

PLAGUE IN THE AMERICAS: AN HISTORICAL AND QUASI-EPIDEMIOLOGICAL SURVEY*

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(Continued)

Pneumonic plague.—Primary pneumonic plague made its appearance during the original outbreak in Asunción in 1899 (at least 11 cases, all fatal, in Asunción and Ytaguá). Since then pulmonary cases have assumed considerable importance in various localities. Among the countries most afflicted has been Argentina, with more than 225 deaths in more than 21 outbreaks, scattered through a number of years, in 9 provinces. Most of these outbreaks were in the interior, and several of them were suspected or proven to be of wild rodent origin. In Brazil, 37 out of 129 cases in the State and 33 out of 78 cases in the city of São Paulo were pneumonic, 1926–38; in Parnaíba, 1927 and 1928, 3 out of 22 cases, and Rio de Janeiro, 27 out of 1326 cases (2 per cent), 1904–1914. In Baía, 1935–1936, 5.5 per cent of the cases were pneumonic. In Santa Cruz, Bolivia, 1938, there were 3 pneumonic cases out of 150; in Entre Ríos, Bolivia, 1938, there were 5 pneumonic out of 90 cases; and in Arce, 1921–22, 87 deaths out of 300 were said to be from pneumonic plague. Chile has had very few pneumonic cases, most of them secondary. The last case in Santiago, in 1931, was pneumonic. Ecuador has had several outbreaks, including one in Riobamba in 1938 with 16 fatal cases. There was an apparent pneumonic case in the first outbreak in Callao, Perú, 1903, and some have been reported since. The outbreaks in Oakland, 1919, and Los Angeles, 1924, California, were pneumonic. The first primary pneumonic cases in Uruguay seem to have been the two in 1911, and the last that in Juan Lacaze in 1929. In Venezuela, 6 out of 64 cases in La Guaira in 1908 were pneumonic; 16 out of 107 in Caracas, 1908–09; and 15 out of 113 in the whole country, 1919. Pneumonic cases were also reported in the State of Miranda, 1928. The mortality from pneumonic plague has been very high, usually 100 per cent, although recoveries have been reported. The lowest recorded mortality for pneumonic plague would seem to be that in São Paulo, 1936, 23 cases, 18 deaths, 78.2 per cent.

Other types of plague.—In addition to pneumonic plague, septicemia has not been uncommon; it has been reported from Argentina, Bolivia, Brazil, Uruguay, and Venezuela, among other countries. Various

* Tables and bibliography will appear only in the reprints of this article.

atypical forms of plague have also been described, such as the anginous and eruptive forms mentioned above (Note 5) seen in Ecuador; sub-febrile forms with eruption and polyadenitis, Peru; cutaneous plague and plague "carbuncle" and "chronic" plague, "walking" plague, or plague of prolonged evolution, observed in several countries, including Argentina, Brazil,⁴⁹ Chile, Peru, and the United States.

The majority of cases in the Americas, however, have been bubonic plague.

Vaccination.⁵⁰—Vaccination has been widely used in certain areas of the Americas at certain periods, but no definite conclusions as to its value yet seem possible, and a number of writers apparently feel that whatever its worth, it is by no means as effective as other measures, such as case and contact isolation, and rat destruction, and rat-proofing, which are apt to be neglected when too much reliance is placed on *en masse* vaccination. It is almost a routine measure, however, to vaccinate physicians, health inspectors and other personnel working in a plague area who are necessarily exposed to contagion. Contacts may either be vaccinated or given protective inoculations of serum. As many as 55,000 persons are said to have been vaccinated in the Vera Cruz, Mexico, epidemic (1920) and lesser numbers in Sinaloa, Mazatlán, Siqueros and Villa Unión, Mexico, 1902–03 (17,174); Vallegrande, Bolivia, July, 1928 (8,548); Brazil, northeast area: 1937, 5,000; 1938, 27,000; and Asunción, Paraguay, 1928 (a whole regiment and the capital garrison). In Mazatlán, of 1,137 persons vaccinated with Haffkine's vaccine, none became ill; in Villa Unión and area, of 2,894 persons vaccinated with Besredka and 681 with Haffkine vaccine, only two persons, one from each group, became ill, and they were thought to have been in the incubation period of the disease when vaccinated. The stifling of the Asunción outbreak in 17 days was attributed to vaccination plus other measures; favorable results with vaccine were also observed in the sick. In Brazil, in 1938, more than 4,000 persons were vaccinated with vaccine from the National Department of Health, and there was only one case, which recovered, among them. The results of the Bolivian vaccination as regarded protection against plague were not reported, although it is admitted that vaccination does not always protect, but there were two fatal reactions and five per cent severe and 50 per cent transitory general and local reactions among the vaccinated.

