s the Spanish missions south of San Antonio had thousands of head of cattle, milk cows, horses, mules, oxen, goats and sheep.

The mission herds were greatly reduced by 1800, partly because of screwworms. By 1825 cavalry horses were reportedly killed by maggots as far north as Missouri. Screwworm infestations were found in humans near the present site of Austin, Texas in 1833. Reports of screwworms in southwestern livestock increased rapidly during the 1860s and '70s, the period of the great cattle drives to Kansas railroads. The name screwworm was coined during this era and became a common term to cattle, sheep, goat and hog producers. The screwworm constantly threatened livestock producers until the U. S. Department of Agriculture began the Southwest Screwworm Eradication Program in 1962. Since then, cases have been reported annually for Texas and the United States.

During the 9-year period from 1963 through 1971, a total of 17,591 cases were recorded in Texas. This represents 35 percent as many

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Year	Screwworm Cases Reported	Year	Screwworm Cases Reported
1962	49,484	1972	90,980
1963	4,916	1973	8,913
1964	226	1974	6,902
1965	446	1975	16,764
1966	1,203	1976	29,241
1967	835	1977	39
1968	9,268	1978	1,236
1969	161	1979	32
1970	92	1980	2
1971	444		

Table 1. Number of screwworm cases reported in Texas annually since the eradication program began in 1962.

cases as occurred in 1962 alone. In 1972 and 1976, major outbreaks occurred. Eradication officials attributed these rapid and serious outbreaks to large adult fly populations surviving the winters. Moisture and temperature conditions in the winter and spring of 1972 and 1976 allowed flies to survive far north of their usual overwintering range, causing wide-spread outbreaks in Northern Mexico and the Southwest. Heavy screwworm populations in Northern Mexico spread northward and overwhelmed the intensive sterile fly eradication efforts in the U.S. during these two years. These outbreaks could have been worse without the massive efforts of the eradication program. Weather conditions, new strains of sterile flies, improved monitoring techniques, effective insecticide bait systems and expanded joint efforts with Mexico have made the program highly successful since 1976.

Economics

According to a livestock producer survey conducted in 1977 by the Texas Agricultural Extension Service (TAEX) and the Southwest Screwworm Eradication Laboratory, $113.7 million to $150.5 million were lost because of screwworms during the 1976 outbreak in Texas.

Considering only marketable meat products in the categories of death loss, loss of weight before marketing and dockage at the market, $78.7 million to $104.3 million direct input into the economy was lost during 1976. Based on the economic output multiplier of 3.596, the impact of screwworms on the Texas

Expense	TAEX Estimate	Screwworm Lab Estimate
	(Million Dollars)	
Death loss	$ 47.7	$ 63.1
Extra labor	15.4	20.3
Medication and insecticide	7.3	9.6
Vehicle and fuel	11.2	14.9
Horse and feed	1.1	1.9
Loss of weight before marketing	11.5	15.3
Loss at marketing	19.5	25.9
TOTAL	$113.7	$151.0

Table 2. Total costs of screwworm to Texas livestock producers in 1976.

economy ranged from $283 million to $375 million for that year alone. Since 1962, the eradication program has saved livestock producers more than $1 billion in losses.

Identification

The screwworm fly is approximately twice the size of the housefly. It is bluish-green with three dark lengthwise stripes on its back. Full-grown larvae are about 3/4-inch long and have circular rows of spines that surround each segment of the worm. This gives them the screwlike appearance from which their common name is derived. The tapered head of the worm contains a pair of dark or black mouth hooks. The tail is flat and has two dark plates with openings for breathing tubes. The tails of the screwworms are usually exposed in a wound.

The screwworm can be distinguished from other blow fly larvae by two dark, longitudinal internal breathing tubes extending to the air plates on its tail. These tubes are not visible in other blow fly larvae which may feed on dead flesh in or around a wound. Screwworms have a pinkish tinge when they have completed feeding and are ready to leave the wound. Most common blow fly maggots are white, yellow or gray.

