



THE BLACK DEATH

CHARLES L. MEE JR.



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In all likelihood, a flea riding on the hide of a black rat entered the Italian port of Messina in 1347, perhaps down one of the thick ropes tying a ship up at the dock. The flea had a gut full of the bacillus *Yersinia pestis*. The flea itself was hardly bigger than the letter "o" on this page, but it could carry several hundred thousand bacilli in its intestine. Scholars today cannot identify with certainty which species of flea (or rat) carried the plague. One candidate among the fleas is *Xenopsylla cheopis*, which looks like a deeply bent, bearded old man with six legs. It is slender and bristly, with almost no neck and no waist, so that it can slip easily through the forest of hair in which it lives. It is outfitted with a dagger-like proboscis for piercing the skin and sucking the blood of its host. And it is cunningly equipped to secrete a substance that prevents coagulation of the host's blood. Although it can go for weeks without feeding, it will eat every day if it can, taking its blood warm.

One rat on which fleas feed, the black rat (*Rattus rattus*), also known as the house rat, roof rat, or ship rat, is active mainly at night. A rat can fall fifty feet and land on its feet with no injury. It can scale a brick wall or climb up the inside of a pipe only an inch and a half in diameter. It can jump a distance of two feet straight up and four horizontally, and squeeze through a hole the size of a quarter. Black rats have been found still swimming days after their ship has sunk at sea.

A rat can gnaw its way through almost anything - paper, wood, bone, mortar, half-inch sheet metal. It gnaws constantly. Indeed, it must gnaw constantly. Its incisors grow four to five inches a year: If it were to stop gnawing, its lower incisors would eventually grow - as sometimes happens when a rat loses an opposing tooth - until the incisors push up into the rat's brain, killing it. It prefers grain, if possible, but also eats fish, eggs, fowl and lamb, piglets, and the flesh of helpless infants or adults. If nothing else is available, a rat will eat manure and drink urine.

Rats prefer to move no more than a hundred feet from their nests. But in severe drought or famine, rats can begin to move en masse for great distances, bringing with them any infections they happen to have picked up, infections that may be killing them but not killing them more rapidly than they breed.

Rats and mice harbor a number of infections that may cause diseases in human beings. A black rat can even tolerate a moderate amount of the ferocious *Yersinia pestis* bacillus in its system without noticeable ill effects. But bacilli breed even more extravagantly than fleas or rats, often in the millions. When a bacillus finally invades the rat's pulmonary or nervous system, it causes a horrible, often convulsive, death, passing on a lethal dose to the bloodsucking fleas that ride on the rat's hide.

The Ultimate Bacillus Breeder

When an afflicted rat dies, its body cools, so that the flea, highly sensitive to changes in temperature, will find another host. The flea can, if need be, survive for weeks at a time without a rat host. It can take refuge anywhere, even in an abandoned rat's nest or a bale of cloth. A dying rat may liberate scores of rat fleas. More than that, a flea's intestines happen to provide ideal breeding conditions for the bacillus, which will eventually multiply so prodigiously as finally to block the gut of the flea entirely. Unable to feed or digest blood, the flea desperately seeks another host. But now, as it sucks blood, it spits some out at the same time. Each time the flea stops sucking for a moment, it is capable of pumping thousands of virulent bacilli back into its host. Thus, bacilli are passed from rat to flea to rat, contained, ordinarily, within a closed community.

For millions of years, there has been a reservoir of *Yersinia pestis* living as a permanently settled parasite - passed back and forth among fleas and rodents in warm, moist nests - in the wild rodent colonies of China, India, the southern part of Russia, and the western United States. Probably there will always be such reservoirs - ready to be stirred up by sudden climatic change or ecological disaster. Even in 2011, a case of bubonic plague was confirmed in New Mexico and another in Oregon. Limited outbreaks and some fatalities have occurred in the United States for years, in fact, but the disease doesn't spread, partly for reasons we don't understand, partly because patients can now be treated with antibiotics.

