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NEW WORLD SCREWWORM ERADICATION FROM THE AMERICAN CONTINENT

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1. INTRODUCTION

Cochliomyasis is arguably one of the major diseases to have profoundly affected livestock and therefore the economic development of the agriculture sector in a major part of the American Continent. The magnitude of the myiasis problem dictates that its control is a necessary prerequisite to the maintenance of available livestock industry and increasing agricultural production, need to support general economy development in the Americas. The development of the Sterile Insect Technique (SIT) in the 1930s created a revolution in the methods available to control insect pests and now forms the practical basis for national and regional eradication programmes in the Caribbean Islands, and North and Central America.

2. THE MYIASIS PROBLEM

Screwworm myiasis is a parasite disease affecting both humans and animal and is caused by the larvae of the fly ***Cochliomyia hominivorax*** invading and infesting the wounds of warm blooded animals. The life cycle, in the optimal temperature range of 20-30° C is about 21 days. The female, which mates only once, lays one or more batches of up to 300 eggs at the edge of any wound or skin abrasion, however small. The larvae develop within 24 h, and burrow into living flesh, creating large, deep, open wounds which attract further egg laying females. If unattended, theses infestations are often fatal, particularly in newborn animals where the oviposition site is usually the navel (1). The parasite is native to the Americas and prior to eradication was prevalent between latitudes 30° north and 30° south covering a surface area of approximately 23 million Km^2. (2). The incidence and severity of the disease are dependent upon local conditions such as:

a) Livestock population, the distribution and density;
b) The wildlife populations and their migratory habits;
c) The human population density and the effectiveness of Public Health Services

In addition to direct losses from the disease and the financial requirements for control operations, myiasis also indirectly affects:

a) HUMAN HEALTH through protein deficiencies caused by shortage of meat and milk;
b) LIVESTOCK PRODUCTION, since it causes morbility and mortality;

c) AGRICULTURAL PRODUCTION, through the lack of draught animals and manure;

d) THE RURAL ECONOMY, by preventing integrated agriculture and livestock production;

e) THE NATIONAL ECONOMY, since the national deficit in animal production compels affected countries to import living animals and their products (8).

Myiasis poses a major human health problem; it is estimated that about 342 million people reside in endemic NWS areas. In most countries the disease has been brought under control through strict medical surveillance and treatment but, where the surveillance is relaxed, it presents the threat of developing into epidemic proportions (7). In El Salvador, for example, even during the eradication campaign humans were recorded as being the third most affected species.

With our present knowledge it is impossible to asses the losses caused by Cochliomyiasis in the infested zones. However an indication of the magnitude may be gained by an evaluation carried out in the Caribbean region during the 1980's. The annual estimates of losses (in U.S. dollars) due to surveillance and medication ranged in several countries from $ 4.82 to $ 10.71 per animal (6). If an average of US$ 7.76/animal/year is taken as a theoretical economic basis, then the losses in various regions may be indicated as follows.

American Continent	Area Infested (Million Km^2)	Livestock Population (millions)	Annual Cost (US$)
NWS infested zone Before eradication Programmes	23	662.23	5138.9
Area NWS **eradicated**	6	174.73	1355.9[1]
Area NWS infested:			
Central America	0.3	6.0	46.56
Caribbean Region	0.2	17.5	135.80
South America	16.5	464.0	3600.64

[1] Annual savings following eradication.

TOTAL ANNUAL LOSSES: **US$ 3 783 Million**

The substantial sums involved would clearly justify the eradication of screwworm from endemic areas provided such an objective can be practically realized.

These figures are only very approximate and theoretical and do not take into consideration the substantial losses in productivity due to: death, particularly of newborn and young animals; lower weight gains; additional labour costs; depreciation of hides; reduced milk yield and other economic considerations.

3 CONTROL

Livestock owners control the screwworm primarily by manually treating the wounds of infested and exposed animals. However, many infested animals, being on open range, are either not found or may have a fatal or serious infestation by the time they are found. To prevent this the owners must inspect their herd at least twice a week to treat all wound. The consequences for wildlife are even more serious as they do not benefit from prevention and treatment through human intervention. Human infestations are relatively common and may cause death if not treated (3).

3. ERADICATION

The screwworm can be eradicated using an environmental friendly biotechnology known as the Sterile Insect Technique (SIT). This involves the weekly aerial release of sexually sterilised laboratory reared flied over infested areas. Mating between wild females and sterile males produce no offspring thus interrupting the life cycle and progressively reducing the wild population to the point of elimination. The economics of various eradication campaigns have always been very positive, in spite of the high initial investment cost. Cost/Benefit ratios have been calculated as follows: U.S.A. 1:10 and Mexico 1:4 (4). The historical record of the development and application of SIT is as follows:

1937 – 1938
Dr. E. Knipling developed the theory of autocidal control (SIT).

1950 – 1951
Dr. Bushland and D.E. Hopkins sexualy sterilized screwworm using x-rays.

1951 – 1953
A successful field test of SIT was carried out on Sanibel Island, Flo., U.S.A.

1954
Screwworm was eradicated from the Dutch island of Curacao, a 176 Sq. Mile island 40 miles off of the cost of Venezuela.

1955 – 1957
A screwworm rearing facility was constructed at Bithlo, Florida, U.S.A.

1958 – 1959
The eradication of Florida peninsula was completed successfully.

1963 – 1966
The U.S. Department of Agriculture declared the United States Screwworm-free in May 1966 and assumed the responsibility for maintaining a barrier zone along the 2000 mile U.S. – Mexico border to prevent migrating screwworm flies from reinfesting the U.S.

