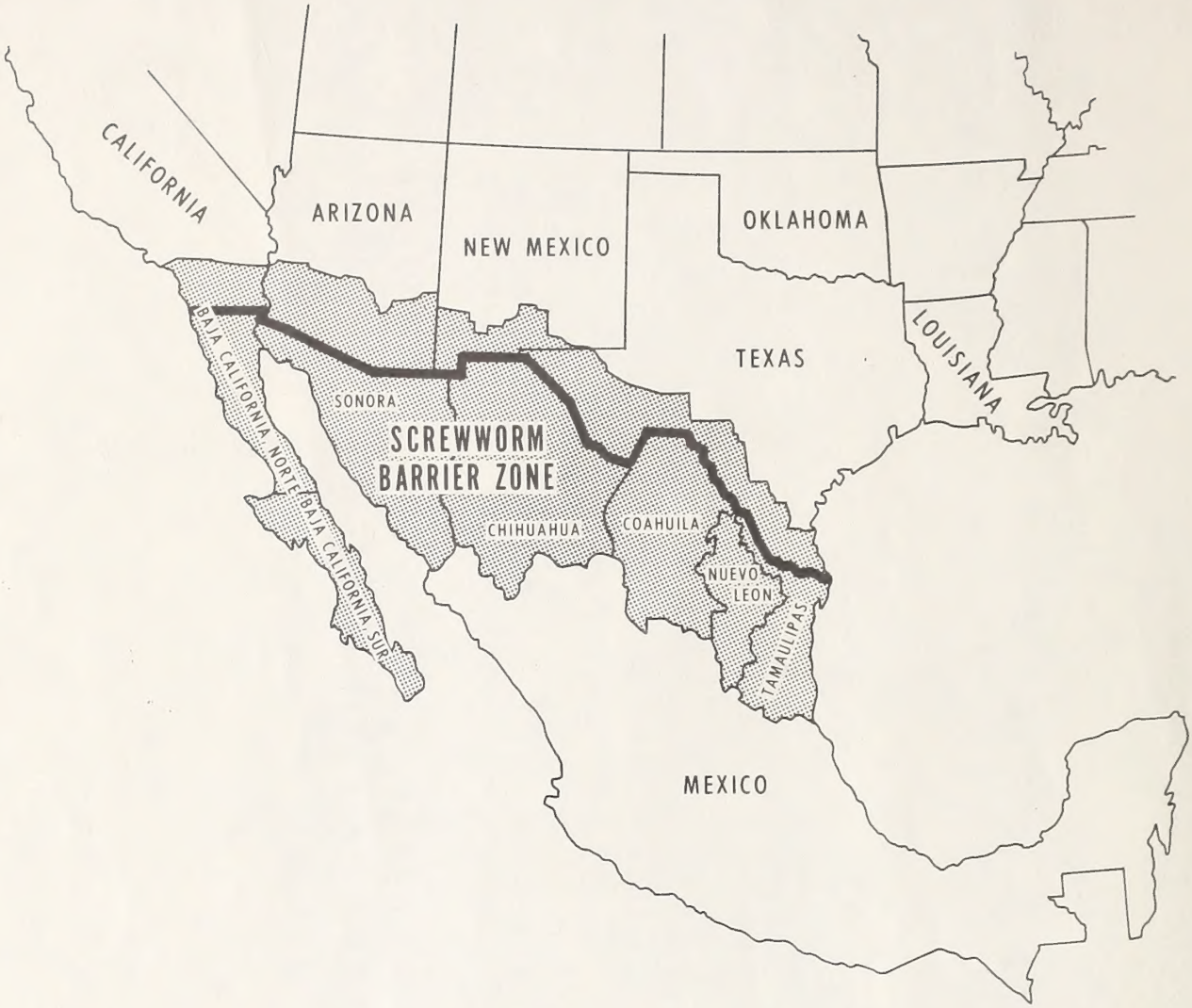
ARS 91-64
September 1967

FACTS ABOUT THE SCREWWORM BARRIER PROGRAM

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service



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This publication supersedes ARS 91-39, Facts About Screwworm Eradication, January 1963.

