

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

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INTRODUCTION

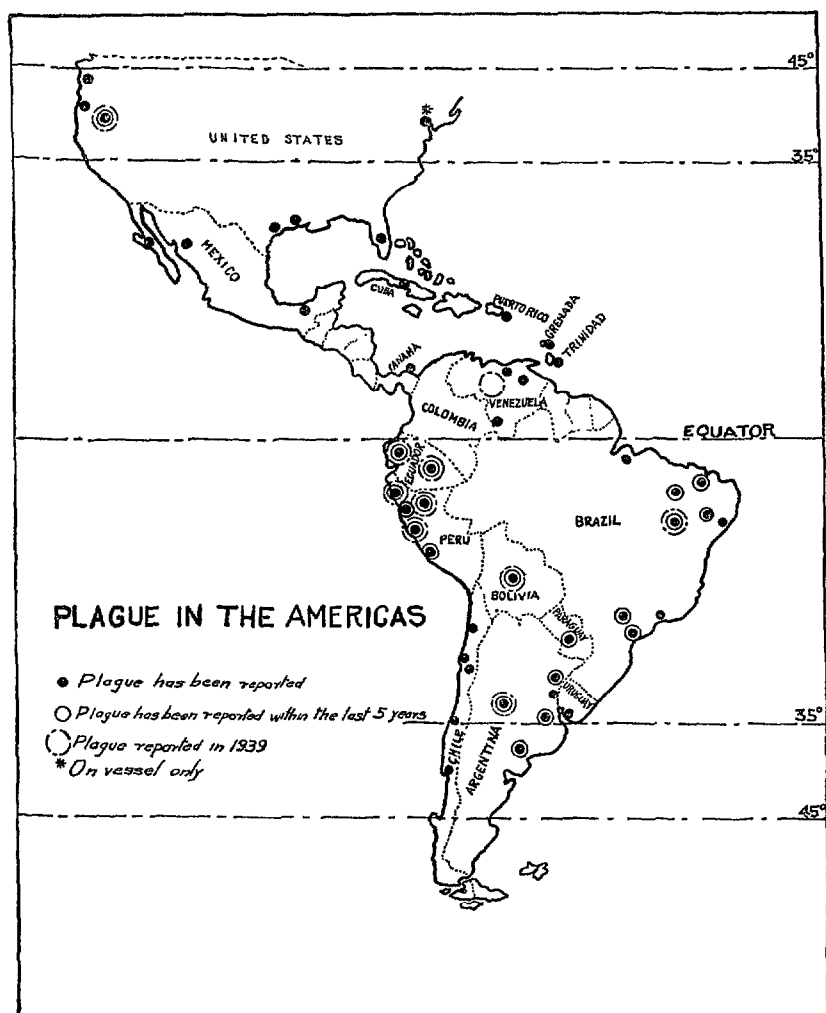
In the history of modern epidemiology, certainly no phenomenon exceeds in interest the revival of the pandemicity of plague toward the end of the XIX century. It is well known that with the shifting of the centers of trade with the Far East from southern to northern Europe, and the improved construction of buildings, especially docks and wharves, the periodic inroads of the disease gradually ceased in Europe during the XVIII century. Signs of its latest reawakening were first reported more than one century later from the interior of China, where it had probably remained endemic; then the scourge crept closer to the sea, attacking the province of Yunnan, and finally, in 1894, ravaging Canton, where 120,000 people died in a few months. By 1896, southeastern Europe was already affected.

The occasion seemed unique in more than one sense. About this time cholera was ending the series of periodic irruptions into the Western world which it had begun around 1832. Yellow fever was soon to be combated effectively for the first time through the confirmation and practical application of Finlay's concept that the *stegomyia* mosquito was the vector of the disease. Almost simultaneously with the corroboration by the American Yellow Fever Commission (1900) of the famous postulates enunciated by the Cuban scientist as early as 1881, plague made its first appearance on American soil, striking both extremes of the continent: south in 1899 and north by 1900. Last, but not least, the etiology of plague had just been suggested (1898) by a member of the Pasteur Institute (Simond), and was soon to be brilliantly demonstrated by the studies of the British Plague Research Commission in India.

Since that time, few indeed have been the American countries spared. The last country in which plague has been recognized is Bolivia. As to why Colombia¹, the Guianas, Central America, the Dominican Republic¹ and Haiti, with some smaller islands, have not been invaded; as to why its eradication proved a comparatively simple proposition in Cuba, Mexico, Puerto Rico, Panama and Uruguay, while so far found impracticable in other countries which used similar methods and perhaps more intensively—no clear-cut answer has yet been forthcoming, even though explanations based on climate, fauna, nature of

¹ See Note 45.

trade and production, and other considerations might be advanced. This protection may have been partly mechanical, through vessels anchoring away from the shore, little trade at ports, or commercial intercourse only with uninfected areas or limited to non-rat-harboring cargoes.