Serum-therapy.—The value of serum treatment of the bubonic form of plague has long been recognized in the Americas; it is considered highly effective if fresh and used in time. Martínez Vinuesa (1926) has stated that after the fifth day of illness, serum is almost useless; and that it is of little effect in the pneumonic and septicemic types

⁴⁹ *Febre do carago* and *ingua de frio*, found in Northeastern Brazil, especially in Ceará and Pernambuco, are thought by some observers to be benign plague. (Oliveira; de Barros Barreto.)

⁵⁰ *Bol. Of. San. Pan.*, Apr. 1937, p. 376; "Acta X. Conf. San. Pan.", 1938.

of plague. However, he felt that even in these latter cases it should be tried.⁵¹ In 1925 Lloyd expressed the opinion that serum treatment was the only effective therapeutic measure.⁵² He stressed the necessity of using fresh serum, in large doses, and reported the favorable results obtained in Guayaquil, Ecuador, in 1908, 1909 and later years. (In 1908-09, it was estimated that the mortality among untreated cases was 60 per cent; among all serum-treated cases, 33 per cent; and among cases treated from 24 to 36 hours after onset, 18 to 20 per cent.) Fifty to 60 per cent of cures were reported among serum-treated cases in Peru (1929). Serum has been used in Argentina since 1899, with good results. Most American writers seem to feel that the mortality from pneumonic and septicemic plague is about 98 per cent in any case, although serum is given these cases also and some cures have been attributed to it. (See Table 3.)

Seasonal variation.—Seasonal variations in the bubonic type of plague are, it is well known, due mainly to climatic factors which influence migration and prevalence of rodents and their parasites, and perhaps breeding periods and conditions of both rodents and fleas. While no respecter of climates, plague has been found to be fundamentally a disease of tropical and semi-tropical areas, doing best in moderately warm, damp weather. Robertson (1923) called attention to the "plague zone," an area bounded roughly by the 35° parallel north and south of the Equator, and noted that climatic conditions extended this broad band to the 45° parallel north in Europe and America. A temperature of 50-80°F, and especially about 70°, and a certain degree of humidity (saturation deficiency under 0.3 inch) seem to be ideal. In such warm climates, plague increases towards the end of winter and spring and begins subsiding with the approach of hot weather. Robertson argues that with a mean midwinter temperature below 45°F, bubonic plague becomes accidental. In temperate climates the plague seasons are summer and autumn. Seasonal variation and geographic distribution are, of course, closely allied to the prevalence and activity of the insect vector—mainly, but not exclusively, *X. cheopis*—which does not fare well in a dry atmosphere and in temperatures over 85°F or below 50°F.

Pneumonic plague, on the other hand, not being flea-carried, is not influenced by temperature. In some countries, such as Argentina and Bolivia, pneumonic outbreaks have been reported in practically every month of the year.

While there would seem to be no special "plague season" in several Latin-American countries, for instance, Bolivia and Argentina, where outbreaks are sporadic, and especially in areas where human plague does not depend on a *cheopis*-infested rat population, some seasonal

⁵¹ Martínez Vinuesa, J.: *Bol. Of. San. Pan.*, May 1926, p. 193.

⁵² Lloyd, B. J.: *Plague: past, present and future*, *Jour. Am. Med. Assn.*, Sept. 5, 1925, p. 729.