For accurate confirmation of a screwworm case, collect maggots for microscopic examination by a specialist. Collection kits are available from county Extension agents, veterinarians, livestock inspectors, livestock auction barns and screwworm program officials. Maggots should be collected from the center of the wound and submitted to the *Screwworm Eradication Laboratory, P.O. Box 969, Mission, Texas 78572.*

Life Cycle

The screwworm has four developmental stages: egg, larva (maggot), pupa and adult fly. The mated female can produce as many as 3,000 eggs, which she deposits on wounds in masses of 200 to 400 during her 2 to 4 week lifetime (Figure 1). The eggs hatch into maggots within 12 to 24 hours, enter the wound and feed on flesh for 5 to 7 days (Figure 2). When full grown, the larvae drop from the

Figure 1. Screwworm wound with newly deposited eggs.

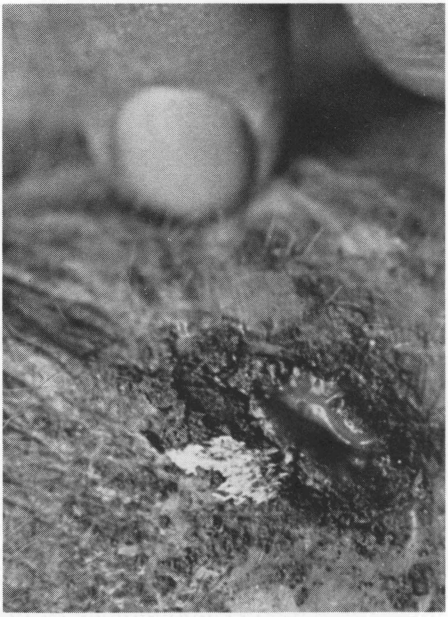
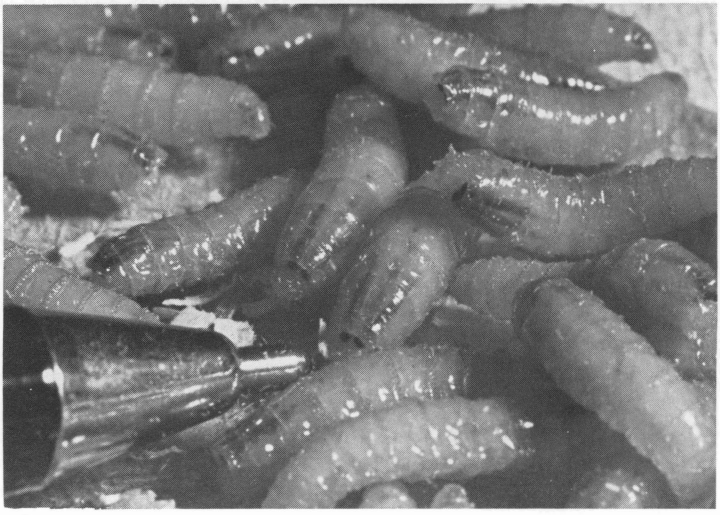
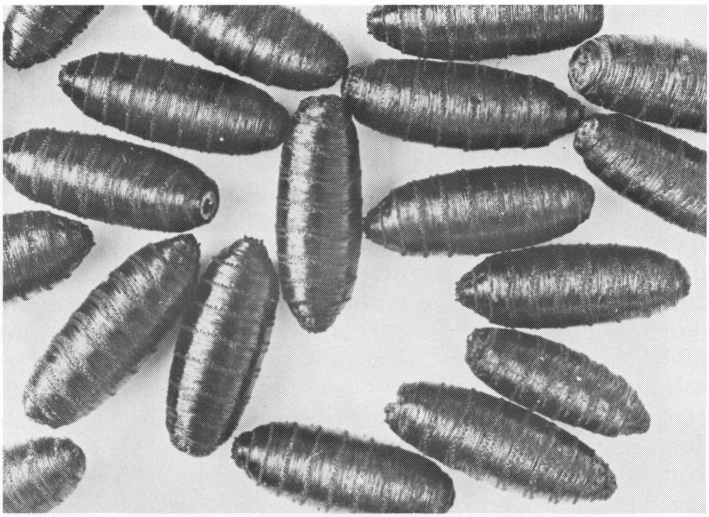