It may seem rather strange that in Europe, in contrast to the happenings in previous centuries, plague in recent times has occurred only sporadically, in ports such as London, Marseilles, and Oporto, and occasionally in Paris.

Other interesting elements have entered the picture in the Americas.

One is the gradual establishment of the so-called "sylvatic"² or rural plague in wild areas where no rats are present (United States, natural infection of wild rodents suspected by Blue, 1903; susceptibility shown experimentally by Currie, 1904; natural infection proven 1908 by Wherry and McCoy; Argentina, natural infection suspected by Malbrán, 1905; proven, 1919, by Uriarte and González; Bolivia, suggested by Veintemillas, Vallegrande epidemic, 1928; Brazil, epizootics among wild or wild "domestic" rats in Ceará observed for many years; susceptibility of mocó and preá demonstrated 1933-34 by Fialho and Camurça and in 1935 and 1936 by de Brito and Marcello Silva.)³ This has served to keep plague alive in the interior of countries which had rid their ports of the disease: Argentina, Brazil, Ecuador, Peru, Venezuela, and the United States; or which have no ports, as Bolivia.

Another observation is the verification of so-called "throat carriers" which have been suggested as responsible for a recent outbreak in Ecuador in which no rat fleas or rodents could be found.⁴ Pareja, Larrea, and Martínez Vinueza have called attention in Ecuador to the presence of two unusual types of plague, namely, the eruptive or variola-like "viruela pestosa" and the anginous or tonsillar "angina pestosa," both with an extremely high mortality (92% and 100% respectively).⁵ The gangrenous or anthrax type ("carbón pestoso") is less common.

The diagnosis of plague by mass inoculation (Chapin, 1909; Lloyd, 1914; Creel, 1915) and by pooled flea inoculation (Eskey, 1936); the application of cyanide fumigation to vessels (Puerto Rico, 1912-13; Cuba, 1913); the discovery of new diseases (tularemia) and new hosts when looking for plague; the emphasis on rat-proofing both on ships and on shore; improved methods of rat poisoning; and international cooperation in plague control have also been important American contributions.⁶

² The name "sylvatic" was suggested by Ricardo Jorge: "Rongeurs et puces"; 1928. The term "rural" had previously been used in Argentina for the same type of the disease. In analogy to the designation used in yellow fever, some prefer to reserve the term "sylvatic" for plague in wild rodents of various types, using "rural" in reference to rat-borne plague occurring in rural districts.

³ United States: Rucker, W. C.: Plague among ground squirrels in Contra Costa County, California, *Pub. Health Rep.*, Aug. 27, 1909, p. 1225; Argentina: Uriarte, L.: *Rev. Inst. Bact., Arg.*, Nov. 1936, p. 142; Uriarte and González, S.: *Bol. Soc. Arg. Biol.*, 1924; Brazil: Fialho, Amadeu: *Rev. Hyg. e Saúde Públ.*, June 1935; Barros Barreto, J. de: A peste no Brasil nos últimos cinco anos, "Actas X Conf. San. Pan", 1938, p. 153.

⁴ *Bol. Of. San. Pan.*, Sept. 1939, p. 867. Uriarte in 1918 reported the finding of plague bacilli in the mouths of individuals not yet ill in epidemics of pneumonic plague. (*An. Dep. Nac. Hig.*, Arg., May-June 1918, p. 9.)

⁵ Martínez Vinueza, J. J., *Bol. Of. San. Pan.*, Oct. 1930, p. 1189.

⁶ Mass inoculation and pooled flea inoculation: *Bol. Of. San. Pan.*, Aug. 1936, p. 799; *Pub. Health Rep.*, June 12, 1936, p. 786. McCoy (1910) and Williams (1920) had pointed out the difficulty of diagnosis in rodents presenting no visible signs of the disease. Macchiavello (*Bol. Of. San. Pan.*, Aug. 1933, p. 799), Long, and Uriarte have referred to inapparent infections in rats. Among 15,000 gray rats examined at the Bacteriological Institute of Buenos Aires, Savino, Morales Villazón and Anchezar found five strains of bacteria belonging to the *Pasteurella*, but different from *P. pestis*. Also, in seven instances bacteria of the

An interesting suggestion to the effect that recrudescence of plague on the western coast of South America was connected with the importation of jute bags from India was advanced by Long and Mostajo and supported by Macchiavello, but opposed by others, including Jorge and Paz Soldán.⁷

Some meaning might be read into the superficial discrepancy between the spread of rodent plague eastward in North America and westward in Argentina.