And, at least from biblical times on, there have been sporadic

allusions to plagues, as well as carefully recorded outbreaks. Constantinople, for instance, capital of the Roman Empire in the East, was ravaged by plague in 541 and 542, felling perhaps 40 percent of the city's population. But none of the biblical or Roman plagues seemed as emblematic of horror and devastation as the Black Death that struck Europe in 1347. Rumors of fearful pestilence in China and throughout the East had reached Europe by 1346. "India was depopulated," reported one chronicler, "Tartary, Mesopotamia, Syria, Armenia, were covered with dead bodies; the Kurds fled in vain to the mountains. In Caramania and Caesarea, none were left alive." Untold millions would die in China and the rest of the East before the plague subsided again. By September of 1385, the *Yersinia pestis* bacillus, probably carried by rats, reached the Crimea, on the northern coast of the Black Sea, where Italian merchants had a good number of trading colonies.

From the shores of the Black Sea, the bacillus seems to have entered a number of Italian ports. The most famous account has to do with a ship that docked in the Sicilian port of Messina in 1347. According to an Italian chronicler named Gabriele de Mussis, Christian merchants from Genoa and local Muslim residents in the town of Caffa on the Black Sea got into an argument; a serious fight ensued between the merchants and a local army led by a Tatar lord. In the course of an attack on the Christians, the Tatars were stricken by plague. From sheer spitefulness, their leader loaded his catapults with dead bodies and hurled them at the Christian enemy, in hopes of spreading disease among them. Infected with the plague, the Genoese sailed back to Italy, docking first at Messina.

Although de Mussis, who never traveled to the Crimea, may be a less-than-reliable source, his underlying assumption seems sound. The plague did spread along established trade routes. (Most likely, though, the pestilence in Caffa resulted from an infected population of local rats, not from the corpses lobbed over the besieged city's walls.)

In any case, given enough dying rats and enough engorged and frantic fleas, it will not be long before the fleas, in their search for new hosts, leap to a human being. When a rat flea senses the presence of an alternate host, it can jump very quickly and as much as 150 times its length. The average for such jumps is

THE BLACK DEATH

about six inches horizontally and four inches straight up in the air. Once on human skin, the flea will not travel far before it begins to feed. The first symptoms of bubonic plague often appear within several days: headache and a general feeling of weakness, followed by aches and chills in the upper leg and groin, a white coating on the tongue, rapid pulse, slurred speech, confusion, fatigue, apathy, and a staggering gait. A blackish pustule usually will form at the point of the fleabite. By the third day, the lymph nodes begin to swell. Because the bite is commonly in the leg, it is the lymph nodes of the groin that swell, which is how the disease got its name. The Greek word for "groin" is boubon - thus, bubonic plague. The swellings will be tender, perhaps as large as an egg. The heart begins to flutter rapidly as it tries to pump blood through swollen, suffocating tissues. Subcutaneous hemorrhaging occurs, causing purplish blotches on the skin. The victim's nervous system begins to collapse, causing dreadful pain and bizarre neurological disorders, from which the "Dance of Death" rituals that accompanied the plague may have taken their inspiration. By the fourth or fifth day, wild anxiety and terror overtake the sufferer - and then a sense of resignation, as the skin blackens and the rictus of death settles on the body.

In 1347, when the plague struck in Messina, townspeople realized that it must have come from the sick and dying crews of the ships at their dock. They turned on the sailors and drove them back out to sea - eventually to spread the plague in other ports. Messina panicked. People ran out into the fields and vineyards and neighboring villages, taking the rat fleas with them. When the citizens of Messina, already ill or just becoming ill, reached the city of Catania, fifty-five miles to the south, they were at first taken in and given beds in the hospital. But as the plague began to infect Catania, the townspeople there cordoned off their town and refused - too late - to admit any outsiders. The sick, turning black, stumbling and delirious, were objects more of disgust than pity; everything about them gave off a terrible stench. It was said their "sweat, excrement, spittle, breath, so fetid as to be overpowering: urine turbid, thick, black or red. . . ."

Wherever the plague appeared, the suddenness of death was terrifying.