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Yersinia Pestis and the Westward Advance of the Great Pestilence

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Abstract: The recent outbreak of Ebola reminds us of the ever-increasing threat of a global pandemic. In an age where thousands travel around the world each day, it is not difficult to imagine how a highly transmissible pathogen could rapidly reach the scale and severity of the historic Black Plague or Spanish Influenza. However, it is interesting to consider how such plagues reached pandemic proportion prior to the advent of air travel or even steam ships. Herein, the author invites the scientific community to reflect upon one of the pathways by which Black Plague was introduced from Asia into Europe. This is a story where harsh science bleeds into the humanities in one of the earliest and most devastating episodes of biological warfare.

Introduction

Our story begins in the 14th Century on the Eve of Europe's Black Plague or what contemporaries called the *Great Pestilence*. We now know this to have been a plague of bacterial origin or, more specifically, of the bacterium *Yersinia pestis*¹. With the current availability of antibiotics, plague is now straightforward to treat, although over 10% of plague cases in the United States are fatal even to this day. Most modern plague fatalities are caused either by delayed treatment or misdiagnosis altogether. Left unchallenged, *Yersinia pestis* rapidly overwhelms the body's immune system, invading the interstitial space and, ultimately, the blood stream². At that point, the infection progresses to septicemia and is almost always fatal. Likewise, a rare but highly dangerous manifestation of plague occurs when it becomes pneumonic, whereby it can rapidly spread through human populations. Fortunately, the far more common bubonic form is transmitted by a less direct route². Various rodent populations are common reservoirs of plague and the fleas that feed upon those rodents are the primary vectors of transmission to humans².

Origins of the Great Pestilence

In the 1330s, rumors began to rumble among European traders in the Middle East of a devastating plague cutting a swathe through the Far East. The origin of that plague is now widely accepted to have been the Gobi Desert³. What surfaced in that desolate land on the Steppes of Asia brought sickness and death to millions throughout Asia. Little could they have known that the plague was also stealing its way west and that it would soon ravage generation after generation of the European population for centuries to come.

At the time, the primary trade routes between Europe and Asia were controlled by the Mongol Empire. One of these routes, the northern most artery of the Silk Road, terminated in the west at the port city of Caffa which was controlled by the Genoese through a grant from the Mongols. By the 1340's Caffa had grown to a city of over 80,000 and enjoyed a near-monopoly on trade throughout the Black Sea region. Although the Genoese presence was essential for the continued flood of European wealth into the purses of the Mongols, it did not come without resentment. Eventually, building cultural frictions between Europeans and locals led to major hostilities at a small trading station called Tana situated on the Don River during which a Muslim resident was killed⁴. European traders were force to flee Tana for safety within the walls of nearby Caffa. Shortly thereafter, a Mongol Khan, Janibeg, arrived with an army and placed Caffa under siege for granting asylum to the suspected offenders⁴.

Meanwhile, the plague continued to ravage the Far East while it slowly made its way west. Lake Issyk Kul, to the east of Caffa and a well-documented resting site along the east-west trade routes, had been overrun with plague. In the late 19th century, Russian archaeologists unearthed an inordinately high number of grave markers along the lake that bore the dates leading up to the advent of plague in Caffa⁵. To this day, the bobak marmot colonies around Lake Issyk Kul sustain highly virulent foci for *Yersinia pestis*.

Back in Caffa, the situation had deteriorated. Although the city had received temporary relief when soldiers had arrived from Italy to lift the siege, the determined Janibeg returned with an army of even greater strength and renewed the hostilities⁵. As his forces dug in around Caffa and assembled their siege



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machines, plague crept one final stride westward and emerged among their ranks. An Italian notary, Gabriele de' Mussi, documented what happened next⁶. "But behold, the whole army was affected by a disease which overran the Tartars and killed thousands upon thousands every day. It was as though arrows were raining down from heaven to strike and crush and Tartars' arrogance. All medical advice and attention was useless; the Tartars died as soon as the sign of disease appeared on their bodies: swellings in the armpit or groin caused by coagulating humors, followed by a putrid fever.... The dying Tartars, stunned and stupefied by the immensity of the disaster brought about by the disease, and realizing that they had no hope of escape, lost interest in the siege. Before they retreated, Janibeg ordered corpses to be placed in catapults and lobbed into the city in the hope that the intolerable stench would kill everyone inside." It was not just the stench but pestilence itself which swept through Caffa, thereby carrying the demise of what had once been a sparkling gem in the crown of Europe's trade industry. Thus, as Janibeg pulled his forces back to the east, dozens of vessels moored in Caffa prepared for a westward retreat⁵. Thousands of residents in Caffa begged, bribed, and, in some cases, killed to secure a place on one of the ships fleeing the sudden outbreak of plague. Hidden among them was the Great Pestilence itself.

Although plague certainly entered Europe via multiple routes, the ships fleeing Caffa were among the first of these⁶. In the fall of 1347, the Great Pestilence took hold in Italy from whence it spread to France, Spain, and Portugal. By 1348, it was ravaging England. Then, circling back on itself, it entered Germany cutting a deadly swathe eastward

and reaching Russia by 1352. Behind it was a black trail of death.

Conclusions

It is estimated that as many as 200 million people lost their lives during the Great Pestilence. That the use of a bacterial pathogen as a weapon was instrumental in facilitating the rapid and far reaching spread of Black Plague is worth reflection. Viral and bacterial pathogens have since grown wings and are capable of circling the world in a matter of hours. The ongoing Ebola outbreak should serve as a reminder and as an alarm. The scientific community must be ever vigilant in the advancement of key detection, prevention, and treatment measures for infectious disease.

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