The wealth of the literature on plague accumulated in Latin American countries is hardly appreciated, and no idea of its volume and value can be gathered from the usual text-books. For instance, among the several hundred references given in the most recent monograph on this subject,⁸ only about a dozen Latin American papers are cited.

The organization of permanent antiplague services in a number of countries, the regular examination of rats in seaports, and the cooperation of the Pan American Sanitary Bureau with national health authorities in plague eradication, especially in ports, testify to the importance given to the solution of this problem in the Americas, and the advances made along this line.

I. GENERAL REVIEW

Not the least strange of the phenomena connected with the history of bubonic plague in the Americas is that the first recognized outbreak of plague in this hemisphere was likewise the only initial outbreak for which the origin could be more or less definitely traced. It has been historically accepted that plague was introduced into South America in April, 1899, with the arrival in Montevideo, Uruguay, of the Dutch sailing vessel *Zeter*, from Rotterdam, with a cargo of sacked Indian rice destined for Asunción, Paraguay.^{9, 10, 11}

Coliærogenes group, and in one, *Brucella bronchiseptica*, were isolated; that is, microbes which might be confused with *P. pestis*. (Savino, E., et al.: *Rev. Inst. Bact., Arg.*, Dec. 1939, p. 142.)

A notable decrease in rat infestation of vessels has been observed since the adoption of more effective fumigation methods, rat-proofing, international certificates, and thorough inspection of vessels. In a study of 4,418 ships arriving at Atlantic ports of the United States from July, 1936, to January, 1937, 8.4% were found to be rat-infested, in contrast to the 50% infestation found during a survey in the Port of New York, 1925-27. (*Pub. Health Rep.*, Apr. 2, 1937, p. 412.) Considerable improvement has been seen in the condition of vessels arriving in Argentine ports since more intensive fumigation practices, including the "extemporaneous" fumigation of vessels with valid certificates if evidences of rat infestation were found on inspection, were begun toward the end of 1934. National vessels are fumigated every three or six months, and less than one rat per vessel is found as a result. The number of rats per vessel in "extemporaneous" fumigations has decreased from over 62 in 1935 to 43 in the first half of 1936, and 50 in 1937. The percentage of vessels found rat-infested in 1937 was 6.25. (*Bol. San., Arg.*, Jan. 1937, p. 67; 1938, p. 352, *Memoria anual*; *Bol. Of. San. Pan.*, June 1938, p. 553.)

⁷ Long, J. D., and Mostajo, B.: *Bol. Of. San. Pan.*, Nov. 1934, p. 1016; Macchiavello, A.: *Rev. Chil. Hig. & Med. Prev.*, No. 1, 1937, p. 69; "Actas X Conf. San. Pan.", 1938, p. 166; Jorge, Ricardo: *Off. Int. d'Hyg. Pub.*, Ses. Extraord. du Comité Permanent, Apr.-May 1934, *Procès-Verbaux*, p. 100; others, p. 28, 99, 104, 110, 116, 131; Paz Soldán, C. E.: *Ref. Méd.*, Jan. 1, Feb. 1, May 1, Aug. 15, and Dec. 15, 1934

⁸ Wu Lien-Teh et al.: "Plague"; 1936, 547 pp.

⁹ Indefinite data for Argentina in the XVII century must be considered apocryphal. (See Canton, Eliseo: "Historia de la Medicina en el Río de la Plata," Vol. 1, p. 380. Canton's account must be dis-

Paraguay.¹²—The hold of the *Zeier* in which the rice was stored remained sealed after it was taken on at Rotterdam until it was opened at Las Palmas, Canary Islands, when dead rats were found. Two sailors became ill, one dying, but the nature of the illness is not known. In Montevideo, the cargo of rice and other materials was transferred to the Argentine coasting steamer *Centauro*, which left Montevideo April 19, 1899, and after calling at Buenos Aires and other Argentine and Paraguayan ports, arrived in Asunción April 26. On the way to Asunción many dead rats were noted, and fifteen days after the arrival of the *Centauro*, a similar plague occurred in the Customs warehouses, creating a real nuisance. During the voyage three sailors became ill, and died in Asunción April 28 and May 1 and 4, the deaths appearing in the official reports as "acute pneumonia," "typhoid fever," and "pleurisy." A fourth sailor recovered. Some suspicion attached to this sudden and fatal illness, and the *Consejo de Higiene* (National Board of Health) ordered an investigation in order to rule out the possibility of yellow fever. Although symptoms characteristic of plague were found, this diagnosis was not made at the time.

