

The Plague of the Cattle Screwworm

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ABSTRACT

This article is written by consulting the publications available online and following the latest conferences or webinars held during June-July 2025, in a limited capacity to contribute and support the dissemination of information on how to control the spread of the wound-infesting pest. The objective is to change the attitude of officials without agricultural or biological training. For the reader, it serves as an open training medium, since the technical field knowledge learned in previous years for eradication has been lost due to age, retirement, and the retirement of people with experience in the agricultural production sector. There are no longer cowboys and ranchers with experience in eradication campaigns or handling wild animals. Nor should it be considered an official means of dissemination; for this purpose, SADER-SENSICA has an online course available, with a minimum of five attendees; all you need to do is complete the official process. I was not allowed to attend, even with registration. Unfortunately, I cannot share with you the new official eradication protocols implemented in Mexico. Watch the hatching at 12:00 and 45:00, following the larval stages to become familiar with them.

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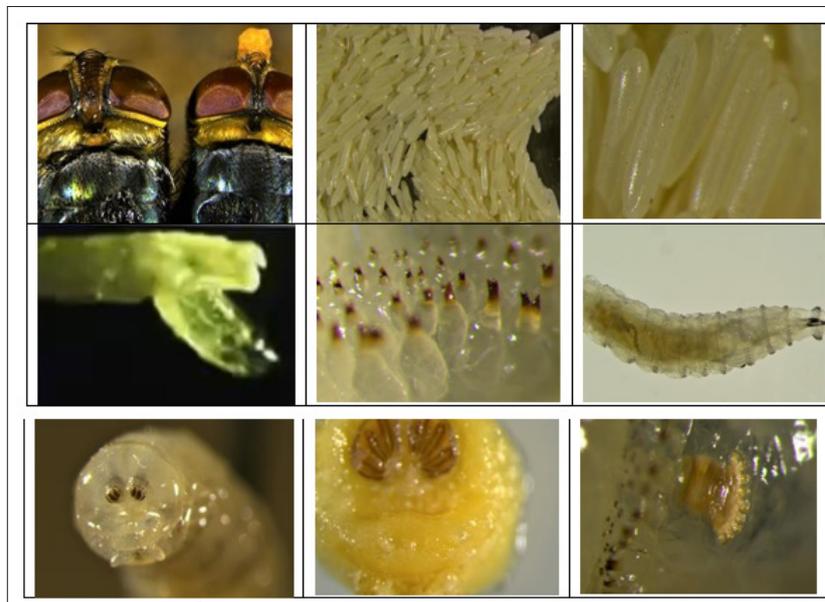
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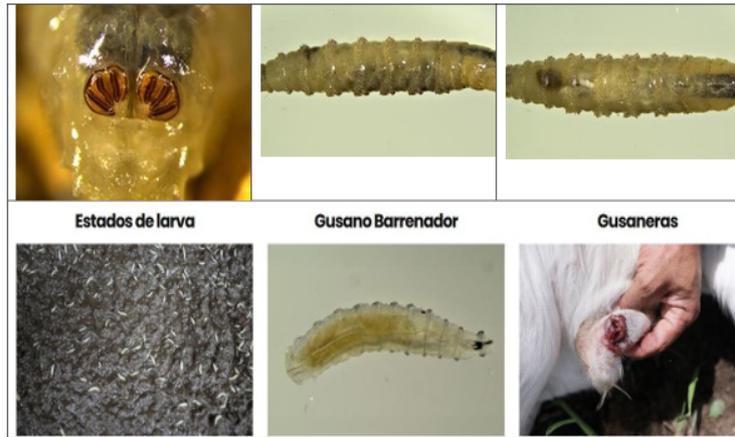
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Introduction

The updated and interesting official reports from the SENASICA Mexico journal Avances are attached. They can be found online.
https://issuu.com/serviciodesanidad/docs/dinesa_01 https://issuu.com/serviciodesanidad/docs/avance_02_2025
https://issuu.com/serviciodesanidad/docs/avance_gbg_03 https://issuu.com/serviciodesanidad/docs/avance_04_2025

This particular written and visual manuscript seeks to highlight past measures to reinforce present-day protocols. I hope the reader will be interested in reviewing the text and viewing the educational photographs that can educate and prepare them for the real world. To learn about synonyms and taxonomy, see the mouth development, respiratory canal, and larval maturity. The anatomy of the fly and its importance in field applications are explained in more detail in subsequent chapters.



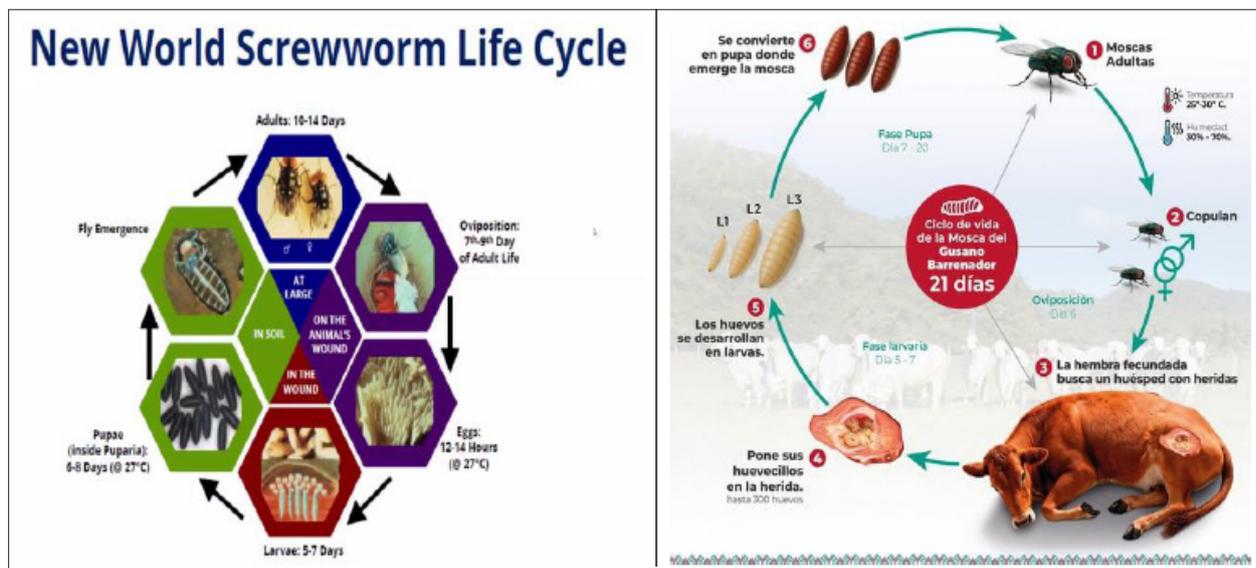


The Aztecs, as a dominant empire, had their own teaching methods; they were a dominant society, but also enjoyed advanced sciences. The conquest established a school in 1551 and a Pontifical school in 1552, laying the foundations for the future of Mexico. For support, see the following thesis: <https://tesiunamdocumentos.dgb.unam.mx/pmig2018/0111625/0111625.pdf>



The wild female fly lays her fertile eggs and lays them near the edge of the cut. Multiple infestations in a single wound are not uncommon. Understanding the fly's behavior helps you understand it and be able to combat it. Without this, you're going into the war unarmed. Know the successes of the current campaign and the possible corrections that need to be implemented.

It's very important to understand the life cycle variations depending on the season, ambient temperature, relative humidity, climate, and geographic area. Each vegetation site requires a different control strategy. What works well in Campeche must be modified for Quintana Roo and adapted successively.

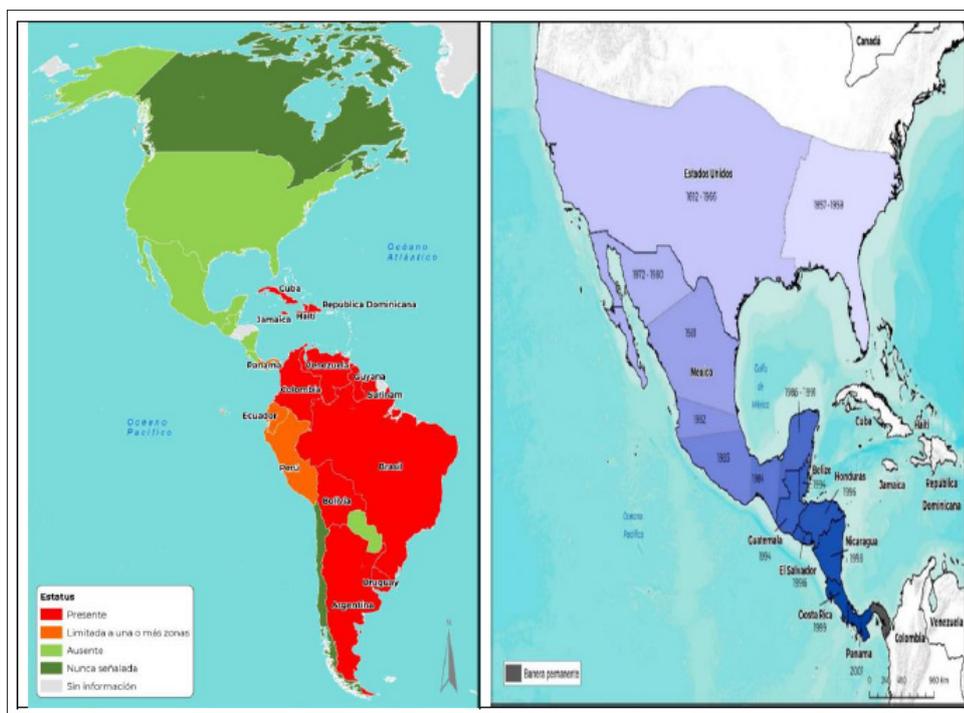


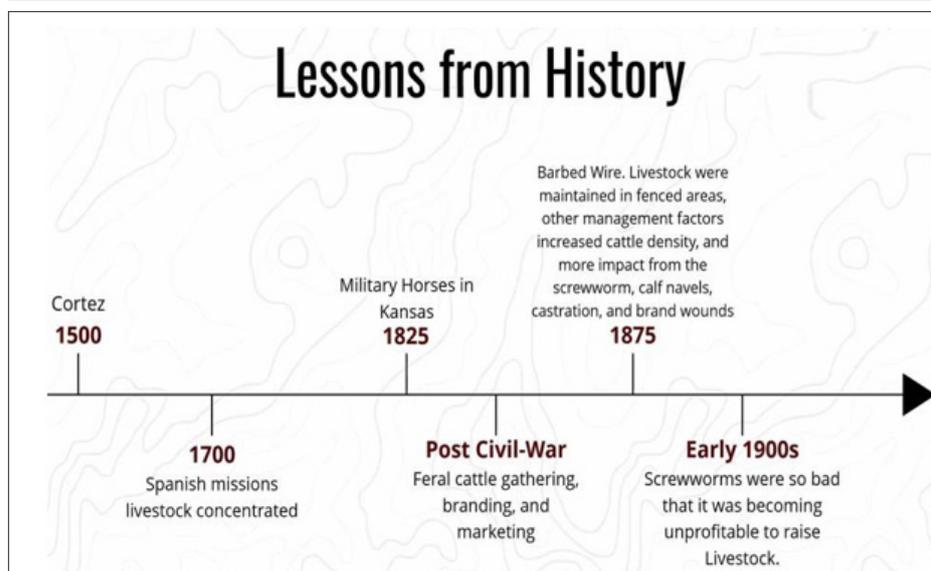
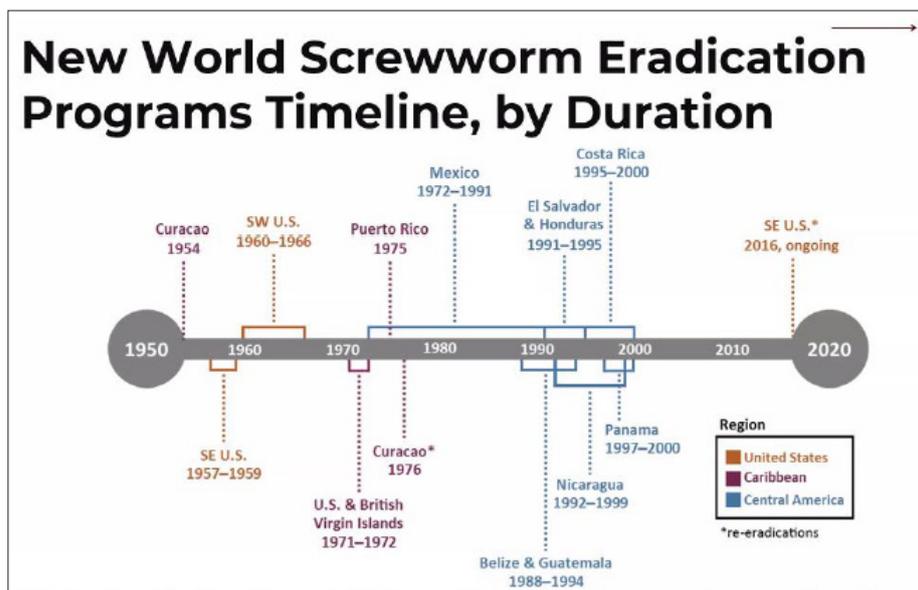
Above all, it must be taken into account that on August 28, 1972, the Mexican-American Commission (COMEXA) launched the campaign to eradicate the New World screwworm (NWW). Entire herds were also driven into insecticide-treated dips against the tick in 1928, and the virus was combated. The Mexican-American Commission for the Eradication of Foot-and-Mouth Disease was

established on April 2, 1947. These simultaneous and joint national actions synergized to achieve the success of each campaign. The campaigns last for years from their implementation until they achieve eradication; they are not a single cycle. Without these multiple efforts simultaneously, the successes would not have been achieved. Today (July 2025), this situation does not exist to provide a single front with several animal health programs; work is carried out separately and in isolation. Technological applications and decisions must be more precise; effort alone is no longer enough, as it was in previous years.

Although the state of Sonora has eradicated brucellosis and tuberculosis through a Permanent Campaign Committee by decree of December 19, 1991, and amended on October 8, 2010, in the Official Gazette. By July 2025, there is a commitment to sample 50,000 animals annually to corroborate their free status. This will allow cattle movement to combat bacteria (Malta fever and Mycobacteria) and, at the same time, monitor Sonora production units for the presence of the greenish iridescent fly (GBNM), which is currently a national concern.

https://www.woah.org/fileadmin/Home/esp/Health_standards/tahm/3.01.14_SCREWW.pdf
<http://www.bio-nica.info/biblioteca/FAO1993.pdf> It shows the differences between males and females, based on the distance between their eyes. Page 69. More details below.
<https://nubedemonte.com/gusano-barrenador/> Historia de la producción de mosca estéril.
Garrapata <https://www.gob.mx/senasica/documentos/situacion-actual-del-control-de-la-garrapata-boophilus-spp>
Aftosa <https://www.gob.mx/senasica/articulos/la-fiebre-aftosa-el-primer-gran-reto-sanitaria-en-mexico#:~:text=El%2020de%20abril%20de,bovino%20y%20porcino%20al%20d%C3%ADa.> Europe is experiencing Foot-and-Mouth Disease outbreaks in 2025. It had already been eradicated, and vaccinations stopped in 1990, making it a contagious disease that spreads easily. What is the risk analysis for imports from Mexico? Brazil, although free with vaccination, stopped vaccinating in 2023. South America has been free since 2012, but vaccination is available in almost all countries. Colombia controlled the 2017-2018 outbreak, originating in Venezuela, a country that does not have any control program. What is the price that Mexico must pay for importing meat? Screwworm <https://www.gob.mx/agricultura%7Cchiapas/prensa/terminan-las-operaciones-de-la-planta-donde-se-producia-la-mosca-esteril-para-combatir-al-gusano-barrenador#:~:text=El%20gusano%20barrenador%20es%20la%20larva%20de,de%20carne%20viva%20de%20animales%20o%20humanos.&text=En%201974%20la%20Planta%20Productora%20se%20construy%C3%B3%20la%20Planta%20Productora,la%20plaga%20fue%20eradicada%20de%20territorio%20nacional.>

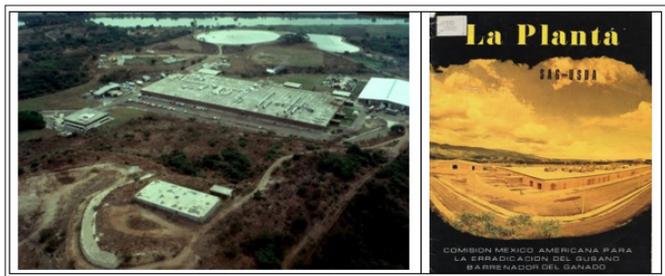




The primary parasitic fly *Cochliomyia hominivorax* is possibly endemic, native to the American continent. It has regionally distinct morphological characteristics, with 12 populations that differ in physiological details found in three intersecting physiographic regions for Continental America: South America, the continental Caribbean, and the Caribbean islands. These subtle differences are considered very important for genetic entomologists, who perform blood cleansing and rotation of the reproductive brood stock at the Pacora, Panama, laboratory, which produces sterile flies with BEAM irradiation and recrosses the females with the dominant strain as a pest. The species was eradicated in progressive stages up to the Panama-Colombia border, considered a biological barrier. Top map: Chile and Canada in flag green; historically, their existence has not been reported. The purple map shows the years of eradication progress.

