Edward Fred Knipling

1909-2000

I. Context

Prior to Dr. Knipling's work, livestock production in North America was plagued by enormous losses each year due to infestations of *Cochliomyia homnivorax*, commonly referred to as the **New World screwworm fly**. These flies had been present in North America from ancient times and more recently had spread to many of the warmer parts of the world. In the 1950's, cattle losses due to screwworms in the U.S. alone were estimated at over $200 million annually[3].

While many flies deposit their eggs in necrotic tissue (i.e. dead flesh), *homnivorax* (whose name literally means "man eater") lays its eggs in the wounds of living warm-blooded creatures. When the larvae (or maggots) hatch, they dive head first into the wound, eating further into the tissues and deepening and enlarging the extremely painful wound. The flies were capable of killing cattle within 10 days of infection. Screwworm maggots were also known to parasitize human flesh[6]. One individual from Calhoun County recognized the need to control these pests and became recognized world wide for his endeavors.

II. Overview

Edward Fred Knipling was born near Port Lavaca, Calhoun County, Texas on March 20, 1909. He was the ninth of ten children born to Henry John Knipling & Hulda Rasch Knipling. Knipling grew up in this German-speaking Lutheran household on a farm of 150 acres on

Westerlund Grade Road in northern Calhoun County. The family grew cotton and corn, raised cows, hogs, and chickens and produced almost all of their own food.

As a young man working the fields and tending the family livestock, he witnessed the devastating effects of screwworms on living animals and of boll weevils on cotton, as well as that of many other insect pests. His reputation as a keen and thorough observer of nature no doubt started as a boy on the farm.[5]

Knipling graduated from Port Lavaca High School at the age of 17. In college, he became interested in entomology while studying agriculture at Texas A & M University. He was struck by the realization of the enormous impact insects had, both good and bad, on the welfare of humanity, not only from the standpoint of food production but also with respect to human health[5].

Harkening back to his observations on the farm, he also formulated the vision early on of the need to manage insects to prevent damage rather than try to control the pests or treat their hosts after the damage had already occurred.[5]

He continued his college education at Iowa State University where he met his future wife, Phoebe Rebecca Hall, who was also a doctoral student in the life sciences. They were married in 1934 and eventually had five children: Anita, Edward, Edwina, Gary, and Ronald. While at Iowa State University, he met Dr. E.W. Lockey from the USDA, who offered him a job on screwworm trapping and population monitoring at Menard, Texas, beginning in 1931. He worked at Menard on an intermittent basis over a period of nine years that was punctuated with continued graduate studies and duty assignments on screwworm in Georgia and other livestock insect pests in Illinois and Iowa. In 1935, at Menard, Dr. Knipling first met and began work with

his long-time friend and colleague, Dr. Raymond C. Bushland. At the time, their research concentrated on treating cattle for screwworm maggots, or “wormies” as ranchers called them, after they had already invaded open wounds. Such treatments were called “smears”[5]. While the scientists developed a smear called *Smear 62* which could successfully treat infected animals, Dr. Knipling realized that you could never really control screwworms that way; what was needed was some measure to prevent adult flies from infecting the animals in the first place. Through careful observation of the screwworms, Knipling determined that during the first day of life as adults the flies frantically attempted to escape from the cage, on the second day they fed, and on the third and fourth days they mated. The males repeatedly attempted to mate with the females, but the females would not submit to a second mating[2]. For Knipling, this was the key! If a method to introduce sterilized males into a population of the flies could be found, he theorized, any female flies that mated with them for their one mating would have no offspring. By repeating this process, each generation of flies would get smaller and smaller until they are finally gone. In this way livestock could be protected without having to treat wounds. Though it doesn't sound too wild today, at the time it seemed a far-fetched idea to many colleagues. "Forget this crazy idea and concentrate on more important things," Dr. Knipling recalled one supervisor telling him, according to a 1975 issue of Current Biography[4].

While at Menard, Knipling refined this idea into an autocidal method of insect control which involved overwhelming the wild populations with genetically altered or sterile males to either suppress or eradicate the total population in an ecologically isolated region. He developed a mathematical probability model to predict the decline of the wild population due to a given number of released sterile males[2]. This controversial method became known as the **Sterile Insect**

Technique (SIT). It would take a number of years, however, before this idea would take form and be realized as World War II soon diverted the scientists' work.

During the war, Dr. Knipling's research was diverted to support U.S. Army efforts to repel and control insects that threatened Allied troops with diseases including typhus and malaria. Credited with leading the USDA team that saved millions of lives by developing MYL & DDT as an effective control of body lice and weapon against typhus, Dr. Knipling won the 1947 U.S. Medal of Merit and the 1948 King's Medal for Service from the United Kingdom for these achievements[1].