variation has been observed. For instance, three annual outbreaks occurred in Jujuy, Argentina: one at the beginning of the rains toward the first of the year; a less severe outbreak at the time of the corn harvest, and another large recrudescence toward the end of the year, a favorable season for rat breeding (Alvarado, 1935). In Rio de Janeiro, Brazil, plague was most prevalent from August to December (winter and spring), with the highest incidence in October and the lowest in April. In São Paulo, 1926-37, of 129 cases, 40 occurred in January and 27 in July, the latter including 23 pneumonic cases. Plague is most active from March to May in Ceará (most humid season) and from July to October in Pernambuco. In Chile there were summer and autumn epidemics in the ports from Valparaiso on north. February through May were the heaviest months in Antofagasta. The plague outbreaks in Cuba appeared in June-July, 1912, and February-August, 1914. In Guayaquil, Ecuador, the plague season has apparently changed; prior to 1916 the yearly epidemic reached its peak in October, November, and December, last of the dry season; but since then the greatest number of cases have occurred in January, February, and March, or the first three months of the rainy season, a shift attributed by Eskey to the development of a high immunity in the house rat and lack of immunity in the outside rat, which seeks shelter indoors during the rainy season. In the mountain areas, human cases have been most numerous from March to June. The epidemics in Mexico occurred in Mazatlán, December to May; Vera Cruz, April to September, Tampico, March to August, Cerritos, November to April; and Carbonera, May. In Peru, October through February are the heaviest plague months, with the peak during the summer, especially in northern Peru; the summer-winter variation has not been so noticeable in the vicinity of Callao and Lima. Unseasonable epidemics have occurred in all parts of Peru, and in some rural communities the incidence apparently depends on the crop season. An outbreak in April, 1931, in Lima was attributed to the migration of rats from the garbage and refuse dumps. In the United States, plague was present in San Francisco from March 1900-1904; again from May to November, 1907; in August, 1908. The outbreaks in Oakland, 1919, and Los Angeles, 1924, were pneumonic. In New Orleans, plague occurred in June, July, September, and October. In Venezuela, plague was present in La Guaira from April to July, 1908; in Caracas, April 1908-October 1909; in the State of Miranda, February and March, 1928, several pneumonic cases; in the whole country, 1919, highest incidence was in April-October (89 out of 113 cases), followed by January-February (24 cases). The 1939 outbreak in Aragua was in December.

Altitude.—It is interesting to note that sporadic outbreaks of plague have occurred at altitudes of over 6,000 feet in Bolivia, over 9,000 feet in northern Peru and over 10,000 feet in Ecuador.

Rats.—In Argentina, *R. norvegicus* is found throughout the country; *R. rattus* along the coast, and also over a great part of the interior, and *R. alexandrinus* principally along the coast. In ports, in 1936, *norvegicus* was the most prevalent rat in Buenos Aires, Santa Fe and Bahía Blanca, and *alexandrinus* in Rosario. In the rural areas of northeastern Brazil, *R. rattus* prevails. In Salvador, Bahia, *norvegicus* is most common; in Rio de Janeiro and Recife, *rattus*; in Maceió, *rattus* (and *musculus*); in Fortaleza, *musculus* and *m. silvaticus* (field rat). *Rattus* is said to be the most common rat in northern Chile; *norvegicus* in Concepción. Guayaquil usually has a predominance of *norvegicus*, followed by *rattus* and *alexandrinus*, but the proportion varies. In the Sierra, *alexandrinus* predominates, though *rattus* is nearly as common and *norvegicus* is also found. In Paraguay *norvegicus* prevails, followed, to a much lesser extent, by *rattus*. In the towns of northern Peru, *alexandrinus* and *rattus* predominate; *norvegicus* is also present; in the central and southern area, *norvegicus* generally exceeds *rattus* and *alexandrinus*. *Rattus* is considered an important plague carrier in the interior. In Caracas, Venezuela, over 95 per cent of the rats examined in a survey were *norvegicus* and the balance, *rattus*. (See Table 4.)

Wild rodents and other animals.—As previously noted, plague has been thought to exist among wild rodents in Argentina since 1905. The following species have been found naturally plague-infected: *Microcavia australis*, *Galea musteloides*, *Graomys griseoflavus gris.*, *Lepus europaeus* (rabbit), *Hesperomys murillus*, and *Sylvilagus brasiliensis*. While natural infection of wild rodents in Bolivia does not seem to have been proven, it is noted that “cávidos” (*cavia* ?) and *graomys* are abundant throughout the country; and are possibly involved in the spread of rural outbreaks such as those in Tomina and el Azero, where *rattus* has not been found. In northeastern Brazil, wild rats or crosses between wild and domestic rats, including the cane rat (*rato da cana*), *Cercomys laurentius*; the “spine rat” (*rato de espinho*); and *Holochilus sciurius* (*punaré*) have been found receptive to plague, as well as the “preá” (*Cavia aperea*), the “mocó” (*Heredon rupestris*), the “pixuna” (wild mouse), and the cotia (*Dasyprocta agoutis*). In Ecuador, a reddish-brown wild rat has been found, and also an apparent hybrid of this with *alexandrinus*. Domesticated guinea pigs have been implicated in both Ecuador and Peru; it is interesting to note also that in Ensenada, Mexico, in 1902, the death of 27 pet rabbits in 2 foci was noted, although rabbits were not at that time believed to be susceptible to plague.⁵³ In Peru, a small grayish field rat and a wild reddish-brown rat have been observed. Plague infection of these wild rats in Ecuador and Peru has not been reported. In the United States, plague infection has been demon-