Mexican Territory

Most of Mexican territory was free of the fly since 1991 and the northwest with free campaign since 1972-1982, see purple map. Therefore, Mexico should have been quarantined in 2024 and not given endemic treatment as happened in 2025. The country of Mexico was internationally recognized free of GBNM since September 9, 2003 and with that, over time, in 2013, by decision of the federal government, the old sterile fly production plant that used gamma and X-rays in Chiapa de Corso de Tuxtla Gutiérrez, Chiapas, Mexico-USDA closed. This plant, which had been in operation since 1974, serving the United States, Mexico, and all Central American countries, a campaign to Libya. So, after 12 years of neglect, a serious dismantling is expected by 2025, since these facilities are occupied by a detachment of soldiers. The Packing and Air Dispersal Center was located in Ocozocuatla, Chiapas. What new reports are available on the facility for 2025? See photos from 1974 and SAG-USDA from 1976.



There are 11 ports of entry along the U.S.-Mexico border for 100,000 head of live cattle per month, which are exported to feedlots in the central and northern U.S. The entry of the fly into Mexico forced the closure of the market in November 2024. An average of 7,000 heads per day, valued at \$1,500 each. It's not the fly that's causing concern, it's the maggot infestation and the damage it causes to animals and the economy of livestock farming. If it spreads to wildlife, eradication is more difficult. An assessment of the severity and number of animals carrying the larvae will be conducted later.

During February 2025, the USDA partially opened the border crossings; only four open facilities operated at low capacity. The passage of cattle to exports will be closed again on May 11, 2025. As of May 28, 2025, 1,758 cases were registered in southern Mexico, of which 1,489 have been treated and are no longer active. There are still 269 detected animals, 197 of which are cattle. Is that many or few? You tell me when the plague hits you and you lose an international animal health status that has cost money, time, and effort to achieve this certification and evaluation. With just one sick animal, and boom! The global recognition of free status is over, along with the commercial value it has achieved over the years and the distrust it generates, calling into question other animal health and agricultural certifications.

The cattle crossing was closed for the first time in February 2025 and for the second time for Mexico on May 11, 2025. Exports resumed on July 7, 2025. The crossing will begin in stages for Douglas, Arizona, and Agua Prieta, Sonora, Mexico, only for animals (cattle, horses, and bison) born in Sonora or Chihuahua. The corrals in Nuevo Palomas, Chihuahua, Mexico, will continue to open. Columbus and San Jerónimo-Santa Teresa in New Mexico will continue through Ciudad Juárez, del Río in Texas, then Laredo, and so on, as long as official documentation is submitted. Without hesitation, the eradication campaign (diesel, gasoline, hybrid, and electric batteries) will continue at a national level. All hands to work!

There is a verbal agreement to reopen cattle trading on July 7 through Aguaprieta, Sonora, Mexico, since this state has not lost

its "Worm-Free" status, as 882 cattle crossed on foot that day and is estimated to have an export rate of 1,300 cattle per day. Two days later, the border closure is again announced on July 9, 2025, after an animal with myiasis is found in Veracruz. Zero tolerance, no forgiveness for mistakes, no respite, the US does not want to jeopardize its health status, and Mexico must be more committed and inflexible. It doesn't matter that the USMCA regionalizes disease-free zones. The reader will become more involved as the chapters progress. Animals must be injected with ivermectin seven days prior to crossing the border. This is an infallible rule of the campaign to obtain registration in the program listed in the order of authorization for export. Ivermectin should not be given to dogs or horses. Consult your doctor! The commercial says. This flexibility by the USDA to open the way for cattle is due to the animal health trust the state of Sonora has earned over 60 years of eradication campaigns. The state of Sonora exports an average of 300,000 cattle annually, but by 2024, 400,000 heads will have been crossed.

Where are the puddles coming from if it hasn't rained? Why find out if they're animals we've already eaten, like meat packaged for imports. With or without seals of origin?

There are new efforts by SADER-SENASICA to rehabilitate the old site with modern equipment, working with the US USDA to once again operate a national campaign. If everything goes well bureaucratically and without affecting national sovereignty, the plant will be ready in a year, by July 2026. The other alternative suggested on May 28, 2025, is to use the new plant, which is under construction, to breed sterile fruit flies in Chiapas, and make changes worth \$21 million to adapt it to the *Cochliomyia hominivorax* fly. Why doesn't Mexico install or adapt it with its own resources? What are the authorities afraid of?

Why all the whining? Officials who don't ask for technical advice just sit on their hands. Scientific knowledge and highly trained professionals exist in Mexico, but there is no trust in its application and in putting their knowledge into practice. Can't we also look to a large national market with feedlots?

The mass production of STERILE FLY is an agroindustrial enterprise, just like poultry and pig farms, which require nucleus breeding stock, multipliers, breeding facilities, maternity wards, incubation rooms, newborn rearing, development sheds for the marketing stage, and a commercial process for distributing the animals. Old farms are a thing of the past; they are used, not thrown away, but utilized. However, new farms have modern designs that are expensive but offer better animal welfare and production efficiency. The personnel working there are protected from occupational hazards, and the entire process is sustainable. New is better than old. Why salvage facilities from 50 years ago?



The goal is to eradicate the fly once again and, at the same time, prevent its entry, with a view to selling sterile flies to Brazil, Argentina, Colombia, Venezuela, Costa Rica, etc. Aren't they good payers?

Considering that construction has also begun on their new sterile fly dispersion laboratory in South Texas, they expect to complete it by the end of 2025. While the remodeling work is being completed, to avoid jeopardizing the clean zone, sterile flies from Panama have been ordered to be released in the Rio Grande border basin, just in case, said the other, an action that Mexico is wary of during the dispersal shift because they need to release them on the Guatemala-Mexico border. "Wait a moment," said Piporro, a Mexican film character. "Who has priority?" At this initial moment of geographic penetration of the screwworm fly into Mexico and its infestation density, 200 million sterile flies are required weekly, but the Panama plant is only selling 100 million flies to Mexico. Why doesn't Mexico fork over an advance check and hire second-shift night personnel, hire more pupa-carrying planes for ground release, and other planes for aerial dispersal? Should we wait for the USDA to provide the money?

The easiest and safest thing for Mexico would have been to not allow live cattle heads to pass through to Chiapas, Oaxaca, Tabasco and Veracruz from Central America, mainly Nicaragua and Guatemala. It is said that there are 50,000 heads grazing in national parks and protected reserve areas, considered non-livestock areas per se, waiting to be sold north, heads that turn to look at the fattening markets of Jalisco, Zacatecas, Durango, Nuevo León or others and intermediate collectors for export to the US. With the hermetic closure of the Mexico-Guatemala border, we would not be worried from November 2024 when the limited spread of sterile flies begins again in Chiapas and Campeche, Mexico, since they want to strengthen Tlaxcala, the State of Mexico and Guerrero. This is the pressure from the market and meat importers.

PAÍSES	REINFESTACIÓN	CASOS NUEVOS	CASOS ACUMULADOS	DENUNCIAS ATENDIDAS	ESPECIES
Guatemala	Octubre - noviembre 2024 (semana 44/2024)	52	282	36	Bovinos 237 (84.04%), Ovinos 15 (5.31%), Equinos 12 (4.25%), Caninos 11 (3.90%), Porcinos 6 (2.12%), Caprinos 6 (0.35%)
México	Noviembre 2024 (semana 47/2024)	57	164	69	Bovinos 145 (88.41%), Equinos 11 (6.71%), Ovinos 6 (3.66%), Porcinos 1 (0.61%), Caninos 1 (0.61%)
El Salvador	Diciembre 2024 (Semana 49/2024)	129	356	138	Bovinos 226 (63.48%), Caninos 102 (28.65%), Porcinos 19 (5.33%), Equinos 6 (1.68%), Ovinos 2 (0.56%), Felinos 1 (0.28%)
Belize	Diciembre 2025 (Semana 52/2024)	5	25	5	Bovinos 18 (72%), Caninos 2 (8%), Porcinos 2 (8%), Ovinos 2 (8%), Equinos 1 (4%)
TOTAL		1,425	68,257	1,505	

Semana epidemiológica #10 (del 02 al 08 de marzo de 2025)

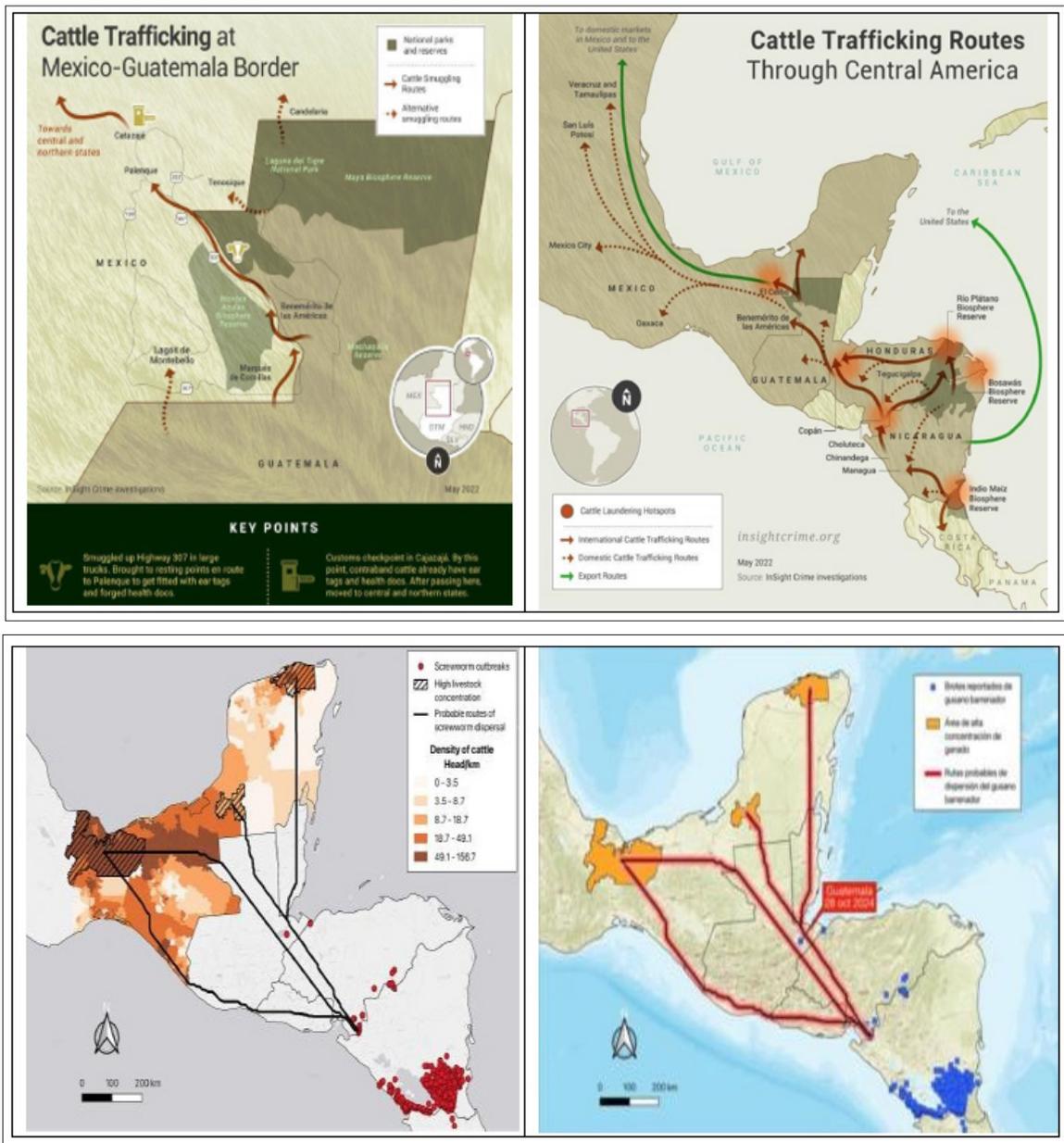
PAÍSES	REINFESTACIÓN	CASOS NUEVOS	CASOS ACUMULADOS	DENUNCIAS ATENDIDAS	ESPECIES AFECTADAS
Panamá	Julio 2023 (semana 27/2023)	393	37,697	227	Bovinos 31,662(84%), Caninos 2,285 (6.1%), Porcinos 1,362 (3.6%), Equinos 1,123 (3.0%), Ovinos 840 (2.3%), Caprinos 161 (0.4%), Humanos 117 (0.3%), Felinos 61 (0.2%), Aves 55 (0.1%), Bufalino 4 (0.02%), Mular 2 (0.01%), Kinkajú 2 (0.01%), Conejo 1 (0.003%)
Costa Rica	Julio 2023 (semana 28/2023)	380	16,325	183	Bovinos 13,278 (81.34%), Caninos 1,505 (9.22%), Ovinos 549 (3.36%), Porcinos 323 (1.98%), Equinos 318 (1.95%), Caprinos 137 (0.84%), Felinos 74 (0.45%), Humanos 64 (0.39%), Silvestres terrestres 25 (0.15%), Búbalinos 19 (0.12%), Aves 17 (0.10%), Conejos 4 (0.04%), Otros 5 (0.03%), Aves silvestres 3 (0.02%), Mular 2 (0.01%)
Nicaragua	Marzo 2024 (semana 11/2024)	424	13,945	184	Bovinos 9,904 (71.02%), Porcinos 2,083 (14.94%), Caninos 826 (5.92%), Equinos 723 (5.18%), Ovinos 249 (1.79%), Caprinos 81 (0.58%), Humanos 55 (0.39%), Aves 14 (0.11%), Fauna silvestre 7 (0.05%), Conejo 1 (0.01%)
Honduras	Septiembre 2024 (semana 36/2024)	95	863	113	Bovinos 754 (87.3%), Caninos 37 (4.28%), Equinos 30 (3.47%), Porcinos 29 (3.36%), Ovinos 12 (1.39%), Caprino 1 (0.12%)

An estimated 800,000 cattle enter Mexico’s southern border annually, herded and transported, from Central America, with SENASICA tags, false tags, and without tags, with and without transit tags. Therefore, there are no good statistics recorded. Mexico exports 1,200,000 heads of cattle to the U.S. annually, including calves and castrated heifers, which balances the national supply and demand for animals for fattening; some enter and others leave. For those who don’t know, the ovaries of young heifers are surgically removed, one by one, both ovaries, in order to enter the export market.

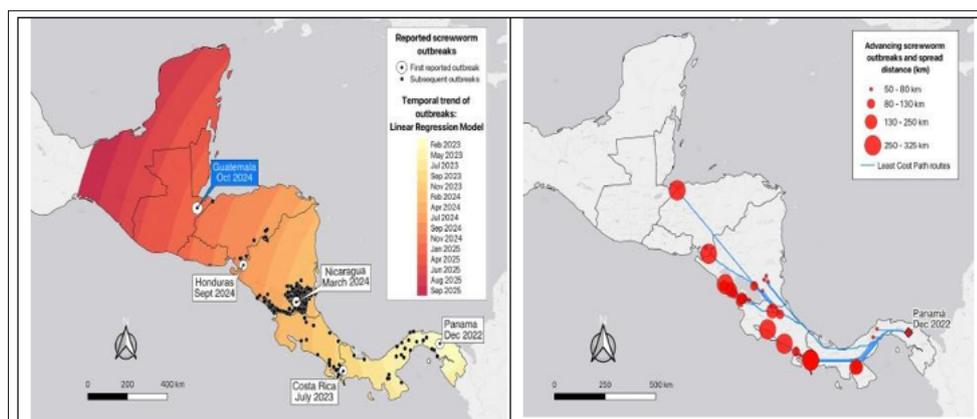
To prevent meat shortages in Mexico and to export beef to the US, the importation process or smuggling routes are experiencing negative consequences. Pupae or cocoons dispersed in the mountains of southern Mexico had already spread for five years, since the border was authorized to open in 2019. They simply awaited changes in their metamorphosis process from larva to pupa and hatching. The animal health consequences didn’t matter until they became noticeable, plaguing humans with a zoonosis. They have tried to minimize the reported cases. It always happens; we just want some cheerful statistics. On May 20, 2025, Honduras will record 49 cases in humans.