Asunción had in those days a rather widely scattered population living in isolated houses. The disease spread slowly, a factor which, in view of the terrible ravages of plague in India and elsewhere, was to provide ammunition for those who opposed the correct diagnosis. The inland location of the port also gave rise to doubt that the disease would make its first appearance in South America in that particular spot. By August, however, when 37 soldiers fell ill in the *Ranchería de la Encarnación* area—a ruinous, unhealthy collection of buildings housing soldiers' families, near the barracks—suspicion had become stronger, and the diagnosis of plague appears in a case on the books of the Hospital Militar for that month, although the death of this individual is not reported as plague in the *Registro Civil* (Vital Statistics Register). The huts of the *Ranchería* were burned and the inhabitants went to La Chacarela and the Loma Clavel, where new cases appeared. By the end of August there were cases throughout the city of Asunción, but mostly in the barracks, of "infectious typhoid fever, purulent fever, gastric fever, meningitis, pleural pneumonia," etc. The disease was spread to small villages, usually on the railway line, by persons fleeing

counted, since he is inclined to believe that plague, being so prevalent in Europe in the XVII and XVIII centuries, must have made its way into America.) The reports for Brazil as early as 1878 should also be taken as non-proven. (See Parreiras, Decio: *Bol. Of. San. Pan.*, May 1936, p. 429, citing Fialho and Freitas.) The same applies to Lastres' statement (*Ref. Méd.*, Jan. 15, 1940, p. 60) that plague probably existed in America in the XVI century, since his only authority is a vague reference in the minutes of the Lima Council, April 12, 1577, to a ship coming from Mexico, where a pestilence prevailed and many Indians were dying.

¹⁰ Agote, L., and Medina, A. J.: "La peste bubónica en la R. Argentina y en el Paraguay"; Buenos Aires, 1901.

¹¹ Uriarte: *Ann. Inst. Pasteur*, XV, 1901, p. 857.

¹² The fact that this was the first epidemic justifies its consideration at some length here.

Asunción; cases appeared in Tembetary, Trinidad, Luque, Tacuarel, Ytagua, Praguay, and Villarica.

Attention of the Argentine authorities was attracted to the increasing rumors that the "mysterious disease" in Asunción was plague, and the report by wire of a suspicious case caused the National Department of Health, on the advice of the Argentine Minister in Paraguay, to send two bacteriologists (O. Voges and J. C. Delfino) to Asunción. They arrived September 14, made bacteriological investigations, and diagnosed the disease as bubonic plague. Although there was opposition to this diagnosis even among the members of the *Consejo de Higiene* of Asunción, it was eventually accepted. With the consent of the Paraguayan authorities, a commission was sent from Argentina to undertake antiplague work.¹³ It also made a study of the history of the disease in Asunción, checking up by interviews with the attending physicians, on suspicious diagnoses appearing in the Civil Register and on hospital records.

Exclusive of cases outside of Asunción, as nearly as could be ascertained, the deaths from plague in Asunción in 1899, beginning with the sailor April 28, were between 89 and 99. Ten deaths were reported for January, 1900; 4 for February; plague was declared extinct in February; by July Asunción was again officially "infected"; in August it was again "free"; and by October 31, plague was once more present. Since that time sporadic cases and about 15 limited outbreaks have occurred from time to time, the last reported outbreak in 1928, and the last reported case in 1936.

Argentina.—From the original focus at Asunción, plague seems to have spread, probably by river traffic, to Argentina: Rosario, Province of Santa Fé (September 1899); Formosa (October 1899); Corrientes (October 1899); and Buenos Aires (suspicious death December 1899; first confirmed case January 1900).¹⁴ The ports of San Nicolas (1899–1900), Diamante, San Lorenzo, Villa Constitución, Santa Fé (1907) and Bahía Blanca (1913, brought from the interior) gradually became infected, as well as such inland towns as Tucumán (1900) and Córdoba (1907). Since that time over 6,000 cases have occurred in the country, and the disease has remained endemic in scattered form inland.

Brazil.—Plague reached Brazil by 1899 in Santos (present by September, 1899; officially confirmed October 18, 1899) and had entered Rio de Janeiro by January, 1900, and Salvador, Baía by 1904.¹⁵ The S. S. *Rey de Portugal* from Oporto was at first implicated in the infection of Santos, especially since it left Oporto at a time that city was plague-

¹³ The Commission consisted of Drs. C. Malbrán, chairman; S. Alvarez, A. Greslevin, J. C. Delfino, O. Voges, A. Medina, and L. Uriarte, together with disinfectors and assistants.