⁵³ *Pub. Health Rep.*, Jan. 16, 1903, p. 73.

strated in eleven species of ground squirrels (*Citellus Washingtonii*, *C. richardsonii*, *C. richardsonii elegans*, *C. armatus*, *C. beldingi oregonus*, *C. columbianus*, *C. variegatus grammurus*, *C. beecheyi*, *C. beecheyi fisheri*, and in prairie dogs (*Cynomys parvidus*, *C. leucurus*, *C. gunnisoni zuniensis*); in marmots (*Marmota flaviventris englehardii*, *M. flaviventris nosophora*); chipmunks (*Eutamia quadrivittatus frater*); squirrel (*Callospermophilus chrysodeirus chrysodeirus*); chickaree (*Sciurus douglasii albolimatus*); flying squirrel (*Glaucomys sabrinus lascivus*); wild mice and wood rats (*Peromyscus truei Gilberti*, *Neotoma cinerea occidentalis*, *N. lepida intermedia*, *N. fuscipes mahavensis*, *N. desertorum*); kangaroo rat (*Dipodomys ordii*); and cottontail rabbit (*Sylvilagus nuttallii*). To date, plague has been found in rodents from 10 Western States (Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming⁵⁴).

Dead cats have been reported in connection with plague outbreaks in Argentina, notably in the Pampa and Catamarca, but experiments by Uriarte and Morales Villazón have not demonstrated plague infection. Inoculation with the plague bacillus causes a chronic disease, characterized by emaciation and abscesses, but the bacillus cannot be recovered at autopsy.⁵⁵ Feline epizootics occur with relative frequency in Ceará, Brazil, but the exact etiology is in doubt. Marcello Silva feels that some of the infection in cats is due to plague, and Araujo has confirmed the experimental susceptibility of cats to that disease.⁵⁶ Results of a recent investigation into a feline epizootic in Crato, Brazil, by Macchiavello, have not yet been published.

Jellison has studied the rôle of predatory and scavenger birds: crows, magpies, owls and hawks, in southwestern Montana. The discovery of 109 live rodent fleas of six species in the nest of a burrowing owl is of interest. Other predatory species serve as accidental hosts of rodent fleas. Casts from predatory birds fed infected tissue were consistently infectious; tests on the infectivity of feces were negative.⁵⁷ Araujo was unable to find the plague bacillus in the contents of the gizzard or intestines of vultures which had fed on infected material.⁵⁸ Bats have been found to be sensitive to plague by scarification in Argentina.⁵⁹

Fleas.—While *X. cheopis* is the most common rat flea in the Americas, its incidence varies in relation to the prevalence of different species of rats, the temperature, and the humidity. In Argentina the proportion

⁵⁴ Eskey, C. R., and Haas, V. H.: *Pub. Health Rep.*, Aug. 11, 1939, p. 1467; Meyer, K. F.: *Am. Jour. Pub. Health*, Nov. 1939, p. 1225.

⁵⁵ Uriarte, L., and Morales Villazón, N.: Sensibilidad e insensibilidad a la peste de algunos animales, *Rev. Inst. Bact.*, Arg., Jul. 1936, p. 721.

⁵⁶ Barros Barreto, J.: "X Conf. San. Pan.", 1938, p. 154.

⁵⁷ Jellison, W. L.: *Pub. Health Rep.*, May 12, 1939, p. 792.

⁵⁸ Araujo, E. de: *Bahia Med.*, Aug. 1937, p. 155; *Bol. Of. San. Pan.*, Sept. 1938, p. 819.