Maps And Contraband Hunting Route

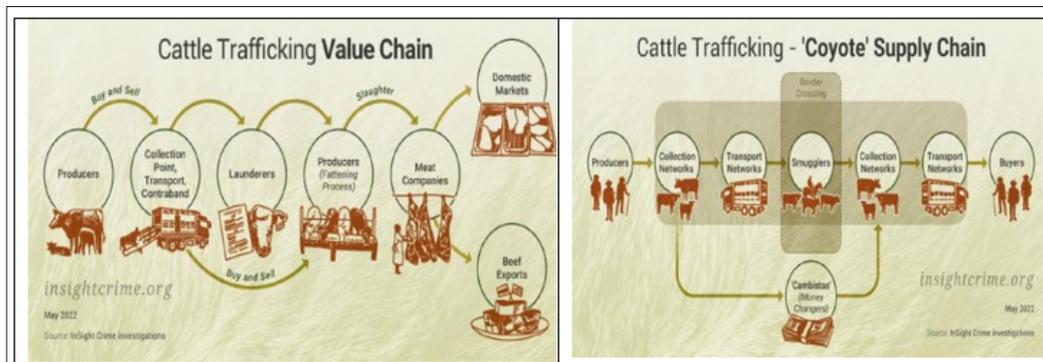


Map of the cattle traffic route across the Guatemalan border. Four routes follow the cattle traffic from Panama until it crosses the border into Mexico. Traditionally, it travels up the Gulf of Mexico, with little dispersion to the feedlots in central Mexico. The darker areas represent, according to census data, a higher density or concentration of cattle, a traditional cattle-raising area. The red and blue dots are cases of the cattle screwworm.



Spatial outbreaks with the presence of the GBNM fly by date. The lightest color is 2023, and the darkest is predicted for September 2025. Geographic distribution of outbreak progress is shown in red circles, and the blue lines are destination routes.

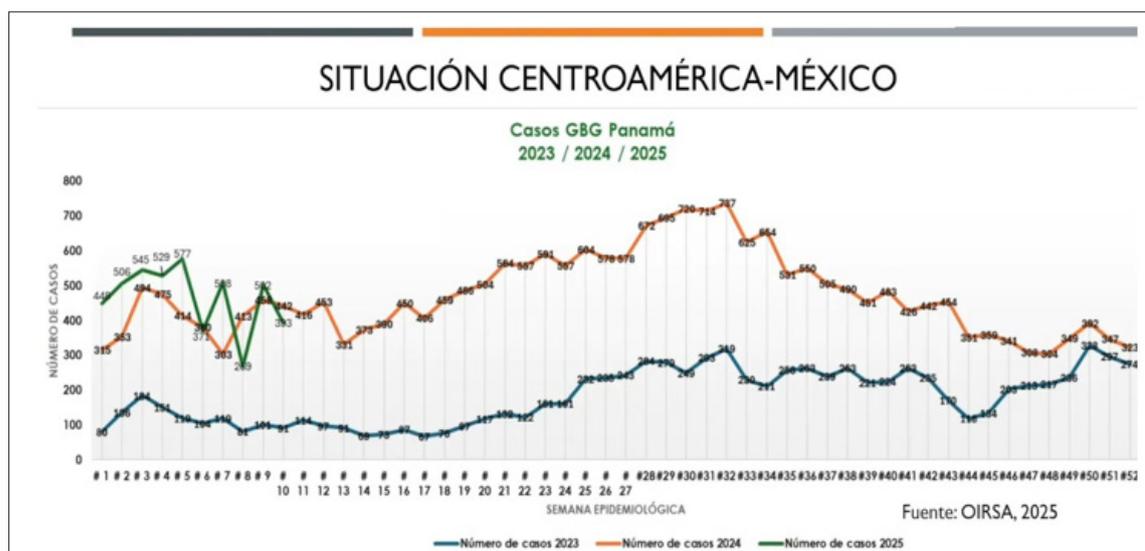
There was time to publish a thesis. Since when has this been going on? Those in Veracruz who are involved in this business keep their mouths shut. In Sonora, we say they're from Pitiquito (shutting their mouths), and the big collectors from Caborca (opening their mouths).



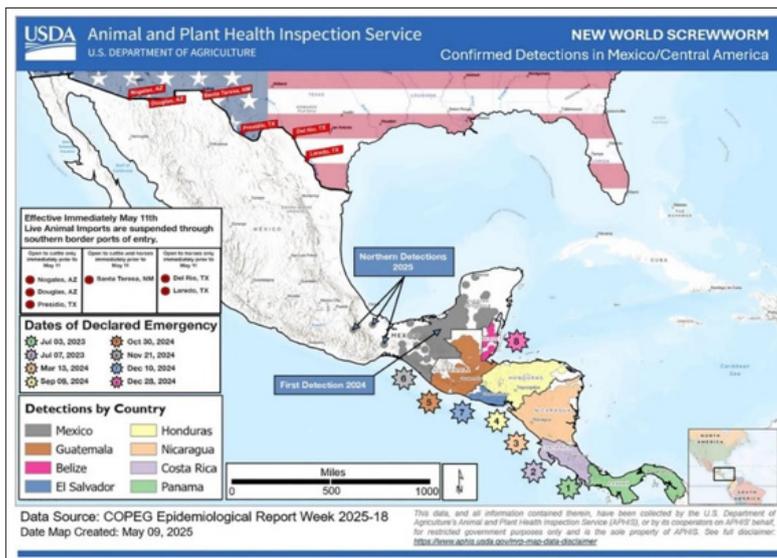
A UNAM study indicates that land smuggling of cattle across the southern border of Mexico-Belize (193 kilometers) and Guatemala (956 km) accelerates the spread of the plague that parasitizes cattle, increasing the country's vulnerability.

<https://programs.wcs.org/5greatforests/en-us/News/ID/23749/Cattle-trafficking-routes-The-screwworms-gateway-to-Mexico>
<https://insightcrime.org/investigations/cash-cows-cattle-trafficking-from-central-america-mexico/> An article of more than 50 pages describes the transit process, washing of cattle with official tags granted by the Cattle Association, use of forage from ecological reserves, etc. They are not detailed here; the source must be consulted.

The beef value chain involves many participants and intermediaries, including the so-called coyotes. Look how quickly herds and people become infested. It is not contagion because it is strictly an insect or parasite. Panama observes changes in 2021, warns of a first warning of increase in August 2022, reports in February 2023 that the increase in worm infestations is unusual, on July 5, 2023, an outbreak of the "disease" is declared nationwide, reporting almost 18,000 cases, Costa Rica is declared in July 2023, in Honduras in September 2024, Guatemala in October 2024, in Mexico in November 2024, quickly by February 8, 2025, there are cases in all 7 Central American countries. Nicaragua in May 2024 more than 3300, Costa Rica 9400 reports and Guatemala recognizes it on October 28, 2024. January-February 2025 Mexico recognizes in Tabasco, Quintana Roo, Yucatán, in April-May 2025 Mexico extends the infestation to Veracruz, Oaxaca, another case in June in Veracruz.



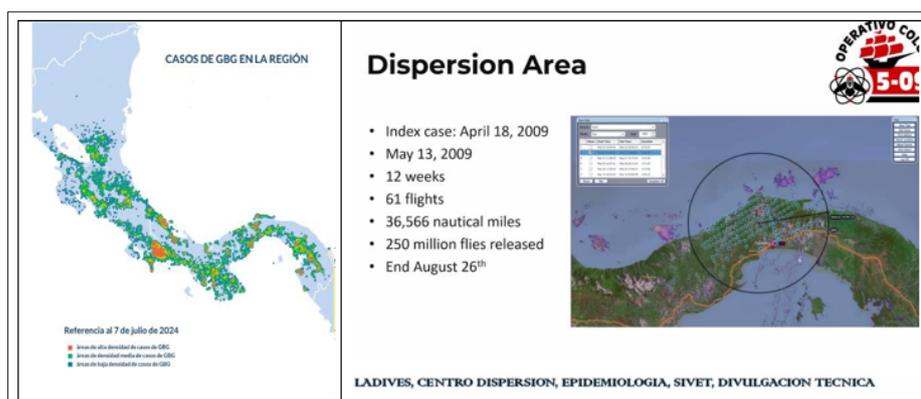
Verde semanas 2025, naranja 2024 y azul 2023



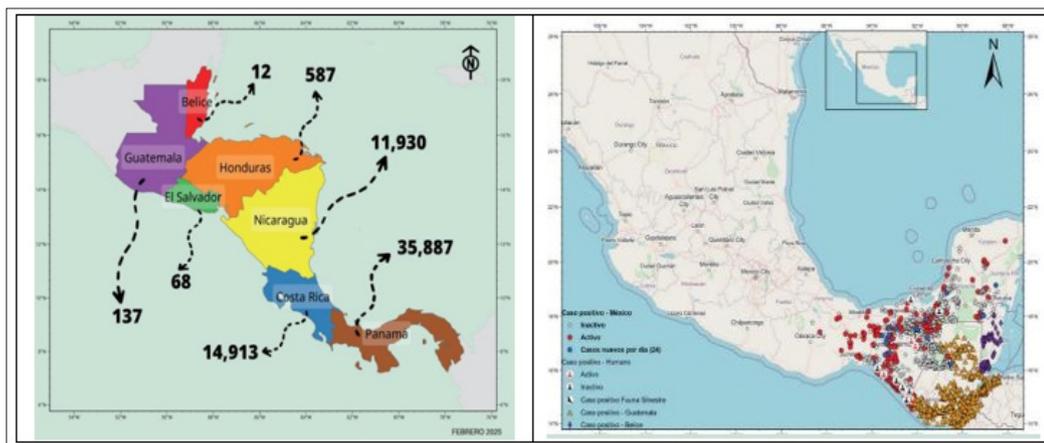
Mexico saw it coming and activated the National Emergency Animal Health (DINESA) on July 29, 2024, but it wasn't enough. A high fly ball to center field provided time to catch it, and they didn't worry until it reached Mexican soil. On November 21, a calf was officially registered as the first case of larvae. See original photo.



On January 18, 2025, 14 cases were officially reported in horses and cattle in Campeche and Chiapas. On May 27, six people with myiasis were found. There are 1,500 reported cases, and more than 900 are in Chiapas. By June 11, 2,095 cases had accumulated in southern Mexico. The majority were in cattle and other affected animals: horses, dogs, pigs, sheep, humans, goats, birds, one eagle, and one cat. It is not contagious, but maggots spread quickly. Mexico is no longer free (1991-2024) from the New World cattle screwworm fly. And the donkey is back to the wheat, even if it causes tympanization or acidification of the digestive system. There was time to prevent it, but there are many interests. See map of Central America as of July 7, 2024.



Screwworm cases as of July 7, 2024. Panama, Costa Rica, and Nicaragua. Orange indicates high-density areas; green indicates medium-density areas; blue indicates low-density areas.



If these countries want to export, they should organize themselves into marketing groups and ship larger quantities of animals to be shipped by sea, as Australia and New Zealand and others do. But ambition is there: a head in Central America costs \$300, and after a week of transport, once across the border with the United States, it reaches a price of \$1,800. The temptation of a quick deal is great.

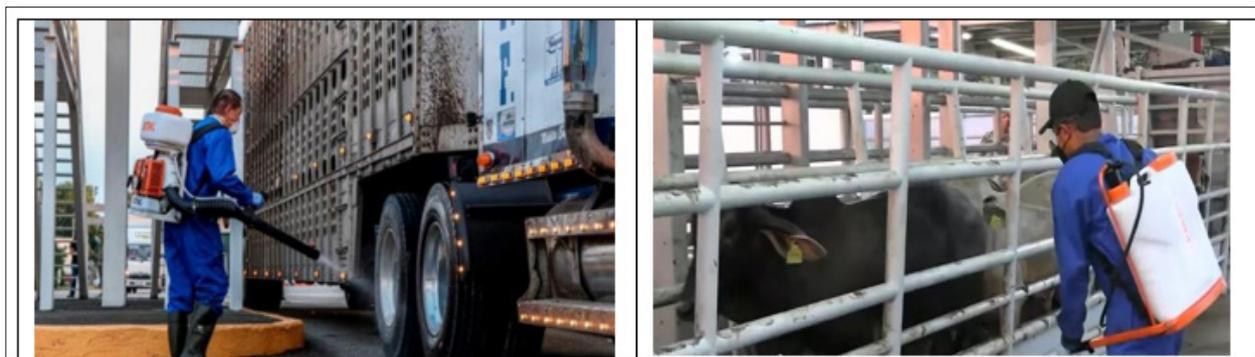
Methods And Strategies

Pablo Picasso says, "Inspiration exists" but it has to find you working. Ordinary citizens should not sit idly by; we must be motivated, interested, attracted, and curious about knowledge, sharing what we observe, since prevention and early diagnosis contribute to the control of GBNM. Considering sanitary control and stopping the plague as a priority, the conscious cooperation and collaboration of any citizen, schoolchild, hunter, cowboy, or rancher is required. Above all, in the event of any sighting, sniffing, or suspicion, it is important to notify trained animal health authorities participating in the state campaign, field managers, local livestock associations, commissioners, and authorities, since only an expert entomologist will make the true scientific identification of the pest or fly, confirming its presence and location. We must all be participants and vigilant in the epidemiology of the parasite, reporting maggot infestations in any living animal. Official personnel will be in charge of the proactive campaign with strategic responses to eradicate the fly and maggot infestations. Giving notice is being part of it. from the outstretched arms of the official campaign program. Without our participation, they simply can't do it alone.

A single unilateral action is not sufficient to control, much less eradicate, the pest. Much needs to be done to strengthen all human and technical capacities, including pharmaceutical supplies, field inspectors, sufficient trained crossing station personnel, and operators at cattle crossing gates with adequate facilities, corral space, and lighting. If immersion baths, which are ideal, are no longer in use, high-pressure spray baths should be built, as in Tazajá, Tabasco, to mist with sufficient length to reach a deep bath of the animal's body as it crosses these facilities, with sufficient time to clean hooves carrying pupae. Transport, trucks with pallets, livestock crates carrying excrement, and fly-catching booths should be used appropriately. The use of trained canine-trained animals to sniff out wounds and odors caused by larvae, especially during nighttime inspections, should include careful human eye support and white and ultraviolet lighting.



We must be honest and avoid botched jobs using gasoline, diesel, burnt oil, petroleum, cresol, creolin, camphor, pinol, mentholatum ointment, or organic oils to supposedly treat injured animals and confuse trained dogs; and above all, we must not sit back, waiting to comfortably solve the problem with the release of sterile flies. Releasing sterile flies is only a small part of the equation, certainly very crucial, but it only works if the entire process is applied; it has no effect on its own. Teamwork and the sum of actions contribute to eradication. Releasing sterile flies doesn't do everything.



Land transport vehicles are fumigated at inspection stations. If a positive animal is found, the entire load is returned; healthy animals are not separated from those with worms. A truck with a sore on its tire is returned with all healthy animals. Nor are animals with a new wound transported across the border. Pig and poultry farmers, during their campaigns, thoroughly wash their vehicles before crossing sanitary lines and entering the outskirts of the farm. We must learn from them. The same is true of South Korea against the African swine fever virus. It has had it at home, but it is eradicating it.

The fly flies 1-15 km and hitches a ride in the cabins of vehicles and airplanes, and tends to hitch a ride on ships, just like the African bee did. It can reach anywhere. So,

Let's do our job well; complete eradication is no easy task. There is a CEACAN dog training center for cattle screwworm control. The center selects dogs and handlers, and trains selected personnel. They work at cattle health inspection barriers installed at federal verification and inspection points (PFIF), such as those in Cosamaluapan, Veracruz.



The truth is that there will be smells of insecticides, pharmaceuticals, packaged pastures, different geographic origins of the animals, and different transported animal species that confuse the canine animal's scent and determination.





The important thing to know is that the slogan “no wounds, no maggot infestation” has its reason, although the female fly may lay eggs in mucous membranes, the nose, ears, eyes, anus, sexual organs, cavities, or orifices that are moist and healthy, such as teats that provide milk, behind the ears, scrotum, or testicles, especially in castrated or injected pigs. If an animal with maggots or myiasis is detected early, it can be cured, restored to health, and reach market weight; if everything is done in time, when there is still a solution by applying the appropriate treatment, don’t wait until it is dying.

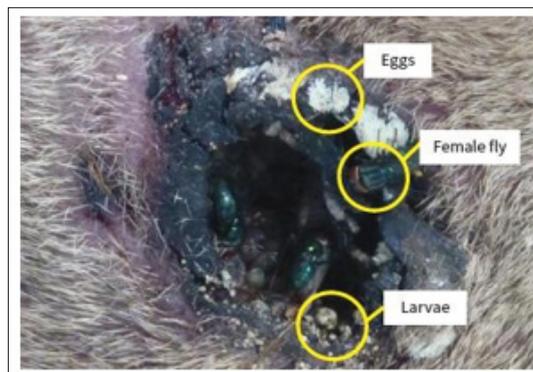
Parte ii Biology of the Parasite

It should be noted that the GBNM fly *Cochliomya hominivorax*, scientifically classified in the 19th century by the Frenchman Jean Charles Coquerel, an authority on its description, was considered a man-eating zoonosis, hence its name. It is a dipteran with a complete biological life cycle (RRAFOS). The female is monogamous with a single fertilization, mates only once in a short life of 30 days, and rations semen with each oviposition, similar to breeding hens when they lay fertile eggs. The females lay 200-500 eggs, each less than 1 millimeter in size, in the wounds of warm-blooded animals, arranged in the form of aligned tiles. They repeatedly search for the same or another cut animal for five days to lay more eggs.