FACTS ABOUT THE SCREWWORM BARRIER PROGRAM

The Screwworm Problem Today

The screwworm is a destructive parasite of warmblooded animals that has been dreaded by livestock producers since pioneer days.

Screwworms are attracted to and deposit their eggs in open wounds of domestic and wild animals and man. Screwworm larvae (maggots) hatch in the wounds and devour the flesh of the living host animal, causing weight losses, general reduction in productivity, maiming, and frequently death. Before large-scale control measures were launched by the U.S. Department of Agriculture in cooperation with the affected States, annual losses to the livestock industry from screwworms sometimes rose to many millions of dollars. Screwworm losses among wildlife were also high.

The last-remaining established infestations of screwworms were eradicated from the United States in 1966 as a result of all-out campaigns in the Southeast and in the Southwest.

Although the eradication goal has been reached, the battle against the screwworm is still far from ended. Mexico and other countries to the south still have established populations of screwworms.

The task now is to keep the screwworm from gaining a foothold once again in the United States. This could happen with disastrous results to livestock producers and related industries unless strong defense against the screwworm are maintained.

Barrier Strategy for Preventing Return of the Screwworm

Currently migration of screwworm flies into the United States from Mexico is being curbed by maintaining an artificial barrier of sterile screwworm flies which are strategically released along both sides of the United States-Mexico border. Release of laboratory-reared sterile screwworm flies deters the buildup of the natural screwworm population in an area several hundred miles wide.

Although the barrier has cut down screwworm migrations into the United States to near zero, a few flies do get through from time to time. Consequently, a continuing alert is required in areas near the international border to keep migrating screwworms from becoming reestablished in the United States, and rapidly building up to the point where they would cause heavy losses to individual livestock producers and the industry.

In addition to releasing sterile flies along the border barrier, the Agricultural Research Service examines animals presented for import at the United States-Mexico border as a regular part of its border inspection. Infested and exposed animals are refused entry. ARS also maintains a patrol at the international border to prevent infested animals from straying into this country from Mexico. In addition, ARS cooperates with the border States in cleaning up sporadic outbreaks caused by migrating flies.

In addition to the release of sterile flies, strict adherence to conventional screwworm-control practices is required. These essential measures include frequent inspection of livestock by producers to promptly detect infestations, immediate reporting of suspected and verified cases of screwworm infestations, use of preventive measures such as sprays and treating wounds with approved smears, and strict compliance with regulations restricting the interstate movement of infested animals.

A Cooperative Program

The Animal Health Division of USDA's Agricultural Research Service has primary responsibility for producing and releasing sterile flies to maintain the artificial barrier. However, border States and the Republic of Mexico provide invaluable assistance.

At the International level, Mexico and the United States are cooperating closely in the operation of the sterile fly barrier zone. A cooperative Mexico-United States study to determine the feasibility of a program to eradicate the pest throughout Mexico has been completed. The United States has advanced funds to the National Institute of Research Studies of the Mexican department of agriculture to defray part of the costs for research to refine present methods of controlling and eradicating the screwworm in Mexico--primarily to develop a specific attractant for screwworm flies.

The border States and livestock industry groups such as the Southwest Animal Health Research Foundation and the National Cattlemen's Confederation of Mexico have contributed leadership and funds to the campaign against the screwworm.

Individual stockmen on both sides of the border also help by providing information about screwworms infesting the barrier zone and adjacent areas and by cooperating in other screwworm-control activities. As part of this cooperation, stockmen collect and submit thousands of larva and egg-mass samples from infested wounds for identification.

Production of Sterile Screwworm Flies for the Barrier Program

Sterile screwworm flies used to maintain the artificial barrier along the United States-Mexico border are reared and sterilized at a plant in Mission, Tex. This facility was set up at former Moore Air Base in 1962 to supply large quantities of flies needed for the Southwest Screwworm Eradication program and to serve as administrative headquarters for screwworm control work in the Southwest. The plant, built in part with funds supplied by stockmen and sportsmen through the Southwest Animal Health Research Foundation, is capable of producing 150 million sterile screwworm flies a week. The facility also includes a Survey Data Center where specimens of eggs and larvae collected by livestock producers are identified and recorded. This information helps to provide an up-to-date picture of infestations within the barrier zone and of outbreaks caused by flies migrating into United States areas from Mexico.