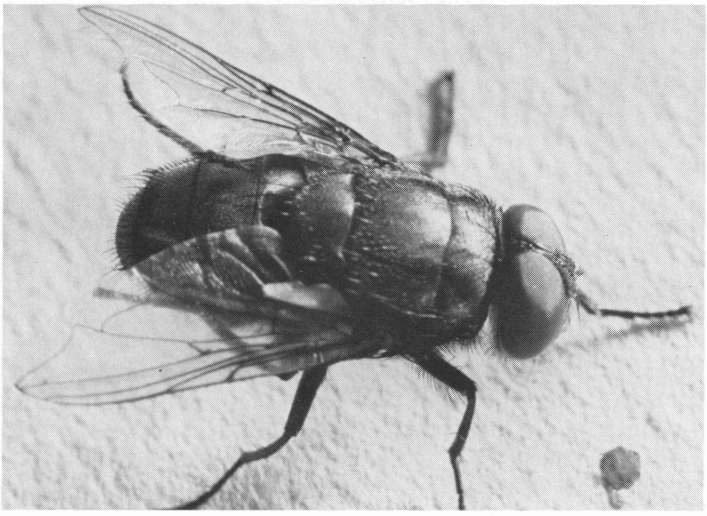
Figure 2. Mature screwworm larvae.



wound to the soil, where they pupate 1/2 to 1 inch below the surface (Figure 3). Under certain conditions, adult flies emerge from the pupae in 7 to 10 days and crawl to the soil surface. For the first few days adults feed on the liquids of manure, exudate from wounds and plant nectar (Figure 4). Females usually mate only once, ordinarily by the second day after they emerge from the pupal case. Five- to six-day old, mated females seek wounded animals onto which they deposit their egg masses. The life cycle may be completed in approximately 21 days.

Figures 3 and 4. Pupal and adult stages of the screwworm.





Damage

The screwworms feed with their tapered heads deep in a wound with the blunt ends exposed for breathing. They continually tear flesh with the mouth hooks and rasp living tissue with their spines. Deep wounds, which exude a brownish, bloody discharge are gouged out of the animal. The screwworms may feed so deeply in the wound that only close observation discloses their blunt tails projecting just above the surface of the bloody discharge. The blood and foul smell attract additional flies, which deposit more eggs on or near the wound. Consequently, thousands of maggots may infest a single wound which, if untreated, could kill the animal.

The Eradication Program

Since 1962, the U.S. Department of Agriculture near Mission, Texas, has produced and mass-released sterile screwworm flies. Because the native females usually mate only once, matings with sterile males leads to extinction since the eggs laid by the females do not hatch. When native fly populations are at low densities, chances for sterile matings are *high*. When native populations are high, chances for such matings are greatly *reduced*.

Approximately 200 million screwworm flies per week have been produced during the screwworm seasons at the Mission laboratory. Maggots are produced in large rearing trays containing a synthetic medium of dried blood, dried non-fat milk, dried whole egg, formalin and water suspended in cellulose acetate base. Larvae are collected at the end of the rearing period and allowed to pupate in sawdust. Pupae are then collected and exposed to sterilizing doses of atomic radiation from a Cesium 137 source. Pupae are then packaged in cartons and stored until the sterile adult flies are about to emerge. The cartons are distributed by air at carefully calculated rates over predetermined release sites where barriers are to be established or infestations have been reported. If the native fly population is low, a major outbreak usually can be stopped quickly. If the native population is high, as occurred in 1972 and 1976, elimination of screwworms through sterile male releases alone is almost impossible.

Early in the eradication program, scientists recognized the need for releasing a hardy, competitive, high quality, strain of sterile fly. Since 1962, the fly strain in the rearing facility has been changed approximately 10 times to achieve this.

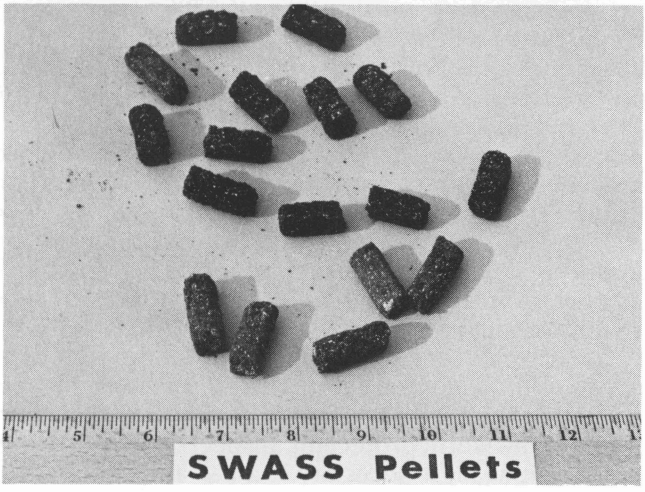
Surveillance or monitoring for native and sterile adult flies is an integral part of the eradication effort. Originally, fly traps were baited with rotting liver to attract adult flies, allowing eradication personnel to detect early native flies for studies. Liver attracted many other types of blow flies which often made analysis difficult.