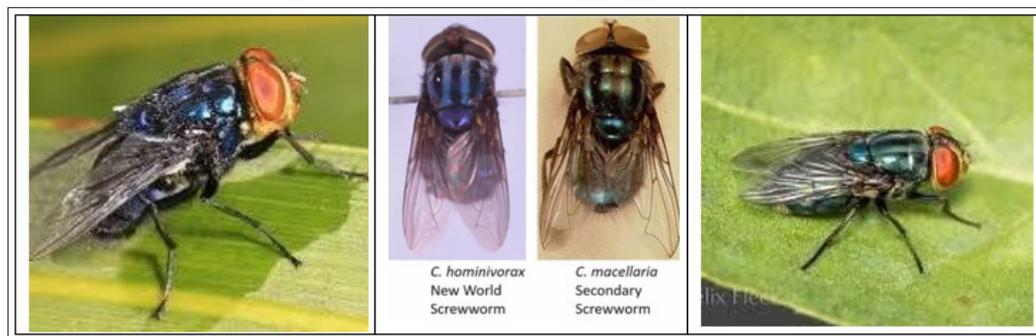


Under favorable conditions, the fertile fly can lay four eggs in less than 15 minutes, and the eggs laid at the wound edge hatch within 12–24 hours at a room temperature of 35°C and subsequently penetrate the muscle. They attach to the tissue and tear it open to feed on tissue fluid. During their growth, they molt to L2 and L3 larval instars.

The egg has a creamy white envelope, or chorion, 1 millimeter long and 0.22 mm wide. It contains an embryo that fully transforms into a larva before hatching in less than 24 hours. It can be said that at this stage, it causes no harm to the host.



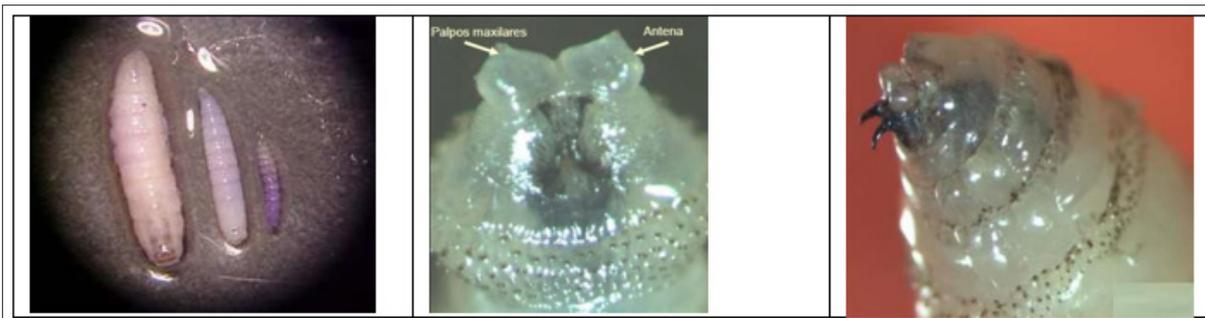
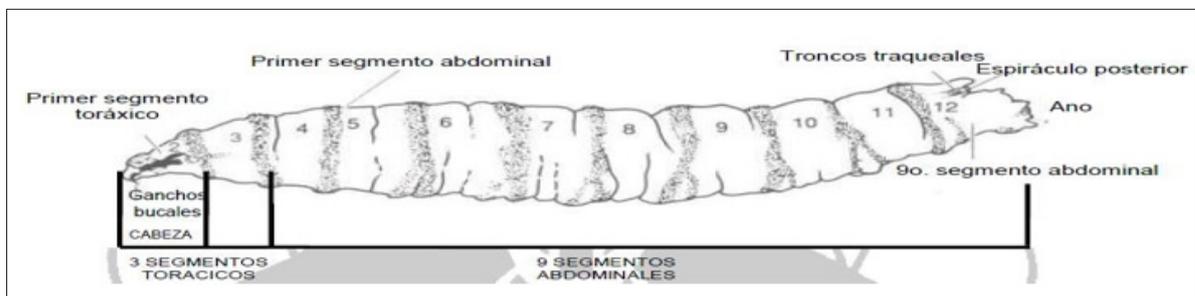
In the cut, the adult female fly can be seen laying new eggs at the edge of the wound, with larvae deep inside the muscle. Other flies enter to feed.



Cochliomyia hominivorax has three horizontal stripes on its back. They feed on serum or juice secreted when breaking living tissue with their two pincers. *Cochliomyia macellaria* (Fabrocius) above, reaching the wound later, as there is greater muscle damage.

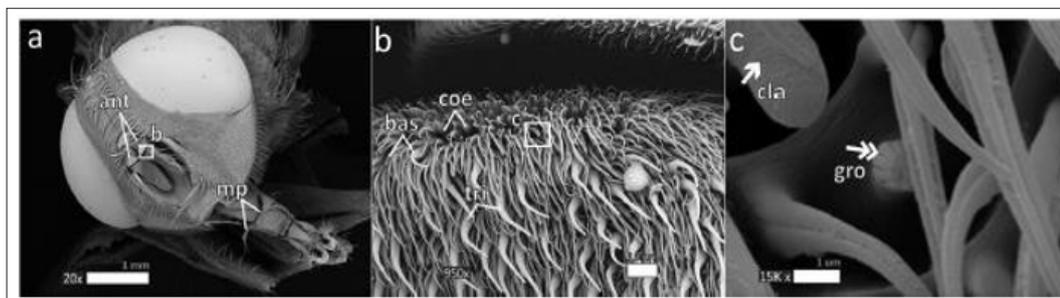
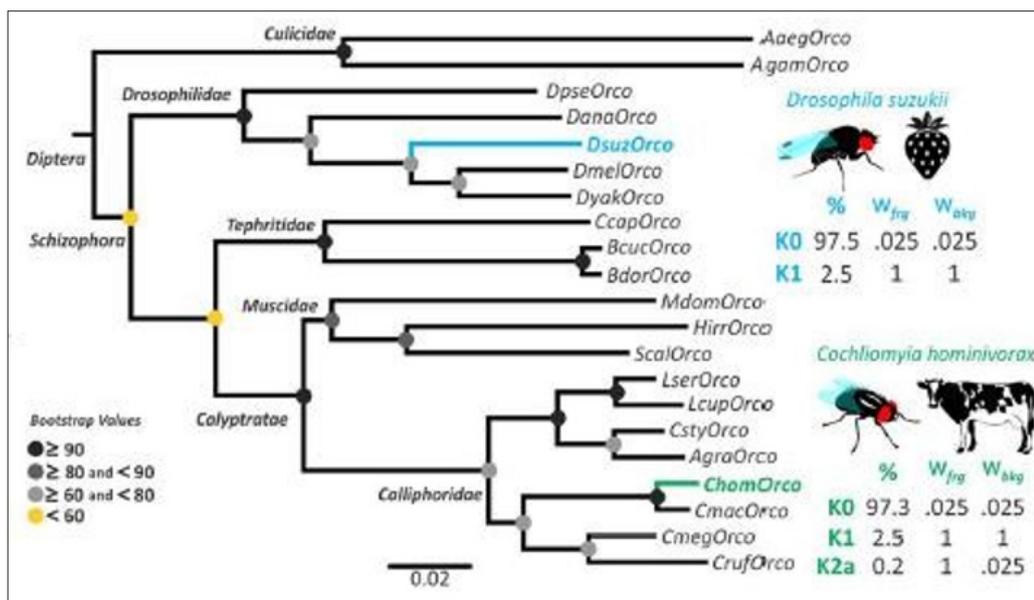


Female fly with eggs. Egg laying with the eggs arranged in an orderly manner resembling a roof. Dorsal suture of the egg. Micropit of the egg. Eggs with suture and micropit. L1 larva, L2 larva, L3 larva. Larval segments. Typical larval structure.

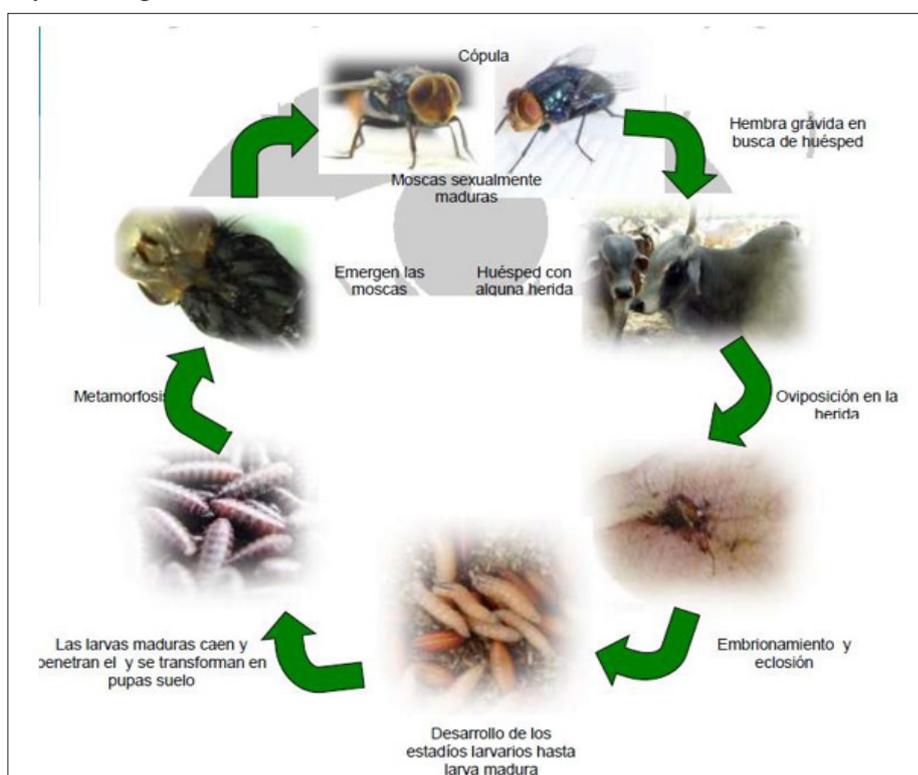


Anatomy of the L3 larva: cephaloskeleton. L3 larvae, mandibles. Posterior spiracle (tail) with peritreme and respiratory openings. L3, L2, and L1 larvae. Maxillary palps and L2 antenna. L3 maxillary hooks (red).

The purity of the species is defined by its olfactory system, since the *DsuzOrco* gene is for the blue fruit fly, and the green *ChomOrco* gene directs its olfactory system toward warm-blooded animals. This prevents highly similar fly species from interbreeding.



Flies use scent to locate food and egg-laying sites. The Orco gene for the New World screwworm fly is the *ChomOrco* gene, giving the species-specific behavior of feeding, sniffing out reproductive pheromones, and specializing in choosing egg-laying sites. If they lose the Chom organ artificially or through mutation, their sense of smell directs them to flowers and fruits.



Life cycle of *Cochliomyia hominivorax*



Confirmed cases in dogs (top). Cases in cats (bottom). Left face and neck, other cat's hand severely affected



Myiasis in a dog with a moderate lesion on the shoulder blade. Treatment progress 24 hours later.





A: Dog with maggots in the neck, B: Dead larvae emerging from the wound 24 hours after treatment, C: Progress at 24 hours, and D: one month after treatment.

Report of the fly's entry from Brazil to France in 1990 with a traveling dog as a carrier. Hoping that one day the opposite doesn't happen and foot-and-mouth disease or *Colchliomyia bezziana* reaches America.

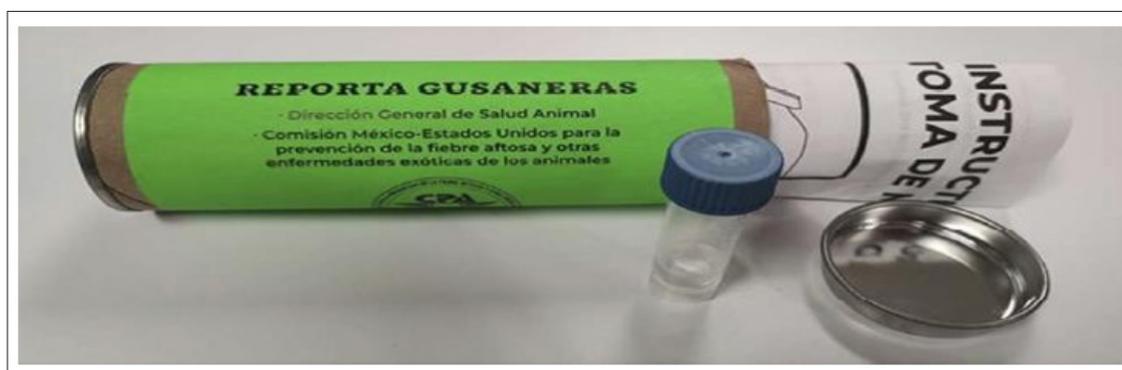
There are other flies of the genus: *Cochliomyia minima* (Shannon), *C. aldrichi* (Del Mona), and *C. nacellaria* (Fabricius 1794) are secondary parasites that feed on necrotic tissue, altering the quality of the samples from the GBNM larvae test tubes. Keep an eye out for these confusing invasive insects when taking samples. Leave the identification to the entomologist; you send the sample, collecting the larvae from deep within the wound.

NWS Sample Collection Protocols

- Supplies:**
 - Gloves
 - 70% alcohol (ethanol or isopropyl)
 - Forceps
 - Screw cap vial or container
 - Tape to seal container
 - Plastic bag with a zipper closure
 - Parasite Submission Form VS 5-38
- Collection Procedures:**
 - Using forceps, gently remove larvae of different sizes from several sites within the open wound
 - Ensure samples are removed from the deepest part of the wound, secondary myiasis may be present
 - Place the larvae in the vial or container and ensure it is completely submerged in alcohol
 - Seal the container and place it in the plastic bag for shipment



Follow protocols. Test tube with alcohol-free samples.



For sampling worm-infected animals.

Secondary species are good for supporting forensic experts in necropsies. There are invasive secondary facultative species such as *Phormia regina*, *Lucilia sericata*, *Calliphora vicina*, *Chrysomya rufifacies*, and accidental species. They should not be confused with the cattle screwworm. It has nothing to do with *Colchliomyia hominivorax* GBNM.

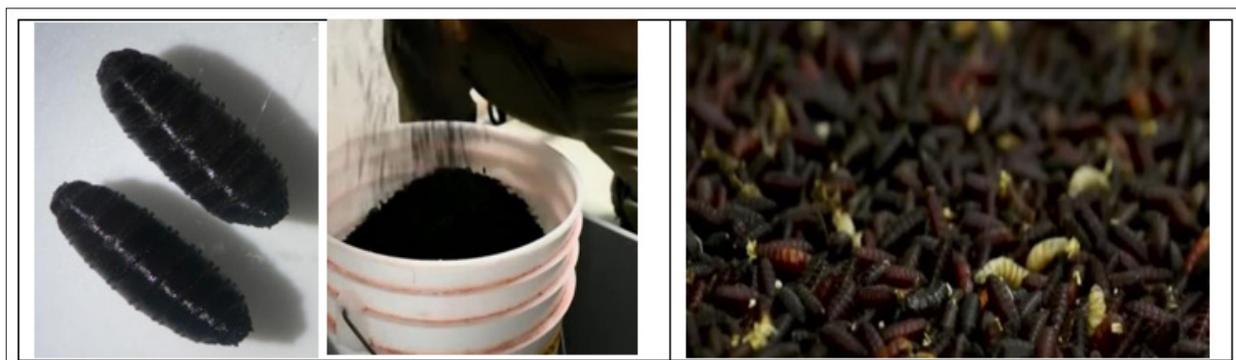
<https://ecuador.inaturalist.org/taxa/120922-Cochliomyia>

This fly, *Cochliomyia hominivorax*, has a diurnal preference and its activity ranges from 18°C to 33°C, with a peak activity preference at 25°C-30°C, with a relative humidity of 80%. They are very inactive at night and slow down below 15°C. They are bothered by windy days; populations are highest in regions with over 1,500 millimeters of annual rainfall. Their population distribution is not uniform for each habitat. They prefer wooded areas, jungles, and forests, but they will not rule out preying on animals that are in

open grassland or flat terrain to lay their eggs. It is advisable to conduct vegetation index studies before combat. They can fly to an island 5 kilometers away to lay eggs. Their sense of smell is highly specialized.

