JOURNAL

OF

ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

VOL. I JUNE, 1908 No. 3

Proceedings of the Twentieth Annual Meeting of the Association of Economic Entomologists

(Continued from April number)

The following papers were read by title, on account of the authors being absent, and as the manuscript has been forwarded to the secretary they are included as a part of this report:

THE ORANGE WORM

(Trypeta ludens)

By PROF. A. L. HERRERA, *Chief of the Commission of Agricultural Parasitology, Mexico.*

This worm has been the object of long work tending to its destruction, said work being begun during the year 1900, when was established the Commission of Agricultural Parasitology, in the City of Mexico, which was especially intrusted with the work of combating the pest. The alarm among the Mexican orange growers was the result of the promulgation in California of a law whereby was forbidden the importation of the Mexican orange, without any distinction as to the place of origin, and under the supposition that every orange grown in Sonora, Nuevo Leon, Tamaulipas, and other states of the Mexican Republic, also contained the germ of a dangerous plague. Through the investigations and studies of the Commission of Agricultural Parasitology, it has been demonstrated that this pest exists only in the tropical parts of Mexico, particularly in the states of Guerrero and Morelos, and above all in Yautepec, where over 500 orange orchards are in full production.

As it was considered or thought that the pest was easy to be fought

and controlled, and that really it would present no danger in a cold or temperate country, the Mexican government invited Mr. J. Isaac, secretary of the Board of Horticulture of California, to come to Mexico during the month of March, 1905, and we accompanied him on several of his excursions. Afterwards, Mr. Isaac published a very important report (California State Horticultural Commission: Report of the Commissioner Appointed to Investigate the Prevalence of Trypeta ludens in Mexico. Districts Affected by the Orange Worm. Nature, Habits and Extension of the Pest. Methods Adopted for Its Control. Danger to be Apprehended from its Introduction, Etc. Sacramento, 1905, p. 1–48; Plates and Maps.)

The methods adopted to control this pest have been, lately, the subject of a report presented to this commission by Mr. W. W. Froggatt, commissioned by the British government to study the pests of the fruits, and who was in Mexico, coming from Australia, during the month of November of the present year. He visited Yautepec, the center of the pest and also of the work of the Commission of Agricultural Parasitology. According to Mr. Froggatt, the control work, conducted by this Commission, has been efficacious and within one or two years the pest will practically be of no moment.

It must be observed that every orange leaving Yautepec for Mexico or other parts, is carefully examined by skillful persons, well acquainted with the matter, and they confiscate every fruit having spots due to the sting of the ovipositor of the fly, or bearing any other sign of being attacked by worms. The examination is conducted at the railroad station or in the orchards. Thus is greatly lessened the danger of the worms infesting the orchards of other countries, provided the shipments come from Yautepec and not from other warm parts of Mexico.

In any case, however, the danger of infestation by this pest is rather problematical, since, according to my own observations, the fly remains completely inactive during the cold days; it is an insect of the tropics, and to be able to live and multiply it requires a medium temperature of at least 21 degrees. Once, it made a sporadic appearance in the temperate climate of Guanajuato in but one orchard. It lasted one year and was controlled. The following year a few flies appeared, but were not given time to multiply, being attacked by the same means. Since then, Mr. Dugès thinks the pest has never been seen any more. The same occurred in Zacatlan, in the State of Puebla. The flies were seen one year on pears but have not made any further appearance.

Lately the pest was thought to infest also the Mamey (*Mammea*

americana), but it has been found that it is another species (*Anastrepha serpentina*).

Means of control.—For the last seven years the pest has been combated, in Yautepec, by burning or burying the fallen fruit from the trees and cleaning of the orchards; the old wooden and thorny fences are replaced by wire fences; the orchards are carefully cultivated and the intercalar crops of sugar cane, "jicama," (*Dolichos*), etc., have been suppressed. One of the means that have been tried during these last months consists in injecting in the fallen fruits some gasoline or benzine, thus avoiding the transportation of heavy loads of oranges to the incinerating furnaces or burying ditches. These injections are performed by a workman who perforates the fallen oranges not yet rotten with a nail or any pointed tool, in but one place, so that the hole thus formed be of about the same diameter as a large pencil; then he squeezes the fruit in order to extract a large amount of its juice, and another man gives him an ear-syringe filled with gasoline or benzine, which is injected in a sufficient quantity, that is, all that may be contained inside of each orange.