Although it is similar to the first sterile-fly plant constructed at Sebring, Fla., in 1958 for the Southeast campaign, the Mission plant incorporates many refinements in equipment and production methods, which increase plant efficiency. Average production of sterile flies is around 125 million per week. Half of all flies reared and sterilized are males.

The plant has over 75,000 square feet of floor space, and its operations require three work shifts, 24 hours a day, 7 days a week.

Screwworms are reared in shallow vats that contain animal protein such as beef or pork lungs, horsemeat, nonfat-dried milk, and dried blood, to which a small amount of preservative and water is added. This mixture is kept at 100° F., about the temperature of wounds in animals. As the larvae mature they crawl from the rearing vats and are collected and placed in trays containing sawdust where they enter the pupal (cocoonlike) stage of their life cycle. To produce 140 million flies, the following approximate amounts of materials are required: about 200,000 pounds of beef and pork lungs; 11,000 pounds of dried blood; 8,500 pounds of horsemeat; and 2,700 pounds of nonfat-dried milk product.

When the screwworm pupae are 5 1/2 days old, they are briefly exposed to Cobalt 60, an atomic energy product that emits gamma rays. Male and female flies that later emerge from the pupae are sterile. However, they are not radioactive and so present no radiation hazard to people, animals, or plants. Measured numbers of irradiated pupae are placed in cartons in which the flies emerge from the pupal cases.

Flies Released in Strategic Pattern

Sterile screwworm flies are being airdropped in a strategic pattern in the barrier zone at an average rate of about 125 million weekly. The barrier extends along the 2,000-mile international border from the Gulf of Mexico to the Pacific--and varies in width from 300 to 500 miles.

The principal target areas are sections of Mexico in which screwworms normally overwinter and build up in large numbers to migrate into areas of Mexico adjacent to the international border and into the United States.

Airplanes loaded with boxes of sterile flies fly regularly in a grid pattern over these "danger" sections. The airplanes are equipped to drop the flies automatically at predetermined intervals and at rates required to overwhelm native screwworm populations.

One area of intensive fly drops is located in a warm, humid section of Mexico immediately to the South of the southeastern part of the Texas border and extends 500 miles into the interior of Mexico. Another grid extends some 500 miles into Mexico to the south of Douglas, Ariz. To facilitate distribution into this area, flies are trucked to Douglas where they are packaged for airdropping.

At present about three-quarters of the flies reared at the sterile-fly production plant in Mission are dropped in the Mexican section of the barrier zone. This is done to "push" established populations of screwworm flies further away from the freed areas of the United States.

In the case of outbreaks reported in the United States, the immediate area is hot spotted (subjected to the release of 100,000 sterile flies per week for 3 to 6 weeks) and the exposed livestock are sprayed with coumaphos (Co-Ral) in order to deny hosts to the pests before they can build up and spread.

The pattern for release has purposely been kept flexible since the buildup areas from which screwworms spread are affected by unpredictable climatic conditions and other factors such as unusual movements of livestock into an area. For example, heavier than usual rains in a normally arid section of Chihuauha adjacent to Southwest Texas and New Mexico during 1966 resulted in better grazing and movement of cattle into the area. This factor plus conditions favorable for screwworm survival resulted in a rapid buildup of the screwworm population and a spillover of migrating screwworms into the United States.

So that sterile flies can be released quickly on target in newly infested areas before the screwworm populations can explode, livestock producers and pet owners are urged to inspect their animals frequently, collect larvae and egg masses from all infested wounds, and send in the samples as soon as possible. In the United States, larva samples from all Southwestern States go to the program headquarters at Mission for identification; in Mexico, samples are sent

to Mexico City for identification. Since the reports and laboratory findings provide the basis for mapping future patterns for releasing screwworms, livestock producers have a key part in the continued success of the sterile-fly release program.