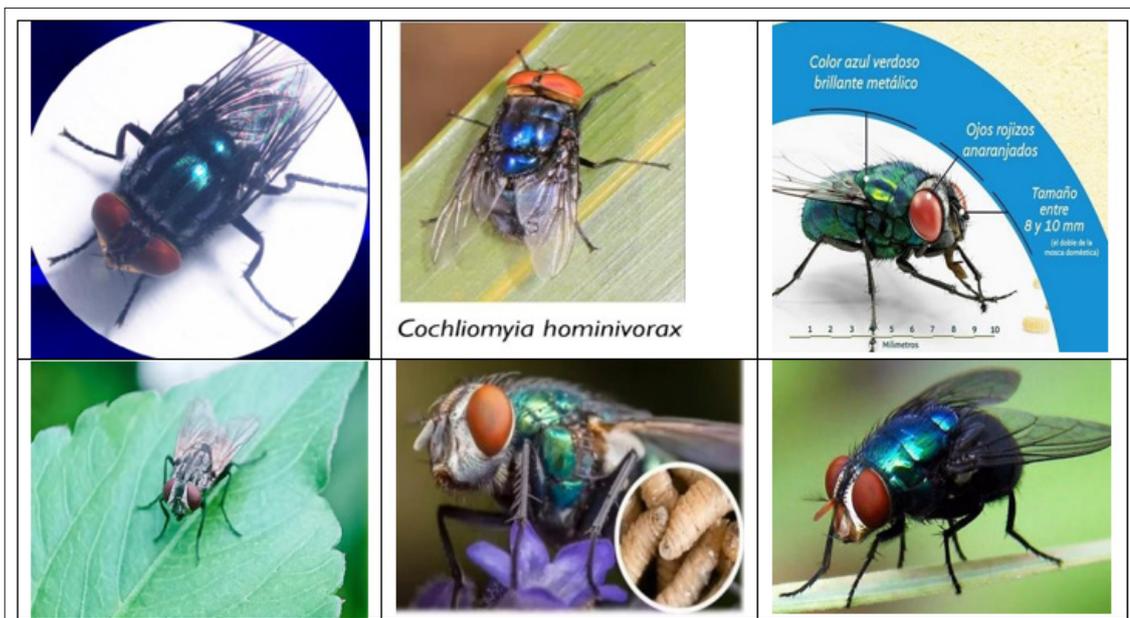


Pregnant or male-fertilized females are attracted to cuts and can fly for miles in search of exposed prey, not to eat, but to lay eggs and reproduce. The eggs laid by the fly on the edge or periphery of the wound quickly hatch in less than 24 hours and feed on muscle in the first instar L1 larval stage, cylindrical in shape, with a soft, calliphorid body without distinction between the thorax and abdomen. They take 7 days to reach an L3 size of 17 millimeters in 12 segments, before falling to the ground to mature as a pupa in a protective casing or puparium for 7 days or more and hatch as a virgin fly that matures in 3 days to reproduce, giving time for the micropyle to form to allow the entry of sperm. Upon receiving semen, it takes 3 more days for the ovaries to mature physiologically and begin laying at intervals every 3 days. It is an autogenous fly, not requiring an initial feeding of a protein-rich source to mature the first eggs. The male matures sexually after 2 days. The longevity of the fly is 30 days, that of the male 14 days. In its life cycle it manages to lay 1000 to 4000 eggs. The OIE Terrestrial Manual 2019, Chapter 3.1.14, states that the complete life cycle of the NWS can take 2–3 months in cold weather. It cannot develop eggs at temperatures below 10°C and does not reach habitats above 2,000 m above sea level. However, in temperate conditions with an average air temperature of 22°C, it completes its life cycle in 24 days, and in tropical conditions at 29°C, the life cycle is 18 days. Pupae do not mature well in flooded soils, very low temperatures, extremely high temperatures, or sunlight.

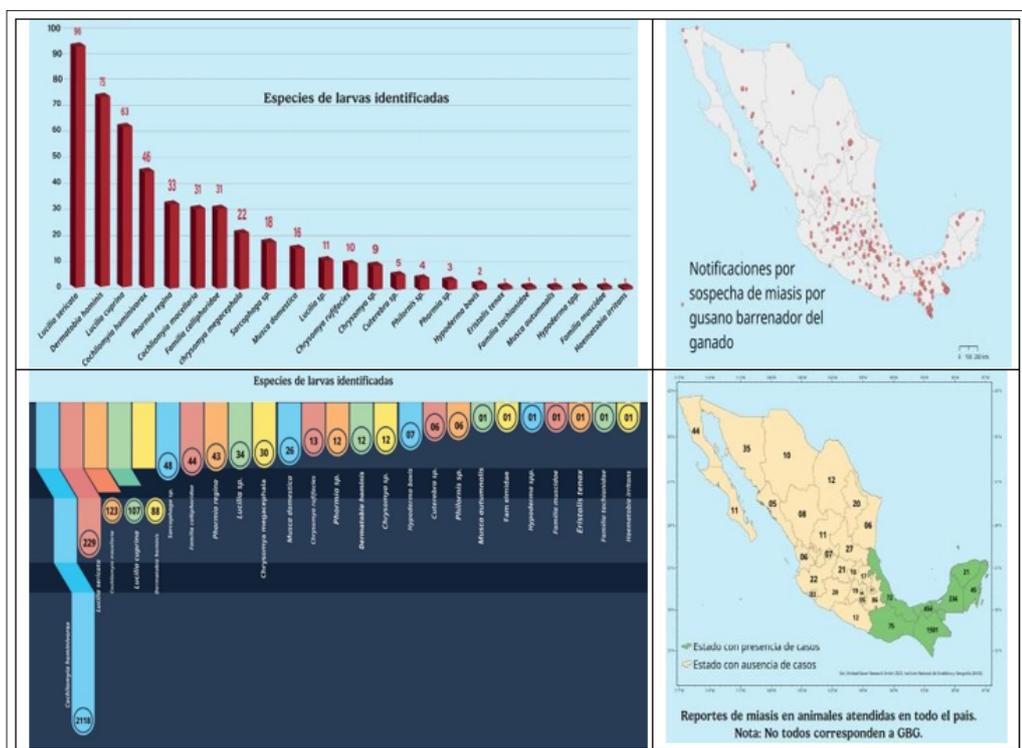


The dark brown or light brown pupa is encased in a protective cocoon measuring 10 millimeters long by 4 mm wide. Bands of sclerotized spines from the previous L3 stage can be seen. This allows it to wait 7 days to 3 months to open or break the cocoon and emerge to the surface from a depth of 5 centimeters, burrowing in the soil or leaf litter as a young, sexually immature fly. It waits a few hours for its body to dry and its wings to harden before unfurling. Fumigation with the pupa buried in soft soil is not effective. There is no contact with the poison. There is much to learn about the biology of the GBNM fly.

Screwworm larvae are gregarious and feed en masse on living tissue, primarily from a fly (insect) that causes maggot infestations or myiasis in warm-blooded animals and mammals. The resulting pathology involves muscle trauma from the larva's mouth hooks and highly toxic waste. The open wound promotes bacterial infections that must be treated diligently, as there is repeated oviposition by the same fly and other GNM flies, as well as by various secondary species of other flies. The GNM fly is adapted to the humid forest environment with shade and leaf litter that protects it from the sun. It is somewhat less beneficial in deserts, but there they fly longer distances, 4–29 km daily and up to 150 km weekly. Their 60-year control has given them resistance to insecticides. Mexico has had studies dating back 25 years. Have new assessments been initiated yet? The experiences of other countries can be consulted. The male fly is polygamous and can mate up to six times with several females. While searching for a virgin female who will accept it for mating, it feeds on flower nectar, worms, and body juices from wounds and carrion fluids. Therefore, poultry farms, pig farms, dairy barns, feedlots, and milking pens must monitor their facilities for sanitation and cleanliness, ensuring they are aware of any wounds and signs of worm infestation. There are currently several reports of rural backyard chicken coops with myiasis, so the fly isn't particularly aggressive; it will eat anything, even when the birds' temperature is warmer than its biological needs. Since there are no other options, the flies will eat the birds, although they are not their favorites.



The cattle screwworm (GBNM) is larger than a house fly. The pupa is larger than the fly itself. It has nothing to do with agricultural pests like the famous fruit fly *Drosophila melanogaster*, much less with the corn and sugarcane stalk borer *Diatraea saccharalis*, nor with the coleopteran blackfly *Phyllophaga* beetle. Not to be confused with the commercial breeding of the blackfly *Hermetia illucens* to produce insect protein to feed fish, pets, chickens, and pigs. This quality of protein may be very expensive for dairy and beef cattle.



Larval species identified during the campaign. Suspected cases only.

For a comprehensive and accurate survey of fly species found in southern Mexico. This thesis is from UNAM.

It is not the reader's responsibility to know the 10,000 genera with 160,000 species of midges in the world and differentiate the saprophytes that feed on corpses or dead tissue, the forensic flies that also have a metallic color, the horn fly *Haematobia irritans* a muscid that infests beef cattle, which are fierce hematophagous biting to suck blood mainly in dairy stables, the meat fly *Sarcophaga carnaria*, there are facultative ones that eat the flesh of dead animals but also infest live animals, *Stomoxys calcitrans*, the metallic fly *Lucilia caesar* blue-green feeds on nectar, excrement and corpses, *Lucilia sericata* has reached Canada in benign years, the horsefly *Dermatobia hominis* that parasitizes other human bloodsuckers (mosquitoes, fleas, bedbugs) leaving its eggs in them while the sucker infests the dermis of humans leaving a few sticky eggs, the family of horseflies very popular for their bites on humans to suck blood, of which there are 207 species in Mexico



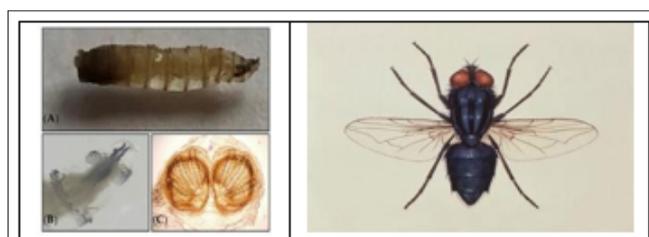
A gray fly that has been parasitized by the eggs of another species. The other wild and fertile flies of the New World screwworm. Below right are sterile. Irradiated female pupae become sterile and mate with fertile wild males, but their eggs do not hatch.

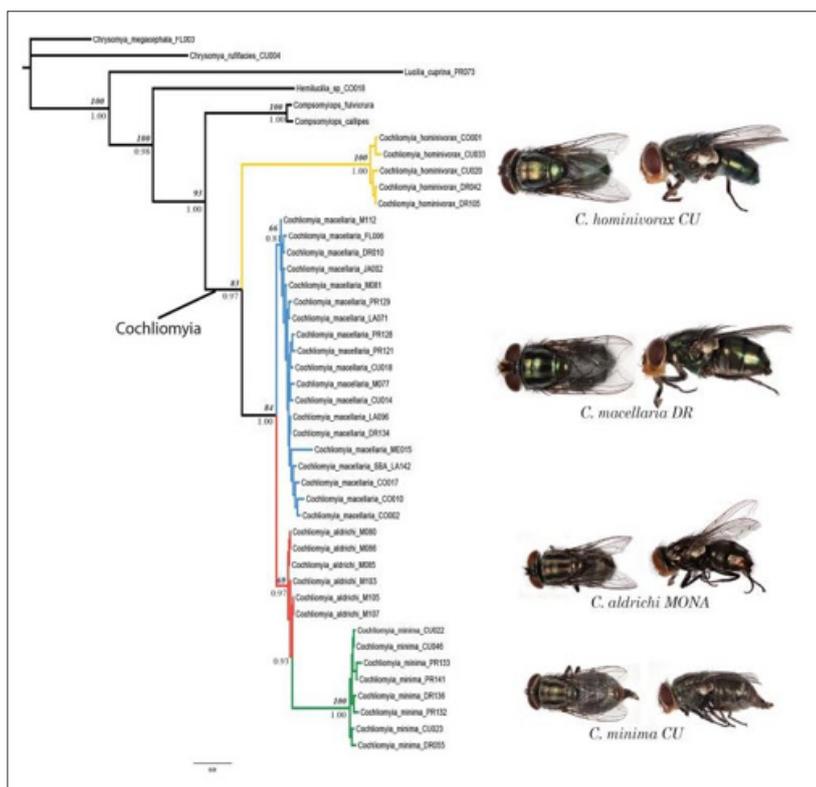
For the purposes of this simple article, there are 100 species of flies worldwide that are considered dangerous in livestock farming, particularly those that feed on live animals with fresh muscle tissue, boring down to the bone. Classification by cutaneous myiasis: Cuterebrinae, Hypodermatinae, Calliphoridae, Sarcophagidae. They settle in body cavities of the digestive tract.

The fly-colored *Chrysomya bezziana* (Villeneuve), already mentioned in this article, is the Old World screwworm fly present in Africa, Asia, and the Middle East. There is a sterile GBVM fly breeding facility in Iraq and Australia. There are other sterile fly laboratories for agriculture on six continents specializing in fruit and vegetable pests. Mexico has a new one under construction for fruit flies and is about to rehabilitate the old plant against the GnMW fly. New or rehabilitate the old plant?



Cochliomyia macellari





Phylogeny of *Cochliomyia*



For illustration purposes only: *Chrysomya megacephala* adult insect raised in a laboratory. Different stages: Egg, L1 larva, second instar L2 larva, L3, mature L3 growth with food, pupa, and male.

LEBANON. Unfortunately, the New World screwworm (GBNM) from the Americas, *Cochliomyia hominivorax*, had crossed into Tripoli in northwestern Libya. In the summer of 1988, academics from the FMVZ of the Great Al-Fatah University in Tripoli, Libyan Arab Jamahiriya, observed atypical maggots, with larval development of 5-7 days, in cold weather they persisted up to 65 days, they burrowed into the ground as a pupa with a brown cocoon, the academics feared damage to wildlife as well as livestock farmers, they took samples to corroborate by sending them to a second British morphological identification study, establishing themselves in flocks of sheep in North Africa in 1988 corroborated by FAO in March 1989. Three tests and a fourth later.

Before developing a sterile fly release program, a collection of New World screwworm pupae was taken from Tripoli to the Biosciences Research Laboratory in Fargo, North Dakota, USA, to determine whether the wild strain that had invaded Lebanon was sexually compatible, without reproductive barriers, with the sterile flies produced in captivity and brought from the Chiapa de Corso facility in Chiapas, Mexico. Once the feasibility of using the technology was confirmed, 70 million pupae and flies were shipped weekly. Mexico had the capacity to produce 500 million flies weekly.

As a non-endemic region, it was quarantined. Sterile flies from the plant in Mexico had to be shipped during the 1989-1991 campaign.



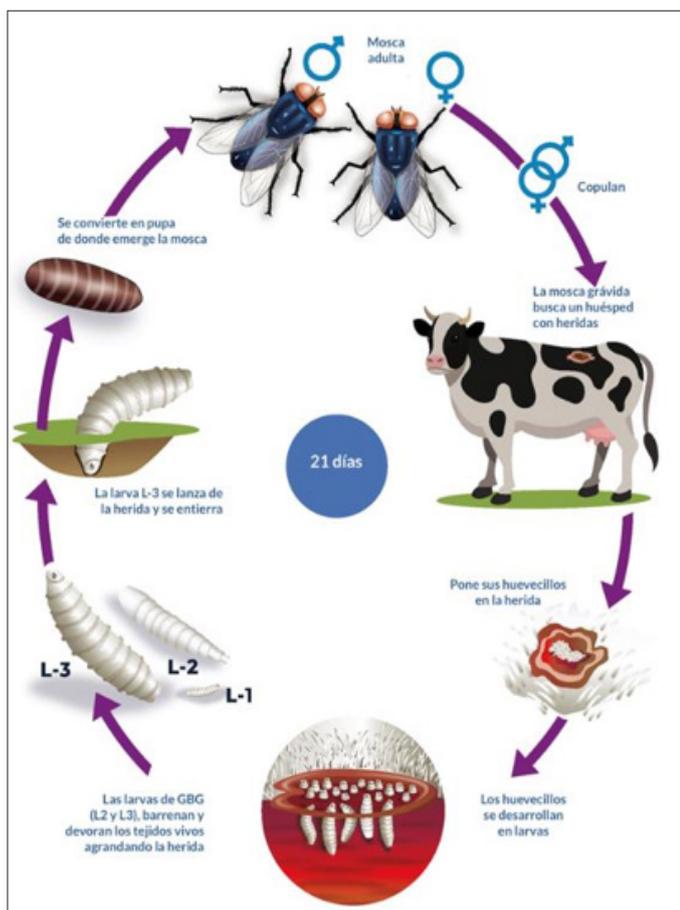
Zootechnicians in Lebanon check animals for pests, and herds are sprayed with insecticide. Photos from Mexico of the packing of the release boxes, sifting the pupae from the sawdust, air shipment to an international airport for a flight to Lebanon, and subsequent release of the boxes with the sterile flies.

<https://www.fmvz.unam.mx/fmvz/imavet/v3n1a03/ivv3n1a03.pdf>. Extensive history of the GBNM fly from a UNAM journal. It should be read carefully.



The narrow eye slits almost touch, indicating that it is a male. The female has a broad forehead and widely spaced eyes. Hand-healing a tapir, the wild fly survives

by eating nectar, protein from wound juices, and other feeding behaviors that allow it to survive and multiply in harsh environments. Yes, its life cycle is short, but oh how quickly they become abundant, harming animals.



**Parte iii
 Suppression Phase**

Without the use of sterile fly release. These are common practices carried out in Cuba and South American countries, except Chile, and possibly Uruguay. In Brazil, 160 larvicidal products are approved to combat the New World screwworm (NWMB). Topical products are highly effective in L1 and L2 larval stages, acting in less than 36 hours. However, contact with the larvicide sometimes results in the death of a few L3 larvae, while 70% accelerate early development, anticipating their pupal encapsulation phase and falling to the ground. Coumaphos + propoxur, chlorfenvinphos + dichlorvos, cyhalothrin + propoxur,

cypermethrin + DDVP + citronella + castor oil + metallic aluminum, cypermethrin + DDVP + silver sulfate + aluminum. This late killing of the L3 larvae jeopardizes the intended primary effect. The pupa becomes a fly later.