¹⁴ In contrast to the situation in Asunción, Rosario, and many other places since, health authorities in Buenos Aires had the cooperation of press and public in this original outbreak. Instead of concealing cases, people reported other diseases as plague. In one day more than 200 such reports were made. (Agote and Medina, *op. cit.*)

¹⁵ Amadeu Fialho reported plague in Fortaleza in 1878 and de Freitas gives figures for Pernambuco since 1896. See Note 9.

infected but had not yet been declared so and vessels from it were not yet subject to special precautions, but further investigation revealed that plague was probably present in Santos at the time the *Rey de Portugal* arrived. It was thought that plague might have been imported on other vessels from Oporto, on rice ships from Rangoon, on a vessel from Tamatave (Madagascar), or from Paraguay.¹⁶ ¹⁷

Plague reached Fortaleza in 1900; Recife, Pernambuco, in 1902; S. Luiz do Maranhão in 1903; Belem, Pará, and S. Salvador da Bafa in 1904; and Parahyba in 1912.¹⁸ It is still present in some States.

Uruguay.—Uruguay was possibly infected by the English vessel *Highland Prince*, which arrived in Montevideo October 12, 1900. The ship left Rosario, Argentina, July 8, 1900, and reached Antwerp in August, having had an unidentified illness among the crew en route. It left Antwerp August 30 and London September 7, and on reaching Bahia had to stop for medical aid. There were five cases of plague on board, four of them fatal including that of the captain. Dead rats had been noted on the return voyage and more were found on disinfection at Flores Island (Montevideo). In spite of this thorough disinfection, on the vessel's arrival at Buenos Aires there were two cases suspicious of plague on board. After the arrival of the S. S. *Highland Prince* in Montevideo, dead rats were found in the customs warehouses, and plague was proven in them. A customs-house official died June 27, 1901. There were three more cases that year (September and October), two fatal. These later cases were apparently traced to a bakery in which sacks from an Asunción, Paraguay, bakery known as a plague focus, were used, so that this may have been a re-infection. In April, 1902, dead plague rats were again found in the Montevideo customs-houses.¹⁹

No human or rodent plague has been reported in Uruguay since 1932.

Venezuela.—Plague appeared in Venezuela in 1908 (first diagnosed April 15; officially present June 25, 1908; probably present in La Guaira from early part of year and in Caracas from May 25.)²⁰ ²¹ It spread into the interior but disappeared completely from La Guaira. Source of the infection was at first thought to be Trinidad, where plague had been reported in 1907.²⁰ Later investigations suggested Guayaquil, Ecuador.²¹ Cases were reported in the interior in 1909, 1910, 1911, 1912, 1914, 1916, 1918, 1919,²² 1928, and 1939.

¹⁶ Inspectoria de Demographia Sanitaria, Dep. Nac. de Saúde Púb.: "Informes Estatísticos sôbre a peste no Brasil"; 1928, p. 6.

¹⁷ *Pub. Health Rep.*, Dec. 1, 1899, p. 2140-46.

¹⁸ Silva Jr., Marcello, *Arch. Hyg.*, Mar. 1936, p. 159.

¹⁹ Fernández Espiro, E., "I Cong. Med. Nac.", Montevideo, 1916, Tomo IV, p. 238-263. The author notes that other merchandise from plague-infected countries lay in Montevideo ware-houses at the time of the arrival of the S.S. *Highland Prince*, and the infection may therefore have been from another source.

²⁰ *Pub. Health Rep.*, Apr. 24, 1908, p. 541; June 12, 1908, p. 844; July 17, 1908, p. 1042; *Bol. Of. San. Pan.*, Jan. 1927, p. 37.

²¹ Acosta Ortiz, P., and Razetti, L.: "Actas IV Conf. San. Int." (Panamericana), 1909-10, p. 201-204.

²² Chacón Itriago, L. G.: "Actas VIII Conf. San. Pan.", 1927, p. 252-266.

Bolivia.—Bolivia seems to have remained free from plague until 1921–1922,²³ when an epidemic occurred in the Province of Arce which attracted little attention at the time. The first officially recognized outbreak appeared in Valle Grande in 1928.²⁴ A number of outbreaks, some of them quite severe, have been reported since.

West Coast.—On the West Coast of South America, plague appeared in Peru in 1903, the first cases being diagnosed in Callao and Pisco on May 6.^{25, 26}

Peru.—The first known case of plague in Callao became ill April 28 and died May 1; the Pisco case was first seen May 3. The Callao cases were all among employes of the Santa Rosa grain mill, there being 10 cases with 6 deaths from April 28, to May 29, 1903. Four cases, one a mild one (April 28) which recovered before the disease was known to be present, occurred in Pisco. In both localities unusual rat mortality was observed in the plague focus preceding the human cases; one of the mill employes estimated that well over 300 dead rats were found and disposed of there. Of considerable interest is the fact that sick or dead rats were noted in three other parts of Callao: the English railway station; the Town Hall (Municipalidad) and the International Hotel, and that in February or March, 1903, an employe at the railway station was ill with fever and inguinal swellings, and toward the end of March another employe was similarly afflicted.²⁷