Cost of Maintaining the Barrier

Currently the cost of maintaining the artificial barrier against return of the screwworm is about $5 million a year. Although this represents a sizeable annual expenditure, it is one-tewntieth of the estimated loss caused by the screwworm in the Southwest in some past years. Continuing research, greater efficiency resulting from methods-development studies, and cooperation of livestock organizations and individual stockmen in the Southwest and Mexico have all helped to hold down costs of maintaining the barrier which has been made much wider and deeper than it was at the outset.

Conventional Screwworm-Control Measures Also Essential

Theoretically the screwworm could be prevented from re-entering the United States and becoming reestablished here solely by the massive release of sterile screwworm flies. Practically, however, the cost would be prohibitive if conventional screwworm-control methods were not also used to help do the job.

The livestock inspection and border patrol programs of the U.S. Department of Agriculture help keep infested animals from entering the United States. Federal regulations restricting the movement of screwworm-infested animals also help. So do management programs for preventing screwworm infestation and treating infested animals promoted by the USDA's Agricultural Research Service and cooperating States.

The active help of individual livestock producers and pet owners is also essential for success of the program. In addition to being a primary source of information about outbreaks, livestock producers are the ones who must apply screwworm-control practices in their own operations.

How Livestock and Pet Owners Can Help

To assure that screwworm losses will be held to their present low levels, livestock producers must:

- Submit samples of egg masses and maggots found in wounds.
- Follow an injury- and wound-prevention management program and apply an approved medicant--such as EQ 335; Smear 62; coumaphos dust, spray, or dip; or round (Korlon) spray or livestock bomb--to all unavoidable wounds as a precautionary treatment.
- Refrain from moving screwworm-infested animals from the premises.
- Urge other livestock producers to help fight the screwworm by following these preventive practices.

Pet owners are urged to follow similar practices in order to protect their animals against screwworms.

Much of United States Vulnerable

Before eradication, screwworms ranged seasonally from their overwintering grounds in extreme southern sections of Texas, New Mexico, Arizona, and California through these States into Louisiana, Arkansas, Oklahoma, Kansas, and other States to the north. Localized outbreaks, caused by shipments of infested livestock, occurred as far north as Minnesota and South Dakota. With the return of cold weather, screwworms were killed back to the warmer areas of the Southwest.

Before modern control measures were developed, livestock producers were sometimes forced to restock or go out of business following years of heavy screwworm infestation. More than 1.2 million cases of screwworm infestation resulting in nearly 180,000 animal deaths were reported by ranchers in 96 Texas counties during 1935. This happened despite the fact that there had been substantial advances through research in the treatment of livestock to prevent screwworm losses.

Carried to the Southeast in 1933 through a shipment of infested livestock, screwworms became established in semitropical sections of Florida. Until eradicated from the Southeast in 1959, the screwworm spread out from their Florida winter havens each spring throughout the rest of that State into Georgia, Alabama, South Carolina, Mississippi, and sometimes into North Carolina, Tennessee, Virginia, and even New Jersey and Delaware. Between July 1 and December 15, 1935, more than 240,000 cases of screwworm infestations were reported in the Southeast in livestock. At least 55 cases occurred in humans in the Southern States that year.

After the Southeast was freed from screwworms, expensive inspection stations had to be maintained to prevent infested animals from being moved into the freed area from infested Southwestern States. Despite these safeguards, sporadic outbreaks continued to occur in the Southeast until the Southwest's infestations were controlled.

How the Screwworm Was Eradicated from the United States

A new concept in past eradication--the sterile-male technique--was successfully used in eliminating the screwworm from the United States.

This technique involved the release of laboratory-reared, sexually sterile screwworm flies in sufficient numbers to overwhelm the native screwworm population. The object of this approach was to clear up reservoirs of infection among wildlife and range animals that could not be eliminated by the use of conventional pest-control methods.

The screwworm eradication drive also pioneered in using atomic energy to eliminate an agricultural pest. Radioactive Cobalt was used to sexually sterilize the man-reared screwworm flies released in the eradication campaign.

The sterile-male approach to the control of screwworms was proposed, developed, and tested by USDA scientists during the two decades beginning in 1937. Two circumstances about the screwworm made the pest a suitable object for use of the sterile-male eradication technique: (1) The normal population of screwworms in the United States was relatively low even though highly destructive and (2) infestation was confined to limited areas of the Southwest and Florida following the annual winter kill-back.

