USDA TECHNICAL BULLETIN NO. 34—
THE LEGACY OF PHILIP LUGINBILL

EVERETT R. MITCHELL
Insect Attractants, Behavior, and Basic Biology Research Laboratory,
Agricultural Research Service, U. S. Department of Agriculture,
Gainesville, Florida 32604

ABSTRACT

Philip Luginbill’s 1928 treatise on the fall armyworm, Spodoptera frugiperda (J. E. Smith), long has been considered the source for authoritative information on the biology and dynamics of this pest. What makes Bulletin No. 34 so special? The information presented on the life history and habits of the fall armyworm is interesting and amazingly accurate as verified by numerous publications over the past half century. In view of Bulletin No. 34 and all that has been written on the fall armyworm since 1928, one cannot help but wonder why we are not further along in our efforts to control or suppress this pest.

RESUMEN

La disertación de Philip Luginbill’s en 1928 sobre el Gusano cogollero, Spodoptera frugiperda (J. E. Smith), ha sido considerada por mucho tiempo una fuente autoritativa de información sobre la biología y del dinamismo de esta plaga. ¿Qué hace al Boletín No. 34 tan especial?. La información presentada sobre la historia de vida y hábitos del gusano cogollero es interesante y asombrosamente precisa, como se ha verificado en numerosas publicaciones durante el último medio siglo. En vista del Boletín No. 34 y todo lo que se ha escrito sobre el gusano cogollero desde 1928, uno no puede evitar preguntarse el por qué no estamos más adelantados en nuestro esfuerzo para controlar o suprimir esta plaga.

Who was Philip Luginbill? In my quest to gather information on the man to whose memory we dedicate the 1985 Fall Armyworm Symposium, I came across this cryptic notation in the 1959 edition of American Men of Science:


In the original publication, the citation measures approximately 80 x 18 mm—not much text space for someone who devoted virtually his entire professional career of 40+ years to solving entomological problems of cereal and forage crops.

Although Dr. Luginbill could be cited for his accomplishments in several areas, I
chose to look at the man from the perspective of his most notable contribution insofar as this symposium is concerned—USDA Technical Bulletin No. 34, The Fall Armyworm (Luginbill 1928). This bulletin is among the most widely cited of all publications on the fall armyworm, Spodoptera frugiperda (J. E. Smith), and there are more than 1,300 (T. R. Ashley, personal communication). What then is so special about Bulletin No. 34?

As I read through the bulletin, it occurred to me that under our present peer review system and standards for scientific publications, this particular work probably would be unacceptable to all but the most understanding of editors and liberal reviewers. Why? First, the work would be considered too broad in scope. It covers the taxonomy, morphology, origin and distribution, economic importance, causes conducive to outbreaks, food plants, life history and habits, and control of the fall armyworm. There also are sections on the parasitoids, hyperparasitoids, predators, and pathogens of the fall armyworm. Secondly, there is no statistical analyses of the data; and the data given are in detail uncharacteristic of present-day scientific publications. Third, Dr. Luginbill had the audacity to sprinkle his discussion of the facts with personal opinions and speculation. For example, on the origin and distribution of the fall armyworm he said, "Outbreaks, when general and severe, apparently originate in Mexico and the West Indies." He made this statement without proof of such movement, i.e., he never saw fall armyworm moths actually flying across the water from the Caribbean Islands or Mexico into the United States. To this date, we do not have proof of such movement—but circumstantial evidence then and now indicates that Dr. Luginbill probably was correct.

In spite of the rather primitive conditions, by today's standards, under which Dr. Luginbill and his colleagues had to conduct research, the information presented on the biology, habits, and distribution of the fall armyworm and its natural enemies are amazingly accurate. For example, he described the causes conducive to fall armyworm outbreaks thusly:

The probability of a general invasion of the fall armyworm in the United States depends to a large extent upon the prevailing weather conditions during the winter months in the region where the insect is a permanent resident. This insect thrives best during periods of cool weather, with an abundance of rainfall. Such conditions are favorable not only for a luxurious growth of grasses and other closely allied plants, but are known to check the multiplication of natural enemies, thus permitting the pest to propagate unhindered in enormous numbers. By the time conditions become favorable for the multiplication of natural enemies, the insect has gotten beyond biological control, migrated northward, and invaded the more northerly regions of the United States. If humid weather conditions prevail great damage to various crops may result. During seasons when no general invasion occurs local outbreaks of the insect occur in the South only following a period of heavy rainfall and humid weather.

Outbreaks also are facilitated by a period of low rainfall or drought followed by heavy rainfall. Both drought and heavy rainfall are very damaging to parasitoids of the fall armyworm, and heavy rainfall promotes luxuriant plant growth conducive to rapid build-up of fall armyworm populations. It is precisely these circumstances that precipitated the devastating fall armyworm outbreak experienced throughout the southeastern United States in 1975 and again in 1977.

Dr. Luginbill's assessment of the importance of natural enemies on keeping fall armyworm populations in check is of special interest, especially to those with visions of
suppressing this pest in its overwintering habitat, i.e., southern Florida, in order to reduce the numbers of moths migrating northward each spring. According to Dr. Luginbill “... the abundance or scarcity of natural enemies to a large extent determines whether or not fall armyworms become abundant enough during a season to cause destruction to crops. ... It appears that a general outbreak of *Laphygma frugiperda* becomes possible only when the natural enemies of the insect have been reduced in its permanent habitat, thus permitting the insect to develop in enormous numbers in early spring.”