Various vessels have been implicated in the introduction of plague into Peru, possibly the most suspicious being the *Serapis* from Bangkok, which arrived in Callao December 26, 1902, with 10,136 sacks of rice. She left some of her cargo in Pisco and the rest at the Santa Rosa Mill, Callao. Other ships considered suspect were the *Absterschivan* from Tacoma, which arrived Dec. 15, 1902, with 48,793 sacks of wheat from Washington; the *Amasis* from San Francisco, which arrived February 27, 1903, and which had been in quarantine in various ports but carried neither rice nor wheat; and the *Eatero-Hall* from Tacoma, which arrived March 11, 1903, with 25,213 sacks of wheat.²⁸ Mazatlán, Mexico; Australia, and India have also been suggested as sources.²⁹

Plague soon appeared in Arequipa, Mollendo and Pacasmayo (August, 1903); Lima (March 1904); Chosica and Matucana (April, 1904); Paita (May, 1904) and other localities, spreading likewise into the interior. The disease has remained endemic in the country, and the annual number of cases has averaged about 120 in the last five-year period.

²³ The U. S. Minister at Lima reported August 13, 1903: "Plague has reappeared at . . . the port of Arequipa, and northern Bolivia (including La Paz). . . ." (*Pub. Health Rep.*, Sept. 11, 1903, p. 1529), but no confirmation of this report has been found. "Peste" was at the time used in La Paz vital statistics for any acute disease.

²⁴ Veintemillas, F.: "La peste bubónica en Bolivia"; 1936. (*Tarija epidemic*, p. 144.)

²⁵ Artola, M. R., et al: La peste bubónica, *Bol. Acad. Nac. Med.*, Lima, III:3, 1903.

²⁶ Castañeda, A., *Crón. Méd.*, Lima, Jan. 31, 1904, p. 13 et seq.

²⁷ Artola et al., *op. cit.*

²⁸ Castañeda: *op. cit.*

²⁹ Lavererla, D. E.: "Trans. II Int. San. Conv. Amer. Rep.", Washington, 1905, p. 175; Paz Soldán: La Sanidad Pública en el Perú, "VI Conf. San. de las Rep. Americanas," p. 26; and Dirección de Salubridad, Lima: "La Sanidad Pública del Perú;" 1927, p. 42.

Chile.—Chile also became infected in 1903, the first case of plague being noted in Iquique May 25, 1903, where it had possibly existed since April. The steamer *Colombia* from San Francisco, California, possibly infected in Callao, which entered Iquique April 13 and Valparaíso April 18, 1903, has been considered a possible source, although the *Arequipa* from Callao (sailed May 5, arrived at Iquique May 13); the *Limari* (sailed April 30, arrived May 4); and the *Santiago* (sailed Mar. 2, arrived Mar. 7) have also been suspected.³⁰ The first cases in Valparaíso were observed June 10, 1903; in Tacna (not a port), Antofagasta, and Arica, 1904; Pisagua and Taltal, 1905; Tocopilla and Coquimbo, 1906; Santiago, January 13, 1907; and Mejillones, 1908.³¹ The last cases of human plague were reported in Chile in 1931 and the last rodent plague in 1932.

Ecuador.—Ecuador, strange as it seems, was the last country invaded on the Pacific coast, the first cases appearing February 10, 1908, although suspicious illnesses had occurred a month before.^{32, 33, 34} By rail and otherwise, plague spread inland, affecting various places in the Province of Guayas (1909) and attacking the provinces of Los Ríos, El Oro, and Chimborazo (1909); Manabí (1913); Tungurahua (1916); Loja (1921) and Cañar (1933).³⁴ The disease remains endemic in some foci in the interior of the country, while in Guayaquil the last case was reported in April 1939.

United States.—In North America, plague first appeared in San Francisco, officially March 6, 1900; probably in 1899 or even earlier.³⁵ It reached Seattle by 1907; New Orleans, 1914 and 1920; Beaumont and Galveston, Texas, and Pensacola, Florida, 1920; and Los Angeles,

³⁰ Macchiavello: *Rev. Inst. Bact. Chile*, IV:2, 1932, p. 24-66.

³¹ Macchiavello: *Rev. Chil. Hig. & Med. Prev.*, I:1, 1937, p. 69-87.

³² In August, 1904, an epizootic of rats and suspicious human deaths occurred on Puná, a small island 36 miles from Guayaquil, at the mouth of the river. On August 9 the presence of plague at Puná was officially denied. (*Pub. Health Rep.*, Aug. 26, 1904, p. 1742 and Sept. 2, 1904, p. 1799.)

³³ Suárez, P. A.: "Algunas observaciones sobre la peste negra y la pulga cheopis en el Ecuador"; 1927, p. 6.

³⁴ Mifio, C. A.: "La peste bubónica en el Ecuador"; 1933, pp. 6, 64.