In 1954 laboratory-reared, sterile flies were successfully used to eradicate screwworms from the Caribbean Island of Curacao. The success of this pilot experiment led Florida livestock producers to urge that the method be tried in their State.

In 1957, preliminary tests were conducted in eastern Florida, with encouraging results and the Florida legislature appropriated $3 million to defray part of the costs of a Statewide screwworm eradication campaign to be conducted in cooperation with the U.S. Department of Agriculture over a 2-year period.

In fiscal year 1958, a Federal-State campaign to eradicate the screwworm from the entire Southeast was started by USDA in cooperation with the States of Florida, Georgia, South Carolina, Alabama, and Mississippi. Livestock producers also cooperated by reporting infestations and treating their animals. As the campaign progressed, inspection stations were set up along the Louisiana, Arkansas, and Mississippi borders to prevent infested animals from entering areas that had been freed of screwworms by the release of overwhelming numbers of sterile flies.

In 1959, following an intensive 2-year drive, the Southeast was free of screwworms.

Total costs of the Southeast campaign added up to around $10 million as compared to more than twice that figure in losses caused by screwworms throughout the area in some previous years.

Success of the Southeast campaign led Southwest livestock producers to request a campaign in that area.

The eradication problem of the Southwest was complicated by a number of factors not operating in the Southeast: The overwintering and seasonal migration areas in the Southwest were larger. Adjacent areas of Mexico had continuous infestations of screwworms. Climatic conditions in the arid Southwest were so different from the Southeast that it was uncertain whether strains of laboratory-reared flies released in the Southeast could adapt to the Southwest. Nevertheless the decision was made to initiate the program in the Southwest.

The Southwest eradication program was started in February 1962. The plan had two principal objectives: (1) Eradicate the screwworm from overwintering areas of the Southwest. (2) If feasible, establish and maintain sterile-fly barrier on the U.S.-Mexican border to prevent reinfestation from Mexico.

To rear the large number of sterile flies required for the campaign, a sterile-fly production laboratory was built at Mission, Tex., with the Southwest Animal Health Research Foundation supplying most of the construction funds. The five States comprising the original Southwest Eradication Area--Texas, New Mexico, Arkansas, Louisiana, and Oklahoma--cooperated in the campaign by matching USDA expenditures. Traditional screwworm-control measures involving close inspection and treatment of animals for screwworms and other good management practices were encouraged so as to keep natural screwworm populations to a minimum.

By September 1963, infestations within the five-State eradication area had been reduced by 99 percent and an artificial barrier had been established along the Rio Grande with cooperation of the Mexican government. After Arizona and California entered the program in 1965, this barrier was extended along the 2,000-mile length of the international border from the Gulf of Mexico to the Pacific Ocean.

In 1964, screwworms were eradicated from the original five-State Southwest eradication area but isolated infestations remained in Arizona and California. The last self-sustaining, established infestations in the continental United States were eliminated during 1966 but recurring infestations caused by long-range migrating flies must be dealt with during seasons favorable to screwworms.

Some Facts About the Screwworm

Screwworms attack all warmblooded animals, including humans. Losses may occur as a result of death, or from crippling, weight losses, or increased susceptibility to diseases. Labor that must be provided for animal inspection and treatment, and money spent for materials for prevention or treatment of screwworm injury also represent a form of loss to livestock producers. Game animals, as well as domestic livestock, suffer injury or death from screwworm infestations.

The screwworm is the maggot, or larvae, of the screwworm fly with the scientific name Cochliomyia hominivorax (Coquerel). It has been given the descriptive name "screwworm" because the larva's body somewhat resembles a wood screw.

The screwworm fly is about two times the size of a common housefly. It has a bluish-green body with three dark stripes along the back and orange-colored eyes. Rarely seen except around animal wounds, the screwworm fly is difficult to distinguish from some other blowflies.