The cost of this treatment is, approximately, from 15 to 20 dollars, Mexican money, for every 10,000 fruits. I think that this amount could easily be reduced if an automatic injector were used, which is not necessary for the present. According to practical informations from the agents of the commission, a workman may inject 250 oranges an hour, and therefore six workmen at work for eight hours a day will inject 12,000 oranges. The larvæ do not perish immediately, but they fall into lethargy under the effects of the vapors from the benzine, which slowly spread through the pulp of the orange and thus impede the exit of the larvæ already fully developed and ready to bury themselves.[1]

Parasites.—Since 1907 I have tried, very earnestly, to find the parasites which might help in the destruction of the fly. At first was discovered the *Cratospila rudibunda*, a species of wasp (*Braconidae*), which lays its eggs on the larvæ, through the skin of the guavas and mangos, but unfortunately its ovipositor is very short and could not penetrate to the interior of the oranges. This parasite could not be bred and besides is very scarce in Yautepec.

At Cuernavaca, a horticultural center of great importance, the guavas and mangos are infested by the *Trypeta ludens* and *acidusa*, but there are no orange groves in that place. With great care did I

[1]Mr. Froggatt says that in Australia they have been using petroleum with water to attract the flies, but the experiments made at Yautepec so far have given very little results.

look for the parasites on the fruit fallen under the trees; I found many articulates, which were classified by specialists of the Washington Bureau and they are the following ones:

A larva of *Elateridae*, belonging to *Melanotus* or some allied genus. As far as known, the larvæ of this genus live underground on the roots of various plants.

Stelidota geminata, *Epuraea labilis*. Both belong to the family *Nitidulidae*, or sap beetles, and are known to feed on decaying fruit and similar substances.

A Staphylinid beetle of the genus *Osorius*, the species being in all probability undescribed. This is certainly not injurious to fruit, the species of this genus living in the ground.

Larva of *Anastrepha (Trypeta) ludens* Loew.

A Curculionid larva, probably belonging to the genus *Conotrachelus*.

Species of this genus attack and injure healthy fruit, and an effort should be made, therefore, to breed the perfect beetle. This insect, however, was never found any more as injuring the fruit.

A Carabid larva belonging to the subfamily *Lebiinae*. The larvæ of this subfamily of *Carabidae* are predaceous.

Proctotrypes n. sp. Parasitic in larva of some insect.

A Staphylinid of the genus *Homalota*. The species of this and allied genera are certainly not injurious to the fruit.

A Coleopterous larva. (*Dermestidae*?)

Apharaeta n. sp. Probably parasitic on *Anastrepha* or else on some Dipterous scavenger.

I have not tried to cultivate in vitro, the *Proctotrypes* or the *Apharaeta*, because they seem to me of very little efficacy, even when they have the best climatic conditions, and moreover they are very scarce, and therefore the plague is causing great damages in the Cuernavaca fruit, where the orchardists are still more indifferent than at Yautepec, and do not pay any attention to the destruction of the fallen fruit.

I have made up my mind to keep up during the year the study of the parasites of *Trypeta ludens*, at the various stations. Neither did Mr. Froggatt find, at Yautepec, any important parasite of the orange worm, and as to the parasites recommended by Compère, and which he claims to have discovered in Brazil, they have been useless, according to the information of Mr. Froggatt and Mr. Lounsbury.

As to the *Hexamerocera brasiliensis*, advocated by Von Ihering, thus far it is not known whether it is efficacious.

To conclude, I will say that the danger of infection of the United States orchards does not appear to me as formidable as it has been claimed to be, owing to the difference in the climate, since it is a question of a tropical insect, and besides, though for the last 24 years worm infested oranges have been introduced into the United States, yet it is not known that the pest has appeared in any Florida or California orchard. Since 1884, the orange worm has been imported with the fruits proceeding from Mexico, and sold at New Orleans (Riley. "Insect Life," t. I, p. 45), a seaport which is not far away from the Florida orange groves.

Places in Mexico where oranges are produced abundantly, and are not infested by the Trypeta ludens.—Sonora, Aguascalientes, Chihuahua, Colima, Jalisco, Nuevo Leon, San Luis Potosi, Zacatecas. Most particularly, the orange from Autlan, Guarachita, Rio Verde, is never affected by the worm. It is but just, therefore, that not all of the oranges from Mexico be prohibited, rejected or subjected to examination. The Sonora and Jalisco fruit is extensively exported to the United States and this fruit is never wormy.

Mexico, December 7, 1907.

Bibliography

Las naranjas en Florida. "Boletin de la Sociedad Agrícola Mexicana."—Enero de 1895.

Naranjas de Sonora en los Estados Unidos. Ibid. Abril 8 de 1895.

La naranja mexicana. Ibid. Octubre 24 de 1895.

La perspectiva del comercio en naranjas. Boletin de la Sociedad Agrícola Mexicana, t. 22, p. 58.—Enero 31 de 1896.