³⁵ Kinyoun, J. J.: *Occidental Med. Times*, San Francisco, 1901, XV, 287-303. He states, p. 293: "The first published and proven case [in San Francisco] dates from March 6, 1900, but from all reports and facts which I have been able to obtain, the first case occurred as early as November, 1898 . . . whether the disease existed earlier than 1898 it is impossible to state. . . . The supervising surgeon-general of the Marine Hospital states in a confidential circular letter addressed to the several health officers of the cities on the Pacific Coast that 'in all probability, the disease had existed on the Pacific Coast since 1896.' "

References to plague in New York concern the arrival in that port on November 18, 1899, of the British steamship *J. W. Taylor*, with two cases of bubonic plague on board. The steward, ill when the vessel left Santos, Brazil, Oct. 18, had died en route of a similar illness. The two cases were placed in quarantine on Swinburne Island, where they recovered. No further cases occurred. The vessel was thoroughly disinfected and fumigated. No rat plague was found. Plague was never present in New York itself. (*Pub. Health Rep.*, 1899, 1900; Ann. Rep. Surg. Gen., U.S.P.H.S., 1900; Ann. Rep. of Commrs. of Quar., also Rep. Health Off. Port New York for 1899, Albany, 1900, pp. 22, 30; Doty, A. H.: *Med. Record*, N. Y., Nov. 3, 1900, p. 681; 1908, LXXII, p. 45; Eager, J. M.: "The Present Pandemic of Plague"; 1908.) Plague has also been reported on vessels at Port Townsend, State of Washington (Jan. 31, 1900); San Diego, California (June 22, 1901); Reedy Island Quarantine, Delaware (April 6, 1906), and several at San Francisco. (Eager: *op. cit.*)

New Orleans and Oakland, 1924. In 1903 it was suspected and by 1908 proven that plague had spread to California wild rodents.³⁶ To date 27 species of wild rodents have been found plague-infected, in 10 western States.

Mexico.—Plague occurred in Mexico in 1902–03, 1920 and 1923.³⁷ On December 11, 1902, plague was reported from Ensenada de Todos los Santos, Baja California, and on December 13, a "rare disease" was reported from Mazatlán.³⁸ Investigation by the National Department of Health of Mexico proved the disease to be plague, and on December 31, 1902, Ensenada and Mazatlán were declared to be plague-infected.³⁹ The first case is believed to have occurred October 20. It was alleged that the disease reached Mazatlán by a vessel (the *Curaçao*, arrived in Mazatlán October 13) which had previously touched in San Francisco and which carried Chinese goods. Whether the goods were from Chinatown, San Francisco, or had been transshipped at San Francisco from a trans-Pacific vessel is not known.⁴⁰ Another theory is that the carriers were uninspected Chinese who were not allowed to land at San Francisco but came on to Mazatlán.⁴¹ The later outbreaks in Mexico occurred in Veracruz and Tampico. The number of cases in Mexico to 1923, when the last human case was reported, exceeded 600. The last rodent plague was reported from Tampico in 1925. Rodent control work has been continued, however, especially in ports, and rats are examined for plague lesions.

Panama.—The first and last cases in Panama seem to have been those in La Boca in 1905, when two deaths occurred, the first in a stevedore ill June 15, who died June 23, and the second in a man who frequented the camp of the wharf workers, August 26. Rat mortality was observed for some ten days preceding the first case. There have been no cases since, except for one imported from Guayaquil, Ecuador, who died in the Ancon Hospital in October, 1911.⁴²

West Indies.—In the Antilles, plague has been reported in Cuba (1912–15, supposedly from the Canary Islands, or, possibly, Puerto Rico);⁴³ Puerto Rico (1912 and 1921); Trinidad (June, 1907, possibly introduced by a rice ship from Calcutta, December 13, 1906, or from

³⁶ Rucker, W. C.: *op. cit.*, Note 3.

³⁷ In November, 1899, rumors from various sources reached the U. S. government regarding a fatal epidemic disease resembling plague in Orizaba, and in February, 1900, of plague at Cozumel, an island off Yucatan. Investigation was made by the Mexican government, and about March, 1900, the Mexican Ambassador positively denied that plague had existed in Mexico. (Low, R. B.: "Reports and Papers on Bubonic Plague"; London, 1898–1900, p. 423.)

³⁸ Licéaga, E.: *Gac. Méd. Méx.*, Feb. 1, 1903, pp. 34–36.

³⁹ *Pub. Health Rep.*, Jan. 9, 1903, p. 45.

⁴⁰ Licéaga, E.: "II Conf. San. Int.", Washington, Oct. 1905, p. 384.

⁴¹ Ruiz, L. E.: *Gac. Méd. Méx.*, May 1, 1903, p. 147 148.