The female screwworm fly lays eggs in batches of about 250 along the edges of open wounds. Within 12 to 24 hours the eggs hatch into tiny larvae or maggots that burrow deeply into the wound. At this stage, the larvae are barely visible and are almost impossible to detect in a fly or tick bite, even on close inspection. Only the posterior ends of larvae protrude. With their rasping mouthparts, they tear away at the wound and feed on the exudate and flesh of the living animal for 5 to 6 days, growing to about one-half inch in length. An infested wound attracts additional female screwworm flies that lay eggs, and these multiple infestations usually cause death of the host animal, unless treated. Grown steers have been killed within 10 days.

When fully developed, larvae drop from the wound and burrow into the soil to form brown, tough-shelled puparia (cocoons) which contain the pupae. After about a week in warm weather, screwworm flies emerge from the pupal shells. The life cycle of the screwworm averages about 3 weeks, but can be as long as 65 days during the cold weather.

Weather is an important factor in the location, spread, and severity of screwworm infestations. Warm, humid weather is most favorable to screwworm development and activity. Extremely high or low temperatures and drought tend to limit screwworm populations and activity.

As screwworms cannot survive extreme cold, their overwintering areas are normally confined to tropical and semitropical regions. Following an unusually mild, moist winter, the overwintering screwworm population is likely to be larger and to extend over a much greater area than following a normally cold winter. When this occurs, the danger of reinfestation in adjacent freed areas increases.

Data from eradication campaigns indicate that a single screwworm fly may migrate as far as 300 miles or more from its birthplace during its lifetime. Of course, larvae may be inadvertantly transported for thousands of miles through shipments of infested animals.

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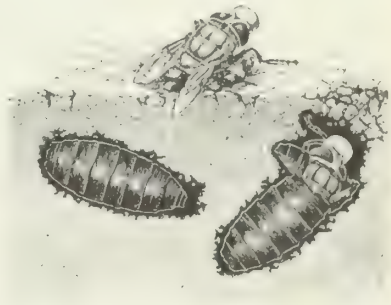

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Under ideal conditions, the time required for completion of the life cycle of the screwworm. . . .from egg to larva to fly. . . .averages about 3 weeks. At 6 days of age, a female fly can lay about 250 eggs on a wound. Tiny, barely visible larvae hatch from the eggs within a day and feed on the flesh for 5 to 6 days. They then drop in the ground and enter the soil where they are transformed into pupae encased in dark-colored, tough capsules. During warm weather, flies emerge from the pupal case in about a week. The females mate at 2 to 3 days and lay eggs 6 days later.

Looking Ahead

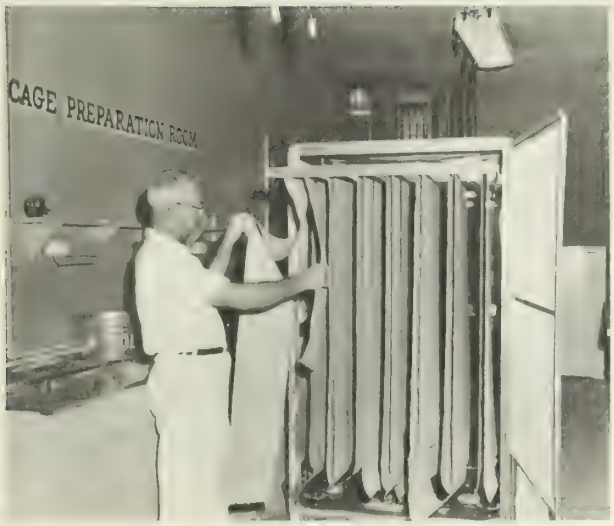
Success of the artificial barrier program in retarding migration of screwworm flies into the United States is good evidence that this country can remain free of self-sustaining established infestations of the pest. However, isolated outbreaks are caused by migrating flies from Mexico. This emphasizes the need for continuing to maintain strong defenses against the screwworm.

One possibility for the future that has been suggested by stockmen on both sides of the border is to eradicate the screwworm from Mexico. A cooperative Mexico-United States study to determine the feasibility of such a program and develop a possible eradication plan has been completed. One result of the possible program would be to eliminate the need for the present barrier along the 2,000-mile international border. This would be accomplished by eradicating screwworms as far south as the 140-mile wide Tehuantepec Isthmus and establishing a new barrier there.