⁵⁹ Barrera, J. M. de la: Peste rural, *Rev. Inst. Bact.*, Arg., Mar. 1936, p. 439.

of *X. cheopis* ranges from 61 to 90 per cent in different areas. *Cheopis* is the most common domestic rat flea in Brazil, followed, often very closely, by *X. brasiliensis*, which sometimes exceeds it in numbers. In northern Chile, *cheopis* is the most prevalent flea, but in Concepción, none were found in over 1,000 fleas, the majority being *L. musculi*, followed by *C. fasciatus*. A few *X. astia* were found in Antofagasta in 1929 (0.24 per cent), but none in 1930, nor in 1932-35. *X. cheopis* predominates in Cuba. It is the most common flea in Ecuador up to about 8,500 feet altitude, and is found as high as 9,000 feet. In addition to *cheopis*, *P. irritans* and *Ct. felis* are found in Guayaquil, and *P. irritans*, *L. musculi*, *Ct. londiniensis*, *Ct. canis*, *Hectopsylla suarezi*, and *Rh. cavicola* in the interior. *P. irritans* and *H. suarezi*, especially the former, have both been considered as possibly responsible for epidemics of plague occurring in the absence of *X. cheopis*, in the interior.⁶⁰ Possible involvement of *P. irritans* is considered in the transmission of the anginous or tonsillar form of plague among Indians who are accustomed to kill these vermin by biting them. *P. irritans* has also been shown capable of infecting guinea pigs. The guinea-pig flea itself, *Rh. cavicola*, has been found on clothing and bedclothes in Ecuador, but while infectible, was not proved capable of transmitting the disease to man. In Argentina, however, *Parapsyllus* and *Rhopalopsyllus* have been shown to transmit plague by biting and to bite man.⁶¹ In Peru, *X. cheopis* is the most common rat flea in the coast area, and it has also been found on guinea pigs, dogs, cats, opossums and man. *P. irritans* is considered of importance in human plague in the interior. In Puerto Rico, 83-99 per cent of the fleas were *cheopis* in 1912 and 98 per cent in 1929-32. In the United States, *C. fasciatus* was most prevalent in San Francisco in 1937, with *cheopis* in about 25 per cent of rats in March and April (end of rainy season) and 35-40 per cent in August and September. *Cheopis* is the most prevalent flea in Montevideo, Uruguay. A survey in Venezuela revealed 94.2 per cent *cheopis*, 3.8 per cent *brasiliensis*, 1.5 per cent *Ct. felis*, and 0.40 per cent *L. musculi*. (See Tables 5 and 6.)

Lice.—In addition to the human flea, *P. corporis* and *P. capitis* are considered of possible importance in the transmission of plague in

⁶⁰ The possibility of the transmission of plague by human parasites was suggested by Simond and others in 1898, and demonstrated from time to time, but *P. irritans* was generally felt to play a minor rôle, if any. In view of the fact that Eskey (1930) considered "viruela pestosa" (vesicular plague) as probably transmitted either by *P. irritans* or *P. capitis*, and most probably the former, Martin's theory (1913) is of interest: that human flea transmission was not important because of the rarity of septicemic plague; that lessened toxicity leading to more septicemia in man might open the way to human flea transmission of the disease. (Wu *et al.*, p. 297.) English authors considered that plague in cold climates, once started, was spread by the human flea. Experience in Ecuador lends some support to both these theories. Septicemic plague in Ecuador, however, is far from mild, the mortality being about 92 per cent in the vesicular or eruptive form. It is of fairly long duration, the eruption appearing about the sixth or seventh day. Human flea and louse transmission is rendered very feasible by the custom of Bolivian, Ecuadorean and Peruvian mountain Indians of holding extended "wakes," after which the clothes of the deceased are distributed among friends and relatives. Plague-infected fleas have been found on such clothing.

⁶¹ Barrera, J. M. de la: "Actas X Conf. San. Pan.", 1938, p. 135.

mountain regions where neither rats nor *X. cheopis* exist. Mostajo and Colichón Arbulú in 1934 demonstrated plague infection in nine lice from the hair and clothing of a plague case in Peru, and suggested the possible rôle of this parasite in certain localities of the Sierra, where the Indians kill lice and fleas with their teeth, where angina pestosa is not rare, and where plague and typhus coexist.⁶²

Pan American Cooperation.—Acting on the advice of the Directing Council of the Pan American Sanitary Bureau, the Director of this institution, Surgeon General H. S. Cumming, in 1929 assigned Dr. John D. Long to carry out epidemiological studies of plague and, when requested by national health authorities, control work in cooperation with them. This work, which has now embraced practically all the South American countries, has been almost unique from the standpoint of international good will and cooperation. Out of this campaign have evolved standard control measures, improved poisoning methods, and noteworthy scientific data.