After the war, Dr. Knipling received a Ph.D. in entomology from Iowa State University and moved to Washington, D.C., to lead USDA entomology research. In this capacity, he continued working with Dr. Bushland to complete the development of SIT in the early 1950s. By the early 1950s, the screwworm had become a major concern. Knipling asked Bushland to search for chemicals which might induce sexual sterility in the screwworm. However, Bushland did not find a useful chemical sterilant. Unknown to both scientists, a method to induce sexual sterility in insects using X-rays had already been devised in 1926 at the University of Texas by Hermann Joseph Muller, who was awarded the Nobel Prize in Physiology or Medicine in 1946. In 1950, Muller published a popular article in the *American Scientist*, which was immediately brought to Knipling's attention. Using Knipling's theory and Muller's sterilization technique, Bushland completed a successful experiment. He showed that irradiated males were fully competitive with untreated males in mating with females in cages, and verified Knipling's theoretical model of suppression of screwworm reproduction by the release of irradiated males into cages containing both fertile males and females.[2]

Next came field experimentation. In 1951, the scientists conducted an experiment on Sanibel Island in Florida which proved one could drastically reduce the screwworm fly population by releasing irradiated, sterile males into the population. In 1953, a more isolated location was selected for another experimental test. 150,000 flies per week were released over Curacao, a 176 sq. mile island in the Antilles with a severe screwworm infestation. Within 3 weeks and 4 fly generations, the screwworm was eradicated from the island. Seeing this success, the experiment was soon put into production, eradicating the screwworm fly from Florida in 1959, and then the entire United States by 1972[2]. Finally, through international partnerships, the screwworm fly was eradicated as far south as Panama by 2001. Screwworm outbreaks on other continents have been successfully treated as well.

SIT technology has been adapted to combat other pests including the Mediterranean fruit fly and the Japanese melon fly which damage fruit crops, and the tsetse fly which carries the lethal African sleeping sickness.

Dr. Knipling remained at USDA until 1973, eventually serving as the top entomological researcher in the USDA Agricultural Research Service. For 27 years thereafter, he remained active as a USDA consultant and collaborator, contributing significantly to new principles of pest insect management.

Dr. Knipling passed away on March 17, 2000, in Arlington, Virginia, where he and his wife of 66 years, Dr. Phoebe Hall Knipling, also a biological scientist and educator, had raised their five children and were active members of the community.

III. Significance

Dr. Knipling published over 225 articles in his career, was inducted into the National Academy of Sciences, received the 1966 National Medal of Science, the 1992 World Food Prize, and the 1995 Japan Prize for his novel approaches to pest control, and was listed in Esquire magazine as one of the "100 Most Important People in the World" in 1970.[1]

Since 1999, the Knipling-Bushland Southwest Animal Research Foundation at Texas A&M has supported research and education in the area where food producers around the world continue to feel his influence today.[1]

It is amazing to think one man, a Calhoun County, Texas native, could do so much for the advancement of humankind saving millions of lives from insect borne diseases during the war and saving the lives of our livestock from lethal insects. Dr. Edward Fred Knipling literally changed the world for the better.

The New York Times Magazine proclaimed on January 11, 1970, that "Knipling...has been credited by some scientists as having come up with 'the single most original thought in the 20th century.'"[1] The Texas Historical Marker for Dr. Edward Fred Knipling will be a visual reminder to the Calhoun County ranchers and farmers and an inspiration for the 4-H members who are always eager to learn about the past and excel in their performances.

IV. Documentation

[1] Wikipedia.org. "Edward F. Knipling". <http://en.wikipedia.org/wiki/Edward F. Knipling>

[2] USDA National Agricutural Library Special Collections: Guide to Collections. Extended Biographical Sketch for the Edward Fred Knipling Papers: Screwworm Eradication Program records. <http://specialcollections.nal.usda.gov/guide-collections/edward-fred-knipling-papers-screwworm-eradication-program-records>

[3] Wikipedia.org. "Sterile Insect Technique". <http://en.wikipedia.org/wiki/Sterile_insect_technique>

[4] http://www.nytimes.com/2000/03/27/us/edward-knipling-90-enemy-of-the-dangerous-screwworm.html?pagewanted=2

[5]USDA Agricultural Research Service. About ARS. The Life and Vision of Edward F. Knipling Concerning the Eradication of the Screwworm, Presented by Dr. E. B. Knipling. <http://www.ars.usda.gov/aboutus/docs.htm?docid=1604&page=1>

[6] Wikipedia.org. "Cochliomyia". <http://en.wikipedia.org/wiki/Cochliomyia>