⁴² *Pub. Health Rep.*, June 30, 1905, p. 1303, 1356; July 21, 1905, 1494; July 28, 1541; Sept. 15, 1971; Sept. 22, 2041; 1911.

⁴³ Guiteras, J.: *San. & Benef.*, Habana, Sept. 1914, p. 313.

Brazil; also in 1908, 1912); and Grenada (1912).⁴⁴ No further cases have been reported since the dates given.

Plague-free countries.—Plague has never been officially reported in Haiti, Colombia, or Central America outside of Panama and British Honduras.⁴⁵ There is apparently some question as to whether the disease appearing in British Honduras in 1900 was plague.⁴⁶

Prevalence.—It has been estimated that about 6,453 cases have occurred in Argentina from 1899–1938, in over 500 localities. Some 3,148 cases, 1,847 deaths have been reported from Bolivia, 1921–1938, although the actual number is considered much greater. Brazil has had around 7,462 cases in nine States and Rio de Janeiro (1899–1938); Chile, 5,121 cases (1903–1931); Cuba, about 68 cases, 22 deaths (1912–1915); Ecuador, about 11,154 cases (1908–1938); Mexico, about 632 cases (1902–1923); Paraguay, possibly 500 (1899–1936); Peru, some 21,037 cases in 630 localities (1903–1938); Puerto Rico, about 88 cases (1912, 1921); the United States, 498 cases, 314 deaths (1900–1937); Uruguay, 133 cases, 58 deaths in Montevideo (1901–1929) and about 25 cases, 14 deaths in the rest of the country (last case, 1932); Venezuela, about 534 cases, 236 deaths (1908–1939).⁴⁷ There have been, therefore, around 57,000 cases of plague in North, South, and Central America, 1899–1938.⁴⁸ (See Table 1.)

(To be continued)

⁴⁴ *Pub. Health Rep.*, 1907, 1908, 1912, 1921.

⁴⁵ Plague has been reported for some of these countries, but the reports were evidently for the most part erroneous. For a report of plague in Jacmel, Haiti, June 17, denied by experts, and in Colombia, Santa Marta Barracks, April, also denied, see *Pub. Health Rep.*, 1913. The only record of plague for Colombia was the finding of an infected rat in the port of Buenaventura in January, 1928, the animal being killed at the very moment it jumped ashore from the English S.S. *Ciz*. Plague was reported for the Dominican Republic in 1929, 1933, and 1935 in League of Nations publications, but the Department of Health of that country, in a letter of June 30, 1938, to the Pan American Sanitary Bureau, stated that plague has never existed in the Dominican Republic and pointed out that the term "peste" is sometimes used locally for "yaws." References to plague in British Guiana refer to 14 deaths, apparently from plague, on a vessel from Calcutta bound for Demerara; the disease gained no foothold in British Guiana itself. (Low: "Rep. and Papers Bub. Plague"; 1902, p. 425.)

⁴⁶ During February, March, and April, 1900, there occurred at Bacalar Chico (13 cases), Corosal (6 cases) and the Northern River district of British Honduras several cases of a disease "strongly suggestive of plague" (Low) but characterized by extreme mildness. No bacteriological examinations were made, no rat mortality was observed, and the disease seemed to die out spontaneously. It was supposedly introduced from Cozumel Island, off Yucatan, where a similar epidemic prevailed but which was declared not plague (See Mexico, Note 37). On June 13, 1900, the Governor of British Honduras stated, "Nothing has since occurred to lead me to believe that these cases were plague." (Gann) The illness was characterized by fever and swollen glands. It was also recalled that plague existed in Rio de Janeiro at the time, from which port vessels in ballast came to Belize and Yucatan for logwood. (Low: "Rep. and Pap. Bub. Plague"; 1902, p. 424; Gann, T.: "Bubonic Plague: Selected Colonial Medical Reports, 1900-01"; London, 1902, p. 92-94.)

⁴⁷ An outbreak in the interior of the country (State of Aragua) with 11 cases and 8 deaths was reported in December, 1939, the first plague reported in Venezuela since 1928, although it is admitted that sporadic cases have occurred in this section during the intervening period. It is of interest that the 1928 outbreak was in a region of the State of Miranda bordering on the State of Aragua. (Director de Sanidad Nacional: Informe al Ejecutivo corr. al año 1928, p. 158.)

⁴⁸ Compiled from official and private reports. While some authors consider the reported cases to be below the actual number (for instance, Saenz, speaking of Ecuador, estimates the actual number of cases as 20 per cent greater than the number reported), on the other hand, it must be taken into account that some of the cases included in statistics are without bacteriological confirmation and might have been erroneously reported as plague during a plague epidemic. . . . Figures for the United States were supplied by the U. S. Public Health Service, Dec. 1939.