Injected avermectin does not act as a preventative, nor does dichlorvos. Topical products (30% dichlorfenthion + 0.32% fipronil) are much more effective. Oral, topical, spreadable, dusted, sprayed, dipped in dips, and systemic insecticides, ectoparasiticides, endoparasiticides, and antiparasitics for pets are doramectin (ivermectin), abamectin, albendazole, macrocyclic citrones, eprinomitin, moxidethrin, coxantel, subcutaneous injection, or dermal application in powder, paste, or liquid form of antiparasitic carbamates, pyrethroids, pyrethrins, and organophosphates, comafos 3%, coproxur, nitenpyram, spinosyn, isoxazoline, and constropilifox. The use of ear implants, necklaces, earrings, ear tags that release insecticide over a prolonged period, ixtle bags, donut-shaped rings, rollers impregnated with insecticides that are smeared on the backs of cattle when they go to drink water, and

food attractants for wildlife to force their entry and cause neck contact with the deworming poison containing marker paint, should not be ruled out.



Alternatives include Dectomax for horses, deltamethrin, cypermethrin, phenol, thiamethoxam, dinotefuran, ethion, piperonyl butoxide, and diazinon. There are adulticides aimed at reducing the population of mature, fertile flies; they are not for general use.

Can they be used in Mexico? Do they require a prescription from the Mexican Ministry of Agriculture (MVZ)? Some good products are not authorized. The golden rule is to change the family of veterinary drugs to avoid resistance to acaricides.

It should be noted that ivermectin, a systemic insecticide administered subcutaneously, although there is also an oral formulation, had already been showing resistance in cattle ticks since 1980. It was taken off the market for a time, returning with chemical changes to its molecule in 1986, even in pigs to combat digestive parasites and not ectoparasites of the skin. Injectable ivermectin is 90% effective, providing 15 days of protection at a dose of 200 micrograms per kilogram of body weight.



It's been a long time since then, but people still believe in deworming despite the many environmental, ecological, and beneficial soil fauna warnings. It's said to have a low purchase price, and a dose of 200 micrograms per kilogram of live weight quickly kills larvae in 1-3 days and provides protection against re-infestations for 15 days. Therefore, it's mandatory to inject 7 days before granting an export permit.

Little is actually done to combat the adult hoverfly as an insect pest. Aerial or tractor spraying of pastures and corrals is ineffective. Malathion can be used against flies on surfaces and nearby spaces. It's not used on large areas because the insecticide also eliminates beneficial fauna. For vehicles, stables, and animals, use sodium sulfalaureate, geraniol, eugenol, menthol, castor oil, and neem oil, which all truck drivers must carry as repellent. Pine tar on surfaces. <https://www.aphis.usda.gov/sites/default/files/pesticides-for-nws.pdf>

Traps with specialized lures for wild GBNM flies are used as attractants (sucrose, indole, yeast, trimethylamine, powdered egg). These are used to detect the presence of species and scientifically identify them by an entomologist, as well as estimate population density and location. This is not intended to eliminate the pest invasion, but rather to alert the dominant direction. Even if you read the entire 1985 manual, the identification is carried out by the National Reference Center for Animal Pathology and Analytical Technology (CENAPA).

<https://www.gob.mx/senasica/documentos/manual-de-identificacion-de-gusano-barrenador-del-ganado-y-su-diferenciacion-de-otras-especies-causantes-de-miasis?state=published>

Sterile flies released in the field are also monitored. Males require a sexual attractant, and females are attracted by wounds or artificial scent.



It requires a rigorous sampling methodology; without it, diagnoses lack estimated precision. They must be planned and targeted to be valid and useful. It's not random. They are still calculations against nature's predictions. It's already raining in July 2025, and trends are changing. Traps must be replaced frequently; dust and rain limit their attraction and their effectiveness in sticking individuals. The pupae underground are protected from predators and dehydration from the sun. It would be necessary to track them with agricultural machinery to expose the pupae to dry air, or select native entomopathogenic organisms as predators, or entophytopathogens that infect the insect naturally for biological control (without chemicals), or wild enemies to feed on them. A similar example would be the anteater. What species does this GBNM fly really crave?

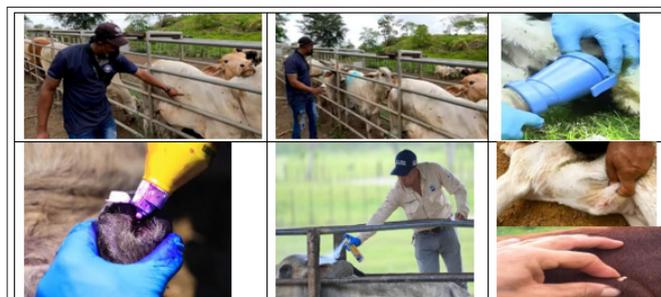


So, to avoid confusion, we, the common people, contribute to the quality of the collection and delivery of larval samples in test tubes filled with alcohol, and we leave the species classification to the official entomologist for the 2025 campaign at the National Center for Animal Health Verification Services (CENAPA). He's

almost certainly trained to make a determination. The tubes should be distributed widely for the collection of larval samples placed in live animals. Ten-gram sachets of comafos for wound dressing are given away. They shouldn't be pinched.



The easiest way for the *Cochliomyia hominivorax* species to multiply GBNM fly populations is to find a newborn mammal and lay eggs in the fresh navel, which takes months to close. Therefore, livestock producers must clean the umbilical cord of each newborn and female, massage thoroughly with disinfectant, dip in 7-10% liquid iodine or 11% iodine tincture, use organophosphate insecticide on the cut, apply a wound dressing, and sprinkle with Negasunt larvicide, a blue-green powder used in the campaign. Treat for ten days. Act and take action, and don't just let the navel air dry as normal. It's easier to prevent egg laying than to go around treating and removing maggots one by one until none remain inside.



	<p>For a longer-lasting Negasunt applied to the skin opening, it can be mixed with cooking oil or another ointment that adheres longer than the powder alone. The spray is only for eggs and L1 larvae. For L2 larvae, ointments and salves are required. For more mature L3 larvae, worm-killing liquids are used, thoroughly scrubbing the depths of the myiasis.</p>
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There are other pesticides for topical treatments, such as permethrin, and the use of systemic pesticides requires official approval and a prescription from the Ministry of Agriculture, Livestock, and Livestock (MVZ). <https://www.youtube.com/watch?v=snnka7c7oec>

An umbilical cord infection can progress to secondary sepsis, worsen into abdominal omphalitis, and subsequently lead to death from toxicity or secondary bacterial infection. In humid climates,

65% of umbilical cords become infested. Infestations increase during the frequent rainy season, with 4-6 uninterrupted days of rainfall per week. During the dry season, 7% of calves become infested. What do you choose: dry or rainy?

The number of sterile flies required to be released is based on the estimate of existing flies flying on a ranch through field sampling using traps and is calculated by multiplying by ten: 1 existing wild fly quantified in the field X 10 sterile flies released as pupae or flies.



Released infertile male flies are individually enumerated for sampling and monitoring with traps to determine if they are active and their working area is within the release zone. Or if they simply remained still at the same release site. They must also go out to search for mates.

Therefore, the suppression phase should require the greatest effort of the campaign. Reducing the insect's population density must be inherently low to allow for the effectiveness of the sterile insect technique and, through the cycles of the reproductive process, to eradicate or exterminate the pest in stages. A normal wild population of X fly species is approximately 40-400 individuals per square kilometer. *Cochliomyia hominivorax* GBNM has around 40 fertile wild flies. This average must be lowered by sampling with greater strategy and dedication. First, reduce the population and then release sterile flies from the laboratory. If this is not done, the system will not work.

All participants must be deeply involved in the details and committed to their effective implementation to reduce the number of flies on a ranch. Capture fertile insects, collect eggs, treat any animal with an open wound, and maintain strict epidemiological surveillance. Have you already trained your rancher or your son? They are also part of the equation. Don't leave them alone without training.

If the weekly numbers decrease with increased effort, then sterile flies can be released. Remember that pupae that are not visible in the soil can re-emerge within a few days. A lower density of released flies has little effect on reducing population generation, and large quantities must be dispersed. Don't be pushy. A significant impact on fly birth control is achieved by dispersing 50 million sterile flies weekly for more than three months during the dry season, over an area of 130,000 km², with flights in a line 1 km apart. If all goes well, a target area can be eradicated in 6 months.

Every animal requires daily primary skin examination, treating lesions quickly, with deep healing using deworming, healing, utopic repellent and repeated frequently for days until healthy

healing, preventing the oviposition of female flies from repeating in any new fresh wound or scratch of the skin, healing even when it has not been infested or parasitized by eggs or worms.



Livestock farmers in the northern hemisphere should conduct controlled breeding; wait until late fall, when the weather is dry, to perform injections, ear cropping, shoeing, ear banding, dehorning,

nose ringing, trimming, castration of females and males, treating scratches from heat mating and male mating, monitoring management practices during herding, ensuring contact with thorns, scratches from barbed wire fences, and impacts from loading that cause trauma, checking newborn navels, observing milking teats, and docking piglets and treating them promptly, not letting them go untreated. Do not wait for the fly to arrive. Prevalence of injuries in Mexico, most affected animal species, and states.



It should be emphasized that it is necessary to remove the worms manually. Thorough removal of larvae involves more than just injecting dewormer and spraying with violet. Applying a small stream or pour-on of mosquito repellent along the back or spine is essential. There are many brands and products. The worms must be carefully removed, and once removed, the wound must be treated and the animal properly treated. Relieving the worms is one thing, but sending larval samples for identification is another. Proper individual care of each parasitized animal and official local inspection of each production unit (ranch or field) is key to the entire campaign. The quality of the sample collection, from 10-15 specimens collected from the depth of the wound, contains several worms or larvae in a tube filled with alcohol for intact preservation, allowing for precise taxonomic identification under the microscope. Identifying the worms as a New World screwworm in the Americas (GBNM). To scientifically determine the species, research laboratories include cuticular hydrocarbon analysis, mitochondrial DNA identification, and random amplified polymorphic DNA polymerase chain reaction (RAPD-PCR). Serological testing is not performed.

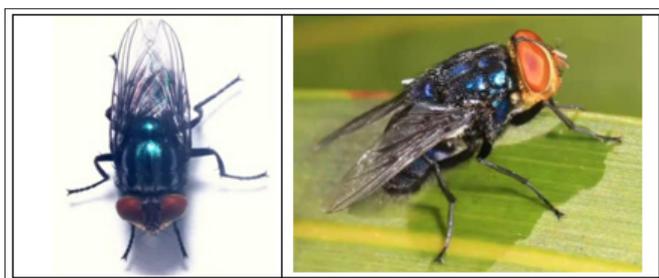
As the days go by, larvae of other secondary fly species will appear on the surface of the exposed wound, so the larvae deep within the wound must be selected; they are the ones that arrived first.

The necrotic tissue, where the flies that feed on dead tissue live, is removed. Furthermore, proper wound care should not leave any larvae inside. There can be no doubt or suspicion that a larva is present in the wound before applying any dye-based product, which would prevent proper visualization.

En la prevención se deben curar heridas, aunque no estén infestadas con larvas, hay que adelantarse a la mosca para que no ponga sus huevos. Enfatizo que, sin la curación correcta del animal, limpieza minuciosa al inicio de la curación, corte de pelo sobrante y desinfección consiente al concluir.

Under no circumstances should the maggot trap be squeezed to squeeze the larvae out. The pressure can cause some larvae to die inside and become trapped in the animal's muscle, parts of the cephalopharyngeal skeleton, hard structures of the head, and the larva's pincers. This will affect the wound's healing time and prevent it from sporulating for a long time. It is better to delouse, removing the larvae one by one. Apply the complete intramuscular treatment to reduce fever, intradermal dewormer, use repellent, and apply a generous amount of iodine tincture to the skin. Without proper hygiene and sanitation of the area or pens, dispersing sterile flies is useless.

La cabeza de la larva de *Cochlimoyia hominivorax* tomada con un microscopio electrónico de barrido, presenta los dos segmentos del tórax en el estadio larvario L3 que se alcanza a los 7 días. Cabeza magnificada de la mosca, coloración de los ojos naranja, cachete amarillo, forma bucal, cuerpo metálico azul-verde. Con 3 líneas en la espalda y la del medio es más corta. Como la E, el palo del medio es más chico como ves. Gabilondo Soler. Cri-Cri



If necessary, supplement sick farm animals with food and water if they are unable to walk until they recover and are able to fend for themselves. Why treat them with medication if they will die within five days from anorexia, starvation, or dehydration? All planned, regulated, legislated, and, above all, voluntary actions contribute to infestation control. We are all part of the campaign. Traps with synthetic, attractive baits, specifically for the GBNM fly

Swormlure 4 (SL-4) or other more advanced formulas, are placed in strategic locations, with sampling and evaluation methodology, as was done to detect the spread of the African honey bee. The same is true for detecting the presence of flies, using topical insecticides or regularly spraying the animals with a pressure backpack, and even applying insect growth regulators to the body.



Vertical trap used in the open field. Collection of wild flies to identify the presence of the GBNM fly under a microscope. Below right, in the laboratory in Pacora, Panama, larvae and pupae are magnified to observe their correct development and life cycle.

Do not rule out attacks by vampires, ticks, midges, fleas, lice, bedbugs, mites, mosquitoes, bites from other flies or ectoparasites, scabies, dermal skin disorders, surgeries that expose wounds that can be layed by screwworm flies, etc. Instead of injecting vitamins, serum, etc., the oral alternative to topical antibiotics is SMEAR or another oral antibiotic if there is an infection, vaccinations, deworming. External applications with material, powder, dermal spray, organic insecticides, etc. We must look at the management and treatment techniques used by experienced livestock farmers in South American countries that coexist with the GBNM fly differently than in areas or countries where eradication has been achieved but the experience has been lost.

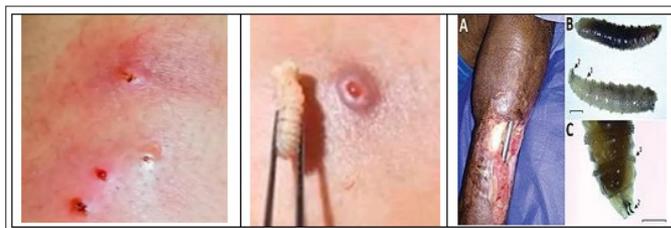
Here, no one's opinion counts when identifying the species of fly or maggot, only that of the entomologist trained in the taxonomy of flies and larvae that cause transboundary fly disease or myiasis, who will provide the accurate report and you'll see. He is the one who will certify and schedule the shipment of sterile flies to contribute to control over a larger area of the ranch. There are too many fly species circulating to allow for an error in judgment. The entomologist is trained to receive electronic photos remotely to classify samples of electronic specimens. This is to shorten transit times. But this does not replace the physical shipment of samples for laboratory identification. REMOTE DIAGNOSIS



The participation of every producer is essential: goats, chickens, sheep, dogs, cats, pigs, cattle, oxen, horses, etc. Zoos that concentrate many species, hunters, game ranches, UMAS (National Parks of Animals), protected natural areas, reserves, and CONANP (National Parks of Agricultural Research and Conservation), above all, must collaborate, since during 2023-2025, worm infestations have been identified in hawks, eagles, deer, tapirs, howler monkeys, porcupines, sloths, felines (ocelots, jaguars), opossums, otters, and many species of jungle animals. It is estimated that in wild populations, 2% of warm-blooded animals in the natural environment are infested, as the GBNM species is an obligate parasite that feeds on living beings. So, the addition of 2% of each species of rabbits, hares, tapeworms, skunks, jews, prairie dogs, badgers, raccoons, coyotes, armadillos, pumas, lynxes, foxes, etc., that have been sighted with maggot traps but not identified in the laboratory, increases the number of animals infested with maggot traps, which also contribute to the dissemination of larvae that fall to the ground and become mature pupae that hatch, increasing the problem of GBNM flies. Wild boar cochis have a social behavior that makes them less susceptible to severe infestation compared to other animals.

Humans with worms should preferably be treated at an official health center and not by animal field personnel. There are hundreds of cases presented in children, adults and the elderly both in

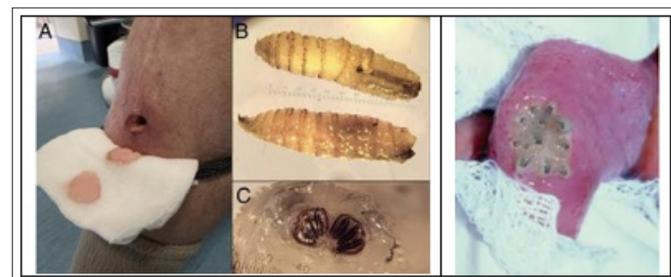
Mexico (26) and in Central America (300), with worms in the head, back, thorax, extremities, damaged gums below the teeth. Zoonosis is not a game, it is a myiasis disease, it requires medical care. It is not for self-medication. It is not just about scratching the itch. The worm can perforate the skull and reach the brain, and removing it is not an easy task.