Plague has held an important place on the agenda of every Pan American Sanitary Conference, and provisions for its control, notification and prevention are included in the Pan American Sanitary Code (Habana, 1924) ratified by all the American Republics, as they were included in the previous Washington Convention (1905) and in earlier agreements with regard to unification of procedure between two or more American countries (such as Argentina and Uruguay, 1899; Argentina, Uruguay and Paraguay, 1900, and later accords.⁶³)

Present status.—Of the American countries invaded by plague, Mexico, the West Indies, Chile, Paraguay, and Uruguay are now apparently free. All seaports are also free, and the international danger is today considered comparatively slight, provided measures in the form of rat-proof building and anti-rat campaigns continue to be undertaken to prevent the reappearance of the infection, and rat examinations, especially in seaports, are regularly made to check on its possible presence.

CHRONOLOGICAL OUTLINE OF PLAGUE IN THE AMERICAS

1898 November. Plague possibly present in San Francisco.

1899 April 28. Sailor died of plague in Asunción, Paraguay.

(Member of crew of the "Centauro," carrying grain brought by the "Zeier," transhipped at Montevideo). First historically accepted case of plague in the Americas.

September. Plague diagnosed in Asunción by Argentine Commission.

Plague probably present in Rosario, and in Santos.

October 18. Plague officially present in Santos, Brazil.

December. Suspicious case in Buenos Aires.

⁶² Mostajo, Benjamín, and Colichón Arbulú, H.: *Ref. Méd.*, Lima, Aug. 15, 1934, p. 524; *Bol. Of. San. Pan.*, Mar. 1935, p. 251; July 1935, p. 621. While infectibility of the lice was proven, they were not shown capable of infecting guinea pigs by biting.

⁶³ Fernández Espiro, *op. cit.*, p. 277.

- 1900 January. First confirmed cases in Buenos Aires and Rosario. Rio de Janeiro infected.
 February-April, plague suspected in British Honduras.
 March 6, first official case of plague in San Francisco, California.
 October 12, plague-infected vessel "Highland Prince" arrived in Montevideo, Uruguay.
- 1901 June 27, first case of plague in Uruguay.
- 1902 December 11, plague suspected Ensenada de Todos los Santos, Mexico.
 December 13, plague suspected Mazatlán, Mexico.
 December 31, Mazatlán and Ensenada declared plague-infected.
- 1903 April 28, first cases of plague in Pisco and Callao, Peru.
 May 6, first cases plague diagnosed, Pisco and Callao.
 May 25, first case of plague diagnosed in Iquique, Chile.
 June 10, first case of plague diagnosed in Valparaiso, Chile.
 Wild rodent infection suspected in California.
- 1904 Wild rodent susceptibility proven in California.
- 1905 June and August, plague in La Boca, Panama.
 Wild rodent infection suspected in Argentina.
- 1907 June, Trinidad infected.
- 1908 February 10, 1908, Guayaquil, Ecuador, infected.
 April, plague diagnosed in Venezuela (La Guaira).
 May 25, plague present in Caracas, Venezuela.
 June 25, plague officially present in Venezuela.
 Wild rodent infection (natural) proven in California.
- 1912 Plague present in Cuba.
 Plague present in Puerto Rico.
 Plague present in Grenada and Trinidad.
- 1915 Last cases of plague in Cuba.
- 1919 Wild rodent infection (natural) proven in Argentina.
- 1921 Plague present in Tarija, Bolivia.
 Plague present in Puerto Rico (last cases).
- 1923 Last human cases of plague in Mexico.
- 1925 Last rodent plague in Mexico.
- 1928 Plague officially present in Vallegrande, Bolivia.
 Last cases of plague reported in Venezuela until 1939.
- 1929 Last case of human plague reported in Montevideo, Uruguay.
- 1930 March, 1930, last human case in Guayaquil until 1935.
 Last human case reported in Rio de Janeiro.
- 1931 Last case of plague reported in Buenos Aires (human).
 Last human plague in Chile.
- 1932 Last rodent plague reported in Chile.
 Last cases of plague reported in Uruguay.
- 1934 Last human cases reported in Rosario, Argentina. (Port)
- 1935 Last human cases reported in Santa Fé, Argentina. (Port)
 Plague recrudesces in Ecuador (September 1935), Guayaquil reinfected.
- 1936 Seven plague rats reported from Buenos Aires dock.
 2 cases of plague Bahia Blanca (Ingeniero White)—last cases in an Argentine port.
 Last human cases reported in Santos, Brazil.
- 1937 Last human cases reported in U. S. up to December 1939.
- 1939 December, plague reported in the State of Aragua, Venezuela (interior) (first report since 1928).
 December, 1 case human plague reported in United States (Utah), first human case since 1937.