In 1975, Swormlure® was developed as a specific attractant for the screwworm monitoring traps. Later, Swormlure II® was

developed which was more exclusive in attracting the screwworm fly. This is a chemical mixture similar to the breakdown or decay products found in a screwworm wound. Wind-oriented adult traps baited with Swormlure II® and located at strategic points along the Rio Grande River on both U.S. and Mexican soil serve as an early detection system for screwworm infestation in Texas and the southwestern United States. Figure 5 illustrates a typical wind-oriented trap on location.

SWASS (an acronym for Screwworm Adult Suppression System) is an attractant, bait and insecticide control system used in combination with sterile fly releases (See Figure 6). Corn cob grits,

Figures 5 and 6. Bait station to monitor screwworm activity and SWASS pellets used to attract and kill adult screwworm flies.



sugar, dried blood, Swormlure II®, wax and DDVP (dichlorvos) technical insecticide are mixed and compressed into pellets using a feed pelletizer. The pellets are released by airplane at a rate of 1 lb. per square mile using a 1-mile swath width to areas where cases have been confirmed or where native female flies have been captured in Swormlure II® baited traps. Sterile male release and SWASS are compatible and are used in the same areas since four times as many females as males flies are attracted to the deadly SWASS pellets. This allows the sterile male release to be more efficient by reducing the density of wild female flies.

When the Southwest Screwworm Eradication Program was initiated, it included plans for a barrier of sterile flies along the 1800 mile border between the United States and Mexico. Mexico is a vast overwintering area for the adult screwworm fly and massive build-ups occur in some years, hampering control. It soon became apparent that for complete eradication of the fly, closer and more extensive cooperation with the Mexican government was necessary. The United States and Mexico signed an agreement in 1972 to initiate the eradication of the screwworm fly from Northern Mexico and ultimately establish a barrier at the Isthmus of Tehuantepec in southern Mexico. The cooperative program began in 1975 with the opening of a mass fly rearing facility at Tuxtla, Guiterrez, Chiapas, Mexico. This "fly factory" produces approximately 300 million flies per week and has the capacity to rear up to 600 million per week. The production of sterile screwworm flies has been shifted to this facility as the Mission rearing facility is being phased out.

Prevention

Refer to Extension publication B-1306 *Suggestions for Controlling External Parasites of Livestock and Poultry* for information about the following control measures. Contact your local county Extension agent or area Extension entomologist for a copy of the publication or for more information.

Inspect animals regularly for wounds. If worm-infested wounds are found, collect maggots from the center of the wound and mail immediately to: Screwworm Eradication Laboratory, Box 969, Mission, Texas, 78572. Eradication officials must know the location and number of screwworm cases to properly plan sterile fly and SWASS pellet drops. Treat all wounds and navels of newborn animals with protective materials.

Postpone animal surgery (castration, dehorning, branding, docking, etc.) until cold weather when screwworms become inactive. If surgery must be performed during warm weather, treat wounds with screwworm protectant. Inspect daily until completely healed and treat again if necessary.

Inspect and spray animals before shipping to protect against spreading infestations.

Check incoming livestock for wounds and infestations. Treat and observe all wounds until healed.

Guard against Gulf Coast tick-screwworm complex. Gulf Coast tick populations often become heavy in brush country and attack the ears of livestock. After attachment, female ticks cause messy feeding wounds in which screwworms may establish. Insecticide-impregnated ear tags are available to prevent certain tick infestations. Various dips, sprays, dusts and aerosols are available to treat tick and screwworm infested ears.

Prevent livestock injuries. Sharp objects, such as protuding nails in loading chutes, bolts and steel in trailers should be eliminated to prevent animal injury.

Support the eradication program. Practice good livestock management. Inspect your herds and encourage your neighbors to do the same. Your support and cooperation will help keep screwworms out of Texas.

Acknowledgments

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