At the same time, scientists and pest-control authorities in this country and Mexico continue studies to refine present methods and develop new techniques for combatting the screwworm. Two examples of this are methods development studies at the Mission sterile-fly production plant aimed at continually improving the efficiency of barrier operations and a research project at the National Institute of Research Studies of Mexico to develop a specific attractant for screwworm flies. Also studies are continuing to further reduce the costs of feeding billions of artifically produced screwworms without sacrificing the size, vigor, and aggressiveness of the flies.

All these are future possibilities.

Meanwhile, in the days immediately ahead, any relaxation of systematic efforts by livestock producers and government agencies to keep the screwworm from becoming reestablished in this country could have disastrous results.



N-46593

Pupae from brood flies selected for hardiness and aggressiveness are placed in large screened cages to provide fertile flies for mass-egg production at the sterile screwworm fly "factory" near Mission, Texas. When the flies emerge from the pupae, they rest on the paper toweling streamers. The cages are kept in a warm, dark room at about 7 days--until the females are ready to lay their eggs.

BN-24891

The larvae go into large feeding vats after 24 hours on the starting diet. A mixture of animal flesh, dried blood, nonfat dried milk, water, and a preservative is placed in the vats and kept at a temperature approximating that of live animals on which screwworm larvae normally feed.

N-46603

Egg masses are collected, weighed, and placed in small plastic containers to hatch. More than 11 million larvae are started every 8 hours.

N-46650

After feeding for 3 to 5 days, the larvae migrate from the vat and fall into water-conveying troughs in the floor under the grates. They are then carried to the pupation room for the next stage in their life-cycle.

BN-17282

The larvae pupate in trays of sawdust. Some larvae change to pupae within 16 hours; others take longer. At the end of 16 hours, the trays are removed from the pupation room.

N-30250

Trays of pupae are stacked on racks and held in a dark room at 80° F. and about 95 percent humidity for 5 1/2 days before being sexually sterilized. Here an attendant examines the color of the pupae which changes from light red to black as pupae mature.

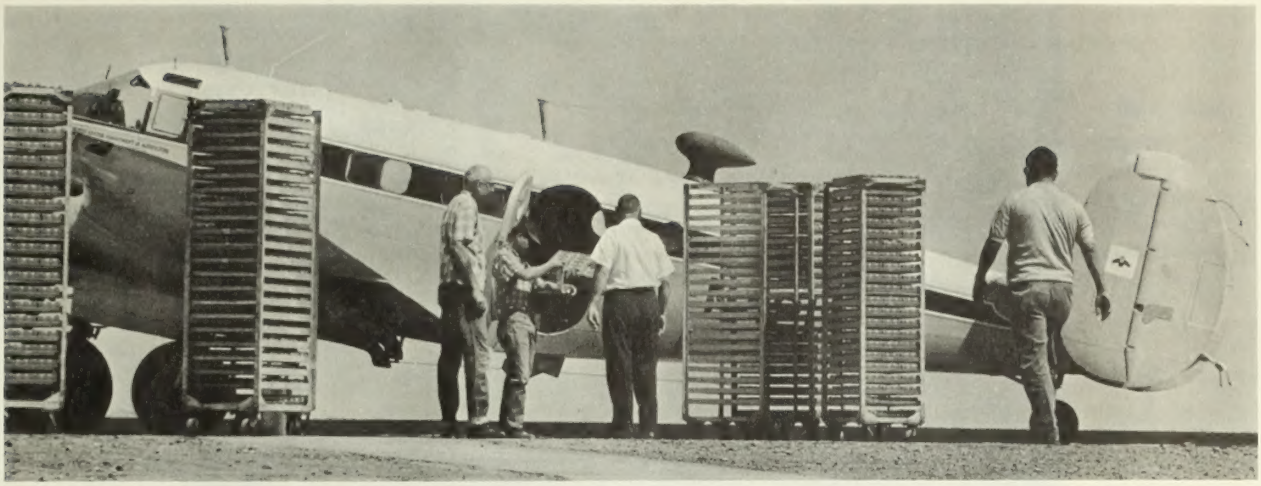
BN-24921

The trays are emptied onto a conveyer that screens out the sawdust and then passes the pupae and any remaining larvae under fluorescent lights. Larvae crawl away from the lights and are collected to complete pupation.