Mild human cases involving skin. Very severe cases involving elbow joint splint implantation.

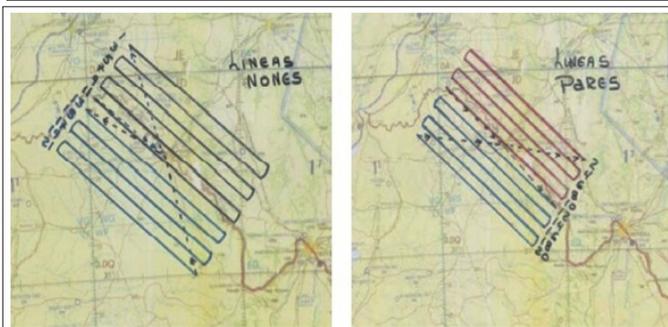


The protruding larva is visible in the human skull. The larva is creamy and 6 millimeters long. The necessary histology is performed for microscopic identification by studying its anatomy in sections.

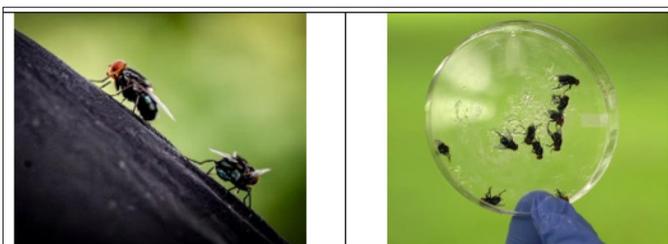


Right leg, L3 larva, with the posterior spiracles about to mature. Five cases in humans treated with ivermectin and cresol.

Dispersal of sterile flies from Panama can be carried out by air, by dropping Whiz Packer boxes of packaged sterile adult flies, or by land, using vehicles or horses, by placing hatching chambers or boxes protected from the elements (rain, sun, wind) and predators that damage the boxes and prevent the mature pupae from hatching, which will become sterile flies.



Sterile fly-dropping flights are planned on a map, forming a dispersal grid to establish flight paths and thereby reduce the aircraft's dead load. Three life cycles of the parasite are maintained, starting with the last positive outbreak of the fly in the trap or the animal with the GBNM maggot trap. Fly releases are not done once; they must be repeated at the same time as the life cycles. Biology and sampling are another very important combination.



In their mature pupal stage, both males and females are irradiated, damaging their reproductive organs and becoming sterile. They are caught in the field in the dispersal zone and tested for reproductive activity.

I am 68 years old, and the last time I witnessed a worm infestation cured was in 1965 in the Yaqui Valley, Cajeme, Sonora, Mexico. Although ranchers and cowboys in the state always carried gentian violet (an antiseptic-coagulant) in their saddlebags for many years, they later used a very practical and convenient spray from a canister filled with pressurized gas. I share my limited comments based on personal experiences in the state of Sonora.

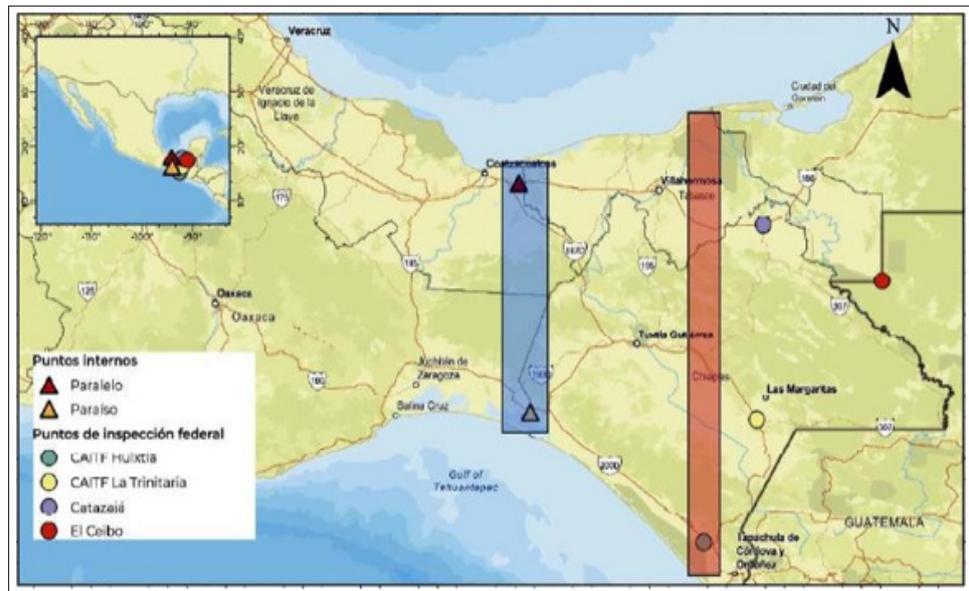
The current re-infestation of the New World Cattle Screwworm in Mexico is being detected by the increasing number of cases of myiasis in humans that have come to light, with 26 reported, and the SADER-SENASICA sanitary authorization allowing the importation of cattle into Mexico from Central America since October 14, 2019, for immediate slaughter, terminal fattening, and breeding. This is coupled with severe budget cuts to the animal health program, staggered over several years. A lucrative trade channel for a few feedlots and intermediaries is now taking its toll on the vast majority of national livestock farmers.

Some people are already fed up with this; they aren't interested in the animal health campaign; they're concerned about the price and the closure of the international market. They don't care at all about pest-free status, or the production of healthy food, much less about acknowledging that hunger exists all around us. This is resolved with committed resources, a focus on doing things right, making technically sound decisions, and setting aside rhetoric that merely serves as a sycophant. How much interest is there from pharmaceutical companies that don't speak out?

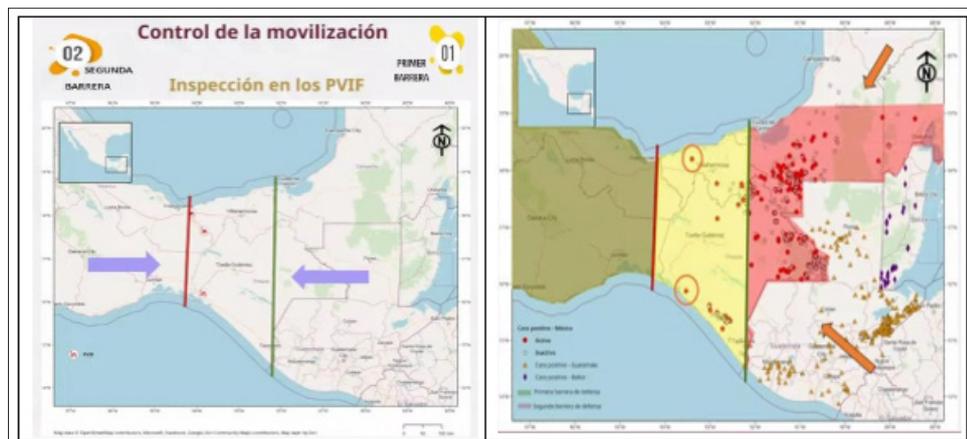
It's true that closing Mexico's southern border to animals from Central America would increase the illegal crossing of livestock into Mexico without inspection or treatment prior to importation. There are no real control mechanisms in place to prevent illegal entry; there are flaws in border controls, and sanitary fences are not respected. Herding corridors for animals on foot have already been used for years; they use the cattle trails for their passage. Therefore, there is no official commitment to prohibit the entry of animals on foot or in vehicles. Cattle are bought and sold; they are liquid goods.



By declaring Central America with the presence of the GBNM, Mexico launched its first border inspection effort. The reported cases were not numerous.



Then they pull out the old scheme. They had to start working with a small number of hired personnel. States must be involved so they can contribute professionals without experience who can quickly respond to the essential needs to contain the entry of animals with worms and who can perform treatment. At this time, there are no shipments of sterile flies to Mexico. None have been ordered from Panama.



In southern Mexico, two imaginary lines have been placed as strategic barriers at the federal inspection and verification points (PVIF). These are the same lines that were used 35 years ago. They are not used to check for stolen cattle, branding, signs of blood, price, or origin. The red signs indicate active cases. There are three PVIFs on the green line of the 92nd meridian. The red line is the 94th meridian. Corrals will be built at the 19th parallel in the Isthmus of Tehuantepec. There are three land communication routes: Caleras-Arriaga via the Pacific, Cosamaluapan via the Gulf, and Valparaíso. Strapping is being checked in Acayuca. Through Chiapas, Ocosingo, Benemérito de las Américas, Marqués de Comillas, Palenque, Salto de Agua, Cotzalá; Tabasco, Balancán, Tenosique, Mascupana; Campeche, Candelaria, Escárcega, Carmen; Yucatán, Tazaja, Huixtla, and others.

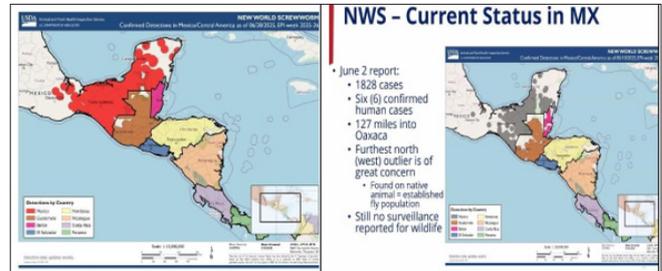
Just as Panama does in the Darien region, with a 48-km border with Colombia, Mexico has two barriers in the Isthmus of Tehuantepec, each stretching 192 kilometers. Red line on the map. INTENSIVE CAMPAIGN PROCESS.





Many professionals are involved in implementing the campaign. Some are contracted by the federal and state governments and organizations. Personnel are deployed to inspect ranches, set traps, and station cattle crossings.

The results are good; we don't have to wait for the sterile flies to be released before we get to work. Sufficient quantities will arrive; the time will come to reopen the irradiated sterile fly production plant in Mexico, while control measures must be taken on ranches and in the workplace.



The red zone is Mexico. On June 2, 2025, there are 1,828 cases, six of which are human.

With these achievements, the press release for July 7, 2025, announces the possible reopening of the border for live cattle to resume staggered trade, through an agreement reached at the bilateral technical meeting to be held on July 1 between the Animal and Plant Health Inspection Service (APHIS) of the United States of America and SENASICA-SADER of Mexico.

Hopefully, sentinel samples have been taken to confirm that there are no GBNM flies in this region. The process consists of inflicting a wound on an animal on different ranches under controlled and supervised surveillance and sampling for several days to ensure they are not infested. Could it be that the flies no longer detect (smell) the cut or bleeding? It shouldn't be ignored; it must be done. If there really are no GBNM flies in the area, they are not infested. If there is any existence, it's confirmed that an area is infested with the plague. Whom shall I fear? Said a cartoon character I can't remember.

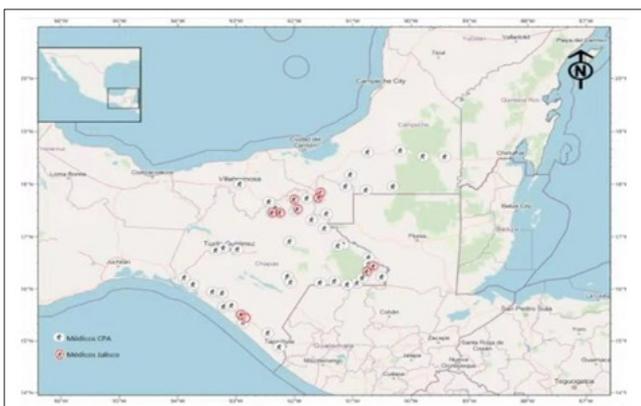
PARTE IV

Sterile Fly Production with Irradiation.

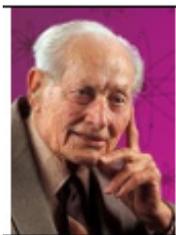
Until 1933, the screw fly was considered just another of the ubiquitous pantheon flies. The practice of breeding the reproductively sterile fly was proposed by Edward F. Knippling and Raymund C. Bushland in 1937, based on studies they had been conducting since 1930. They also observed that if the animal dies before the fly larva is 24 hours old, the parasite in the L1 larval stage also dies. <https://www.nasonline.org/wp-content/uploads/2024/06/knippling-e-f.pdf>



Mexico has issued a national alert to combat the GBNM fly, and the combined efforts of all staff and the combined actions of collaborating individuals are recording a considerable reduction in cases: Chiapas - 63%, Tabasco - 61%, the Yucatán Peninsula - 35%, and the Pacific Isthmus region - 20%. This is the result of numerous training courses and thousands of attendees learning ways to get involved and participate. Above all, the honesty of being vetted and avoiding evading inspections. Route evasion exacerbates the problem; we must all collaborate and do things right.



Entomologist Edward Fred Knippling, with his brilliant autocidal theory of flies. He and Bushland conducted chemical and atomic tests. He received the Nobel Prize in Food in 1992 for his contributions to sterile fly production.



He was born on March 20, 1909 and died on March 17, 2000.

In 1938, Knippling proposed sterilizing males to include them in the New World cattle screwworm control program.

In 1946, Herman J. Muller studied mutations in the fruit fly, and Bushland and Hopkins published sterilization results using X-ray and Cesium 136 tests in 1951 and 1953. This led to the development of their technology in 1950 and the efficient application of atomic energy irradiation at the Bithlo, Florida, laboratory in the United States in 1957. With the Sebring, Florida plant, mass production began between 1957 and 1961. The fly was eliminated from Florida, but re-infestations arose inland, calling the practice into question. On the island of Curaçao in the Netherlands Antilles, it was completely eradicated in 1954, paving the way for the confirmation of this technology, as the island is 65 km from the mainland. With this experience gained, the program for the Southwest USA began in 1962, releasing 155 sterile female and male pupae per square kilometer per week. In 1964, the pest was again eradicated in Texas and New Mexico. By 1967, cases were reduced to 99%. In 1972, 96,000 cases emerged, and 9 million sterile flies were released. Due to its proximity to the Mexican border, there was a great potential for frequent reinfestation cycles. The Mexico-USDA screwworm eradication program was initiated.

Florida was reinfested in 1976 with 261 cases. In 1977, traps with lures were used. There were ethical questions about extinguishing a parasitic species, wildlife species such as deer increased, and the tick infestation grew; not everything was one-way.

The US had already done this previously, transforming Moore Air Force Base in South Texas for the 1960-1970 eradication campaign by using radiation on flies, rendering them sterile. The sterile fly plant from Mission, Texas, was used in 1962 for the southwestern US, and in 1963 it was also released along the border with Mexico. What was learned in Florida was applied here.



Alerts against the New World screwworm (NWB) are in place in the U.S. The fly *Cochliomyia hominivorax* had been eradicated from the country since 1966; see the purple map in the initial section. The infestation appeared in the Southwest in 1972, and in Texas and Oklahoma in 1976. There was a reinfestation in 1982, after which it was definitively declared eradicated. The fly was reintroduced in 1987, once in June on a dog flying from Florida

to Arizona, and again in July on a dog arriving from Panama. Due to the risk involved, sterile flies were again released. Which gives rise to the eradication program with Central America, other reports in dogs 2007, 2010 and another on January 10, 2017. In the Peninsula they were free of the fly since 1959, but in the Key Islands of Florida 20 deer *Odocoileus virginianus clavium* were infested with worms in July 2016 and more in October with myiasis in the Keys, Florida, so 135 deer had to be sacrificed on March 23, 2017 even though it is a species under protection in danger of extinction. Ground release chambers were used, not aerial ones.



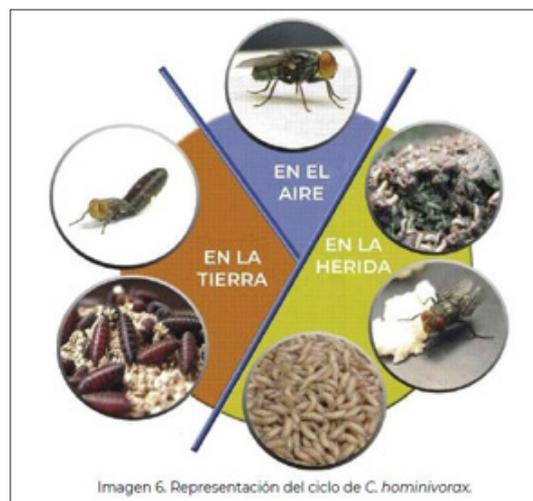
Three days after egg laying, the damage caused by the L1 larvae is already evident. This is the beginning of the maggot infestation; we no longer want to live with this tragedy. Cattle, sheep, and pigs—the plague only causes damage.

In 1978, sterile fly production began at the USDA plant in Mexico. In 1991, the GBNM was eradicated from Mexico. In 1994, the COPEG (National Park of the Pacific Ocean) formed a barrier, and in 1997, a maintenance area was established in Pacora, Panama. In 2006, the GBNM fly was completely eradicated from western Panama. Construction of a sterile fly plant began in 2007.