Dr. Luginbill attributed the general outbreak of fall armyworm in 1912, “... unquesionably the most severe that had ever occurred in the United States [to that time],” to a severely reduced level of parasitization in Florida during the winter and spring that allowed the fall armyworm to increase in great numbers. Although the parasitic enemies had increased their numbers by midsummer of 1912, the fall armyworm already had spread practically throughout all areas of the United States east of the Rocky Mountains. “The caterpillars appeared in destructive numbers in Florida in April and in southern Alabama the latter part of the same month. In early May, moths began to issue from this generation and crossed Alabama and other Gulf States, producing another generation. The moths of the latter generation migrated farther north, repeating the operation again and again.”

Unlike 1912, outbreaks of fall armyworm in 1913 were few in number and local in distribution, owing to the abundance of natural enemies in southern Florida in February and March and throughout late spring. Recent research in South Florida (Ashley et al. 1982, 1983, Mitchell et al. 1984) showed that parasitoids, especially *Chelonus insularius* Cressson and *Tenemucha difficilis* Dasch., have a tremendous suppressive effect on fall armyworm populations most years. Moreover, the percentage of fall armyworm larvae in corn that is parasitized in each of the first four instars is correlated positively with the percentage of available larvae in a given instar within the total population. In view of these findings and the observations of Dr. Luginbill and others on the influence of weather on larval fall armyworm-parasitoid interactions, it is surprising that action agencies have not seized the opportunity to predict possible outbreaks of the fall armyworm through annual evaluations of the parasitization levels of this pest in its overwintering habitat, i.e., South Florida.

In summary, the information presented in Bulletin No. 34 on the life history and habits of the fall armyworm is interesting and accurate as verified by numerous publications on the fall armyworm over the past 57 years. Even with respect to control technology, not much has changed. Pesticides—sprays, dusts and baits—were among the favored methods for control of the fall armyworm in 1928. The chemicals have changed, but to this day, spray and bait formulations continue to be the principal method of controlling this pest.

We will be forever grateful to Dr. Luginbill for his fine contribution. It is unlikely that anyone will take time to prepare a similar document summarizing information on the fall armyworm from 1928 to the present. The reasons for this are not lost on those struggling to gain tenure in academia or to promote his/her professional career in other research organizations. Thus, publication of the proceedings of this and earlier symposia (1979, 1980, 1984) provide a means for keeping current of research on the fall armyworm. Still, in view of Dr. Luginbill’s treatise and all that has been written on the fall armyworm over the past half century, one cannot help but wonder why we are not much further along in our efforts to control or suppress the fall armyworm than we were in 1928. Such is the legacy of Philip Luginbill.

**Endnote**

REFERENCES CITED


FALL ARMYWORM DISTRIBUTION AND POPULATION DYNAMICS IN THE TEXAS-MEXICO GULF COAST AREA

J. R. RAULSTON, Subtropical Crop Insects Research Unit, ARS, USDA, P. O. Box 1033, Brownsville, TX 78520; S. D. PAIR and A. N. SPARKS, Insect Biology and Population Management Research Lab., ARS, USDA, Tifton, GA 31793; J. LOERA G., SARH, INIA, CIAGON, Col. Rio Bravo, Tamps., Mexico; F. A. PEDRAZA M., SARH, INIA, CIAGON, S. Jimenez, Tamps., Mexico; A. PALAMON T., SARH, INIA, CIAGON, Tampico, Tamps., Mexico; A. ORTEGA, CIMMYT, 06600 Mexico D.F., Mexico; J. RUIZ SANCHEZ M., SARH, INIA, CIAGOC, Veracruz, Veracruz, Mexico; P. MARQUEZ C., SARH, INIA, CIAPAS, Juchitan, Oaxaca, Mexico; H. RUELES A. and JOEL PEREZ M., SARH, INIA, CIAPY, Campeche, Camp., Mexico; R. RODRIGUEZ R., SARH, INIA, CIAPY, Merida, Yucatan, Mexico; H. CARRILLO R., SARH, INIA, CAECHET, Cd. Chetumal, Q. Roo, Mexico; R. ARCHUNDIA R., SARH, INIA, CIAPAS, Tapachula, Chiapas, Mexico; and FRANCISCO HERRERA R., SARH, INIA, CAUXEX, Uxmal, Yuc., Mexico.

ABSTRACT

Fall armyworm, Spodoptera frugiperda J. E. Smith, population trends were studied along the Mexican Gulf Coast, the Isthmus of Tehuantepec, and the Yucatan Peninsula using Hartstack pheromone traps. Trup capture generally peaked in November and December, while the lowest capture period occurred during mid year. A temporal progression in trap capture was noted during the early part of the year from Veracruz, Mexico, to the Lower Rio Grande Valley of Texas.

A similar temporal progression in occurrence of larval populations from southern areas of the State of Tamaulipas to the Rio Grande Valley was also observed. Studies in an irrigated corn-growing region encompassing the Lower Rio Grande Valley in both southern Texas and northern Tamaulipas, Mexico (with ca. 200,000 ha of corn) showed the major fall armyworm emergence from the area occurred in June, resulting in an adult population of from 6.1X10^6 to 1.72X10^6 moths.