La exportación de naranja de México. Ibid. 30 de Noviembre de 1896.

Naranjas mexicanas. Ibid. t. 21, p. 372. Junio 30 de 1897.

El comercio de naranjas de California y Sonora. Ibid. Marzo 8 de 1891.

Comercio de naranjas. Ibid. Marzo 16 de 1891.

Comercio de frutas. Ibid. Abril de 1891.

Exportación de naranja de Sonora. "El Economista mexicano." Boletin de la Sociedad Agrícola Mexicana. Julio 24 de 1891.

Exportación de naranja. Boletin de la Sociedad Agrícola Mexicana. Junio 24 de 1892.

La naranja en Jalisco. Ibid. Diciembre 31 de 1893.

Exportación de frutas. Ibid. Febrero 16 de 1894.

La exportación de nuestras naranjas. Ibid. t. 22, p. 191.—16 de Marzo de 1898.

El gusano de la naranja. Ibid. Octubre 17 de 1900.

Exportación de naranjas. "El Progreso de México." Noviembre 30 de 1898.

La exportación de naranjas mexicanas á los Estados Unidos. Las naranjas agusanadas. Ibid. Diciembre 8 de 1898.

Las naranjas mexicanas en los Estados Unidos. Ibid. Marzo 8 de 1898.

Prohibición de entrada á California de las naranjas mexicanas. Ibid. Diciembre 15 de 1899.

La naranja mexicana en el mercado de Nueva York. "El Tráfico." Guaymas. 1899.

Prohibición de importar naranja mexicana á California. "The Fruit World." Los Angeles, Cal. Vol. 7, n. 9, 25 Nov., 1899.

Gusano de la naranja mexicana. Ibid. Vol. 8, n. 10, 3 Dec., 1899.

Cuarentena nacional. Ibid. Vol. 8, n. II, Dec. 9, 1899.

La naranja mexicana. Circular de la Secretaría de Fomento. Enero 9 de 1900.

Howard, L. O. The Orange Worm. Yearbook U. S. Dept. Agricult. 1897, p. 544. Ibid. Boletin de la Sociedad Agrícola Mexicana. t. 24, p. 61-69. Enero 25 de 1900.

Triunfo de la naranja mexicana. Ibid. P. 200.

Riley, C. V. The Morelos Orange Worm. "Insect Life." t. I, p. 45, August, 1888.

Craw, A. Informes relativos á cuarentenas. Report of the State Board of Horticulture of the State of California. For 1901-1902. 1899-1900, p. 12.

Herrera, A. L. Informe acerca del gusano de la naranja. Biblioteca Agrícola de la Secretaría de Fomento. Marzo 19 de 1900.

Informes y estudios publicados por la Comisión de Parasitología Agrícola de México. "Boletin." t. I, 1900-1902, p. 5-22; 32-39; 76-86; 89; 115-118; 145-167; 184-193; 218-228; 287; 289; 374; 386; t. II, pp. 115; 179; 294; 295; 307; 448; t. III, Cultivo y plagas del naranjo, por varios horticultores, p. 1-233; gusano de la fruta; p. 199-220; *Note*. Boletín, n. 7, t. II. El gusano de la fruta. p. 307-448. 1905.

"California Fruit Grower." 25 Nov., 1899. (Quarantine.)

"Rural Californian." April, 1897. Ibid. October, 1897, p. 380.

Howard, L. O. The orange worm does not exist in Jalisco and Sonora. Yearbook U. S. Dep. Agr. 1897, p. 547.

Isaac, J. [1] Report of the Commissioner Appointed to Investigate the Prevalence of Trypeta ludens in Mexico. Districts affected by the orange worm. Nature. Habits, and extension of the pest. Methods for its control. Danger to be apprehended from its introduction, California State Horticultural Commission. E. Cooper. Commissioner. Sacramento. 1905, p. 1-48, plates.

Parasites after Compère : "Journal of the Department of Agriculture of West Australia." 10 (1904, n. 2, pp. 68-72). "Experiment Station Record.' Washington, U. S. Vol. XVI, p. 389.

Von Ihering. As moscas das fructas e sua destruicaio. "Zeitschrift für Wissenschaftliche Insektenbiologie." Heft. 8, Band II. (*Hexamerocera brasiliensis.*)

Lounsbury, C. P. Natural Enemies of the Fruit Fly. "Agricultural Journal, Cape Good Hope." 1905, pp. 309 and 457.

[1] The above paper was accompanied by a large, admirably executed colored chart showing the pest in its various stages and also by many illustrations from John Isaac's special report, cited above, to which specially interested parties are referred.