BN-17286

This canister carries about 31,500 pupae into a Cobalt-60 chamber to be sexually sterilized by exposure to gamma rays. Lead shielding, systematic checks to detect leakage, and a remote control mechanism protect plant personnel and adjacent areas from radiation hazard.

Sterile Fly Release



BN-24924

Cartons of sterile flies are loaded on airplanes for strategic release over the barrier zone along the United States-Mexico border and in this country where sporadic outbreaks, caused by migrating flies from Mexico, are reported.

BN-24916

This is a closeup view of sterile flies emerging from a carton.

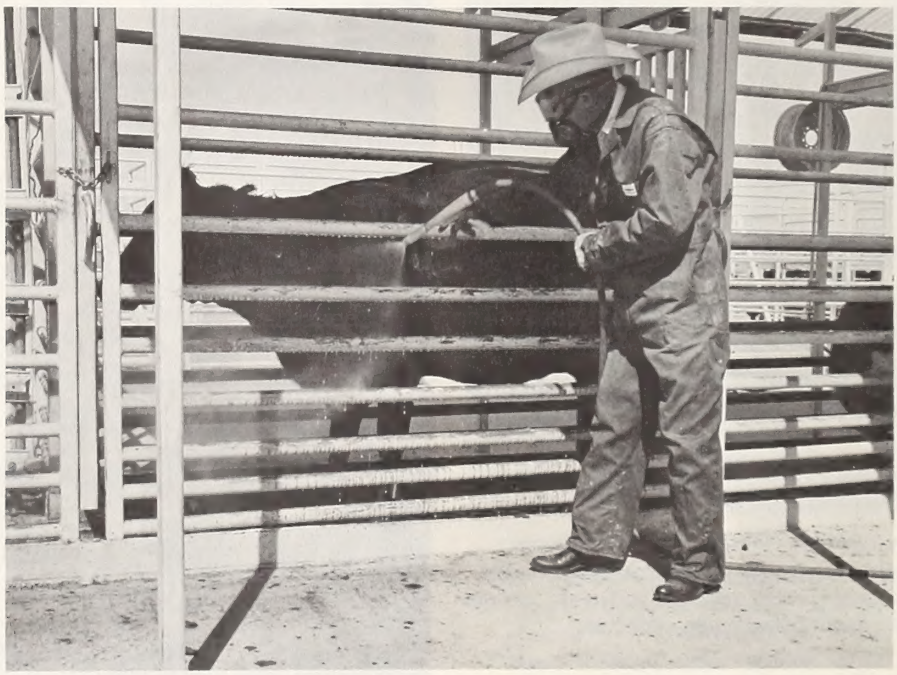
N-28349

Small planes are used for "hot spotting" (releasing large quantities of screwworms over a specific target) Southwest areas where isolated outbreaks caused by screwworms from Mexico are reported.

Border Inspection

BN-20836

No livestock can legally be brought into the United States without a health certificate showing that the animals have been examined and passed by USDA livestock inspectors. Any animals found to be infested with screwworms or other prohibited pests are refused entry.



BN-20487

Whenever a screwworm-infested animal is found in a lot of livestock waiting entry to the United States, all animals in the shipment and the vehicles carrying them are sprayed and any surface wounds treated. This is to eliminate the danger of screwworm infestation.

BN-18514

Livestock and pet owners can help prevent screwworms from becoming reestablished in this country by inspecting their animals frequently, reporting known screwworm infestations promptly, and submitting larva and egg samples from infested wounds for identification.

BN-36419

Protecting animals from cuts and scratches and treating unavoidable wounds promptly are recommended for preventing screwworm infestation.

BN-21863

Mexican ranchers help maintain the barrier zone. Like Southwest stockmen, they inspect their livestock frequently, treat animal wounds promptly, and submit larvae samples for identification.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1967 303-488/12

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Hyattsville, Md. 20782

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