1972
- The U.S.A. experienced it's worst outbreak of screwworm in recorded history with over 90 000 confirmed cases.
- The U.S. and Mexican Governments, on 28th of August, signed the international agreement on animal health, establishing the Mexico-US Commission for the Eradication of Screwworm.

1971 – 1975
The screwworm was eradicated from: Puerto Rico (including Vieques, Mona and Culebra) U.S. Virgin Islands and British Virgin Islands (10).

1973 – 1976
The construction of a new sterile-fly rearing facility located near Tuxtla Gutierrez, Chiapas, Mexico was concluded.

1977 – 1980
The Northern Mexican states were free of screwworm, an area of 1 056 650 Km^2.

1981
The sterile-fly rearing facility in Texas was closed, following the eradication of NWS from U.S.A.

1982 – 1984
Screwworm eradication from the Mexican territory up to the Isthmus of Tehuantepec (1 967 000 Km^2).

1985 – 1986
The 1972 Mexico/US agreement was amended to permit eradication efforts to be extended to the remaining territory of Mexico (Yucatan Peninsula) and to permit the international commission to negotiate with Central American countries and Panama to extend the eradication programme southward. Negotiations began for the signature of agreements between the Commission and the governments of Guatemala and Belize (5).

1991
Mexico was declared free of Screwworm in February.

1988 – 1992
The NWS was recorded outside of the American Continent, in North Africa (Libya), for the first time. Eradication was achieved by using SIT (9).

1992
A major outbreak occurred in Mexico which cost US$8 million and delayed the eradication from Central America.

1987 – 1993
The screwworm was eliminated from Guatemala.

1989 – 1993
Belize achieved the NWS eradication.

1991 – 1993
El Salvador was consider technically NWS free (six months without cases)

1994
On February 11, the US and Panamanian Government signed an international agreement for the eradication of Panama and the construction of a new screwworm – fly rearing facility (11).

5. FUTURE ACTIONS

Central America

The Central American and U.S. governments signed an international agreement for the eradication of screwworm from their territories, which can be expected to be phased as follows: Honduras 1994, Nicaragua 1995, Costa Rica 1997 and Panama 1998, followed by the establishment of a permanent NWS sterile fly barrier across the narrow the Darien Gap.

The Caribbean Region

The eradication of NWS from the countries of the Caribbean Basin is feasible. This prospect is enhanced due to their natural isolation as islands, programmes for individual countries can be addressed on a case by case basis as each government establishes its own animal health priorities. The Jamaica government has officially requested the assistance of FAO for eradication from its territory, based on yearly losses of US$ 3.5 million to the livestock industry.

South America

The SIT will work over areas of any size, providing a sufficient number of high quality sterile insects are available. However, with the possible exception of Chile, there

are no natural barriers to prevent the spread of screwworm between countries. Therefore, all of South America most be considered as one region for eradication purposes. Once started the programme would have to be progressive and continue until South America is completely free of screwworm. A lot of preparatory ground work is needed. The governments and livestock producers in each country **must be convinced or convince themselves** that the eradication is technically and practically and economically justified. They must be ready to commit the resources and the energy to complete the task.

Perhaps most important, **"A LEADER IS NEEDED"**, perhaps an international organization, that must be willing to invest time and money to unite the countries of South America and donors to support the goal of regional NWS eradication. The following actions need to be taken before the development of an eradication strategy:

A. Implementation of a regional information programme to inform animal health authorities, livestock producers, and the general public about NWS, including its effects on humans and the economic implications.

B. Collection of base line data on NWS case incidence for each country of the region. Data should include both human, domestic animals, and wildlife information.

C. A study on the economic impact of the NWS in each country in South America as well as a region as a whole. The study should be conducted by an international organization which can represent the needs of the entire region.

D. Evaluate the cost of a regional eradication programme utilizing cost data available from previous successful programmes.

E. Determine a Benefit/cost ratio based on the estimated cost of a regional programme as compared to the increased value of livestock and livestock products once the NWS is eradicated.

F. Determination of the environmental impact of NWS eradication in each country.

G. When economic impact and benefit/cost ratio information is available, meet with potential donor organizations and countries to seek programme financing.

H. Develop an eradication strategy which takes into account all pertinent factors including:

1. How to organize and control a regional programme?
2. Where to start (north or south)?
3. Where to locate fly production facilities?
4. How many sterile fly facilities to build?
5. How long should it take to eradicate the NWS from the region?
6. Natural boundaries for the NWS migration?

IMMEDIATELY PROPOSED ACTIONS

It is clearly recognised that the governments must determine the level of emphasis to be accorded to NWS control and eradication in relation to other national priorities and commitments, and that the pattern of development programmes, being dependent upon socio-political philosophies and priorities, will vary substantially from country to country. However, it is assumed that for the time being the main approach to the problem will be in the form of localized NWS control operations, confined to certain well-defined areas in certain countries. However, in the future a co-ordinated subregional approach between neighbouring countries could be considered.

At national level

(i) Preparatory assistance, if required by governments, to determine the geographical distribution of NWS.

(ii) Establishment and implementation of technical assistance for the diagnosis and determination of seasonal abundance.

(iii) Establishment of specialized services needed for the purpose of NWS control.

(iv) Training of staff required for the units under (iii).

(v) Assistance in the formulation of control policies and implementation of projects.

(vi) Assistance in the establishment and implementation of the eradication of isolated areas.

At the regional level

(i) Training at scientific and technical level to create a specialist cadre for NWS control and eradication, and to meet research needs (seminars, postgraduate training courses, manuals, film material). Strengthening of training facilities for middle-level control personnel.

(ii) Sponsor applied research to secure control methodologies for specify ecological conditions, the improvement of insecticide applications and, trials with new insecticides.

(iii) Promote a regional approach to the possibilities of NWS eradication.

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