From now on, to improve the potential use of the sterile insect, the USA will most likely use genomic engineering to obtain more males than females and to obtain something similar, genetically modified organisms will be applied by embedding genetic loci of bacteria and viruses, also generating GMOs, males are produced and their offspring inherit a dominant lethal gene *fsRIDL* (method proposed to eradicate the malaria mosquito *Anopheles gambiae*), using CRISP to edit DNA and obtain male flies that transmit a female infertility gene to their offspring, facultative biological parasites (fungi, viruses, bacteria) are used against flies and mainly in their stage in which it transforms into a pupano passing into a pupa in the ground that has a longer duration of 240 hours waiting for its metamorphosis, artificial intelligence systems of the ecosystem and futuristic ones are established, there are initial investigations to generate a vaccine, other tools available for a comprehensive campaign in which bats, birds and other insectivores intervene. It's important to look at different angles, not just one direction. Enteropathogenic fungi that are feasible for other parasites include *Beauveria bassiana*, *Metarhizium*

anisopliae, and *Isaria fumosorosea*.
https://www.researchgate.net/publication/369214727_BIOCONTROL_DE_PARASITOS_DE_RUMIANTES_CON_HONGOS. The tests and experts will tell if they work specifically for GBNM. There is a lot of research missing that needs to be done in biology, epidemiology, population dynamics, surveillance methods, monitoring techniques, trap design, etc.

The sterilization technique for the GBNM fly is not infallible, as failures occurred with the irradiation equipment in Mexico in 2003. Eradication processes take time to achieve objectives, and the current 2024-2025 reinfestation campaign in Mexico could last 24 months, even longer due to a lack of sterile flies, plus years of negotiations to be declared internationally free. All flights from 45 international airports must be inspected, there are 24 seaports, 28 border cities, 19 livestock checkpoints, and federal inspections in Mexico. These include Cgias, Catazja, Tuxtla, and La Trinitaria. It's all part of the line of defense. The fly can arrive by any location and means of transport, in animals and humans carrying it, as well as in trucks carrying bales of feed. This is how the whitefly established itself in Sonora, removing soybeans from the crop list with the crossing of alfalfa bales from the north bound for Topolobamo, Sinaloa. The whitefly travels accompanied by human transport and can fly individually alone as long as it likes, covering kilometers a day, searching for prey to breed on.



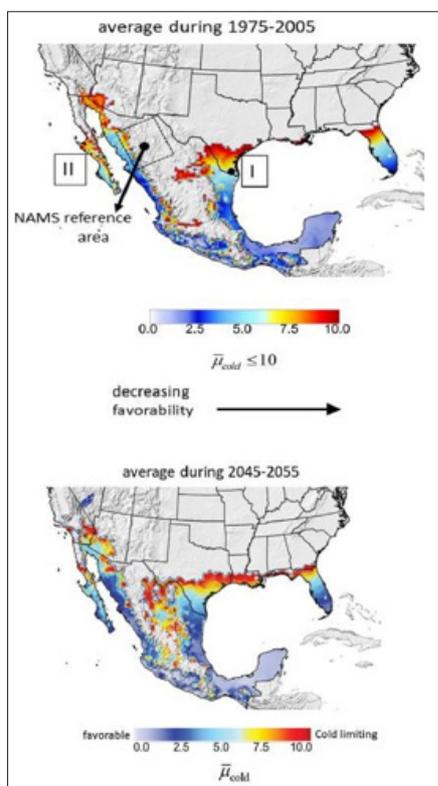
The year 2023 marks the beginning of the introduction of the screwworm fly throughout Central America. It leaves no country in the lurch, inviting Mexico to participate in the worm infestation. By November 2024, Mexico reports infestations in the South and the Yucatan Peninsula. By 2025, it will expand to the state of Veracruz, Mexico. **MARKETS FOR LIVE CATTLE EXPORTATION ARE CLOSED:** Castrated calves and heifers, bison, and horses are not allowed.

Pacora Laboratory, Panama

Learn about the sterile fly reproduction process at the Pacora laboratory in Panama. In video <https://www.youtube.com/watch?v=vtlvfuJ6VkY> or in written https://www.youtube.com/watch?v=PzGVC_Rn118 <https://elpais.com/mexico/2025-06-16/la-fabrica-de-moscas-esteriles-en-panama-el-arma-para-frenar-al-gusano-barrenador-en-mexico.html>



Currently, the only specialized GBNM plant in the world using an autocidal method, meaning the birth rate is reduced cycle by cycle; it is not a single release, requiring biological monitoring, nor is it intended to fumigate to kill them. It is located near Panama City. It has been operational since its inauguration on April 12, 2006, and it began operating on July 12, when the Canal Country was declared pest-free, up to the border known as the dense Darien Gap forest with Colombia. See 10 production processes in a sterile fly breeding plant.



Predicciones del calentamiento global estiman una mayor área óptima para que la mosca se establezca en México y en los EUA. Las zonas rojas de frío limitan su localización geográfica. No se ven muchos rojos en México.



To learn about the sterile fly plant process in Pacora, Panama, see part 9.

<https://www.copeg.org/produccion/> The Panama-US Commission for the Eradication and Prevention of Screwworms (COPEG) is formed. It has a laboratory capable of monitoring the narrow border with South America with millions of sterile flies per week and is not designed to meet the current needs of Mexico's 2025 national campaign and those of Central American countries. The plant operates in a clean, highly hygienic and sanitary environment, with sterility levels to prevent contamination of the breeding chambers and feeding trays. This controlled environment is highly conducive to fungi, thus requiring a rigorous cleaning and sanitation plan. Even so, allergies and asthma can occur among staff due to the organic waste produced.



An important factor to consider when genetically adapting updated strains for the new eradication campaign in Mexico and Central America is that, although it is the same insect species, variants have appeared in Brazil, Venezuela, Colombia, etc., over the past 30 years. In other words, it is not the same fly as before. Frequent strain replacement in captivity is necessary. The new breeding stock from the laboratory must be crossed so that the sterile male fly is attractive to wild female flies, as they detect its distinct pheromone, which is currently affecting livestock. Small genetic and morphological variations are important for the success sought when using sterile males. Larvae overfed with balanced supplements decrease their flight capacity, favoring wild food rather than reproduction, and the enzymatic activity involved in flight metabolism is reduced.



Feed mixer for larval diets with fine powders (vitamins, minerals, milk, blood, plasma, powdered egg, amino acids, additives, honey, molasses). Formaldehyde preservatives are used to preserve the feed and reduce rapid spoilage. The feed produces fertile, healthy larvae for breeding stock and replacement. It also ensures biological safety, develops new, efficient methods, and controls the quality of inputs and processes. Periodic batch measurements are performed to follow a strict quality control plan. Microscopic inspection of the breeding stock and irradiated mature pupae is carried out to avoid releasing fertile flies, as was the case in Mexico. Mature pupae are produced for fly replacement and irradiation. The larvae are washed and work is controlled in contaminant-free, nearly sterile environments, including the breeding stock and breeders.

1.55 grams of eggs are placed on strips of moist cloth in each feed tray for rearing in trays stacked on a shelf. The diet is changed as development progresses. Changing the tray and food for L2 larva.



Pupae are checked every two hours to monitor their maturation date. Mature pupae are manually opened to visually verify their advanced metamorphosis stage and move them to the cold room in a timely manner. Who wants larvae to go? Pupae that are advanced in maturity are collected to determine their change or metamorphosis from larva to fly within the pupa. For the current GBNM eradication campaign, sterile flies are specifically scanned with gamma radiation from sources of cobalt Co-60 or a cesium-137 isotope through nuclear fission. Note that irradiation sterilizes males and females together, but does not affect their courtship ability, desire to seek out females, mounting skills, or flight. The sterile female that is released mates with fertile wild males without producing offspring. In their late phase, the pupae are irradiated, and the females are also sterilized. They then undergo distribution processes to be released into the open air at selected locations in rangelands, jungles, and forests where maggot-infested animals have been found. The flies' bodies are not radioactive. Irradiated female pupae are not separated from the males; they are all placed together in the irradiated and released batch. They are not sexed to separate them, as male chicks are for egg-laying.



Laboratory Procedures And Sterile Fly Production

The entire process is carried out with cleanliness and sanitation at environmental sterilization levels because it can be easily contaminated by fungi and bacteria that would affect the strength and reproductive capacity of the fertile fly breeding stock.

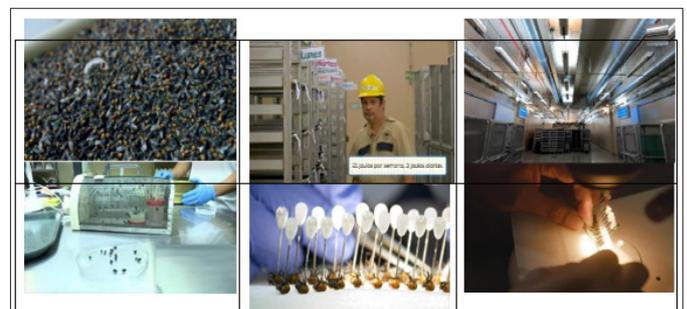


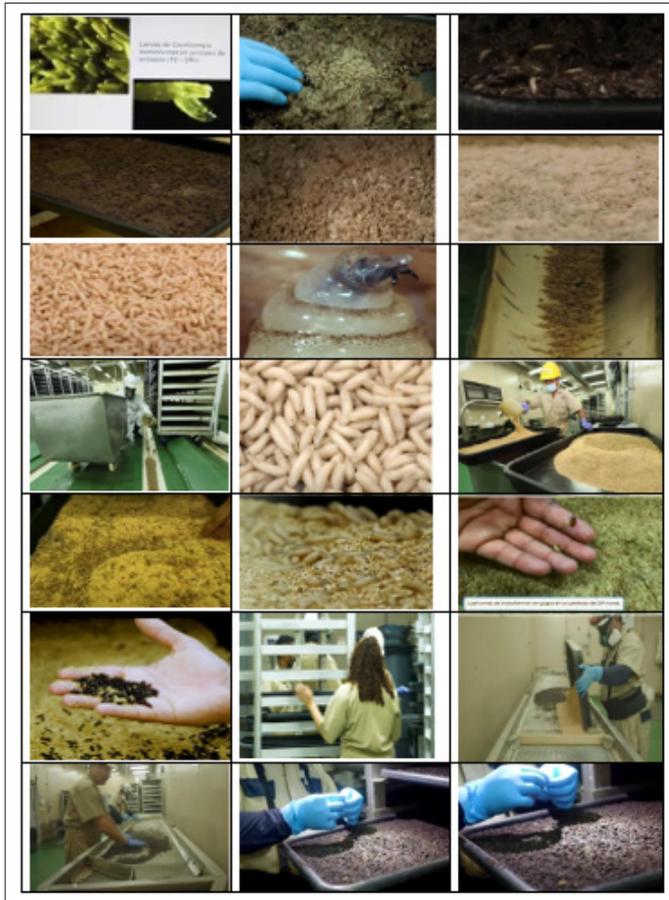
COPEG in Pacora, Panama.



ABOVE. Cages with mosquito netting at the maturity stage, awaiting reproduction and reaching egg fertilization, under a controlled environment to prevent egg laying. Female and male flies are enclosed in the same cage. Security is a top priority (level 3); if they escape, they reproduce normally as wild flies. The oviposition area is lit, and an egg-laying chamber is introduced, similar to greenhouses that simulate environmental conditions for oviposition. The exact temperature is controlled with a heating element on metal surfaces (solera) so that the eggs are laid there and not scattered throughout the chamber. This facilitates collection. The eggs are white. The rails are carefully scraped with a spatula to collect the eggs and place the matted strips from many females in green trays. The eggs are weighed at 1.55 grams per square of fabric. The work is done in a humid environment to avoid dehydration, and the fabric is even wet. Each frame is placed on a tray with artificial food rich in energy, protein, and nutrients. There, the eggs hatch and form stage one L1 larvae.

INTERMEDIATE PROCESSES





This is the Cobalt 19 launcher in Pacora, Panama to sterilize GBNM flies.

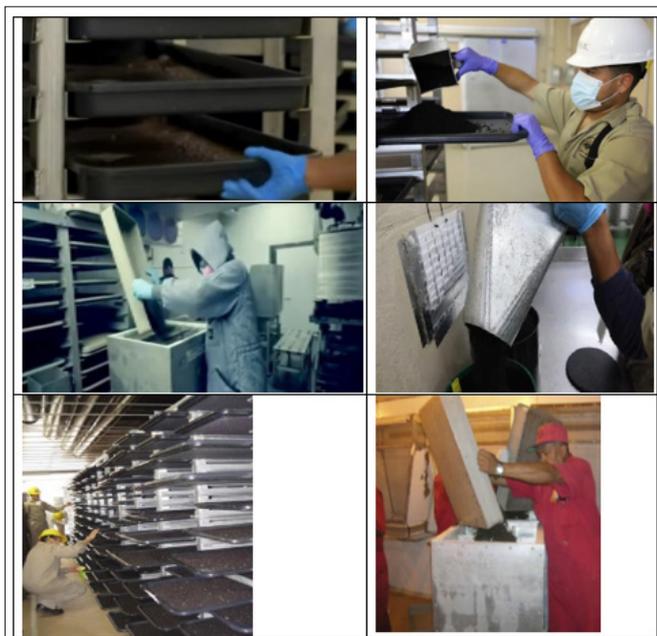


The trays of pupae are taken to the irradiation room. The volumes produced are collected, and a funnel is used to fill the cylindrical container and place it into the atomic radiation emitting apparatus. In Panama, Cobalt 19 is used for pupae irradiation. The corresponding bombardment is performed to sterilize male and female flies at the pupal stage. The fly's chromosomes are ruptured, rendering them sterile, but they continue to behave normally. Orders may be made for flies that are already sterilized and ready to fly. There are several delivery options. The pupae are packed in coolers for air transport to retail packaging and dispersion centers.

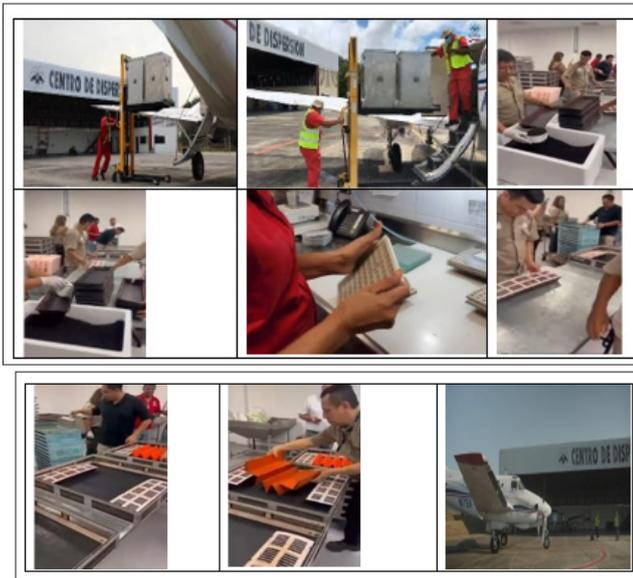
Intermediate Processes for Sterile Pupae.



IRRADIATION



The pupa trays are conditioned to prepare the loads that are introduced into the irradiation apparatus.



Mature pupae are cleaned of shavings. They are then irradiated using the sterile insect technique. Pupae can be packed in coolers for delivery to the destination country or in boxes containing sterile flies for air dispersal. Airlines have distribution contracts

Field Release: Get To Work

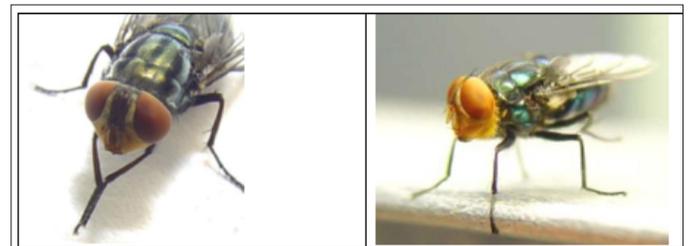
The devastating plague affecting livestock and wildlife is being combated.



The release of hatching pupae is carried out by land by placing boxes with holes. When the pupa matures and the fly emerges, it can fly off to perform the functions for which it was laboriously produced.



In sterile pupal containers or chambers, flies are dispersed by ground, vehicle, or mount. The maggot matures inside the brown capsule or pupa, undergoing metamorphosis from larva to fly. To do so, it opens the upper lid of the cocoon using the ptilino sign to emerge wet. Females generally emerge at dawn at 4:00 AM, followed by males at 7:00 AM. Once their wings dry and harden, they begin to fly to feed and reproduce. Their characteristics are: reddish eyes, a metallic-colored body, a shorter dorsal line in the middle of their back, and an orange face.



The newly released laboratory fly has developed in a hygienic environment and has not been exposed to contaminating bacteria from the environment or the forest, which can cause digestive problems, reducing its flight movements, and restricting its search for wild females that are mature enough to breed. There's no tomorrow; it must outbid the wild males for females to be the first to mate. Everything for the country comes first.



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