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Pests and Their Impacts on Humans: An Environmental History of Infectious Diseases during Mongol Invasions in East Asia

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Abstract

Korea experienced a severe mortality crisis under Mongol rule during the thirteenth and fourteenth centuries. Scholars have examined the high death toll during the Mongol Invasions of Korea (1231–1259), arguing epidemics exacerbated the wartime conditions. By closely scrutinizing historical documents on epidemics and pests, this article situates epidemics within a broader environmental context that encompasses not only Korea but also Song China, Japan, and Vietnam in the thirteenth century. Although there is no direct evidence to suggest the same pathogens for the parallel of epidemics across East Asia, these countries shared the similarities of being invaded by the Mongols, and such vulnerable wartime conditions and the climate anomalies of the thirteenth century could be the main environmental variables to precipitate these widespread outbreaks in these regions.

A key question remains regarding the type of wartime infectious diseases. This article adopts environmental perspectives to explore whether the thirteenth-century outbreaks in East Asia, especially Korea, might be connected to the Black Death or could potentially be typhus—commonly seen in warfare or something else. Without ruling out the possibility that the Mongol invasions may have transported new pathogens to the Korean peninsula, I argue that the environmental legacy of these invasions was to create a new cultural disease environment in Korea. Korean historical records frequently mention the presence of rodents and lice, likely transported by the Mongol cavalry, which posed a threat to daily Korean life during the prolonged Mongol invasion periods, suggesting the possible outbreaks of plague or typhus. Furthermore, the Mongol nomadic culture, with its affinity to livestock like horses, cattle, and sheep, also created another environment conducive to bacteria transmission. Even after the invasions ended, the established disease environments and continuous movements of people continued to affect the Korean peninsula and its animal and human inhabitants during the thirteenth and fourteenth centuries.

Keywords

Mongol Invasions, Environment, Epidemics, Korea, Japan, Vietnam, Plague

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Introduction

The Second Plague Pandemic, historically known as the Black Death, represents a complex epidemiological phenomenon at the intersection of environmental, climatic, and human mobility factors. Scholars have been debating its origins, with early historiography proposing a Chinese genesis transmitted by Italian merchants.[1] McNeill and Cao have posited that the 1333 outbreak in China may have served as a precursor to the European epidemics, although the evidence linking thirteenth-century Song China to the Black Death remains inconclusive.[2] Meanwhile, during the period of the Black Death in Europe from 1346 to 1353, only a single epidemic outbreak was recorded on the Korean peninsula.[3] This outbreak,

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* I appreciate the feedback and suggestions from colleagues and reviewers who engaged with earlier drafts of this paper.

1 Francis Aidan Gasquet, *The Black Death of 1348 and 1349* (G. Bell, 1908).

2 William McNeill, *Plagues and Peoples* (Anchor, 2010), 42; Cao Shuji 曹树基 and Li Yushang 李玉尚, *Shuyi: zhanzheng yu heping Zhongguo de huanjing zhuangkuang yu shehui bianqian: 1230-1960* 鼠疫: 战争与和平中国的环境状况与社会变迁, 1230-1960 (Shandong huabao chubanshe, 2006), 63-65; Cao Shuji 曹树基, "Dili huanjing yu Songyuan shidai de chuanranbing" 地理环境与宋元时代的传染病, *Lishi yu dili* 历史与地理 12 (1995): 183-92.

3 *Goryeosa* 高麗史, vol. 34, 1348. 4.

occurring in the fourth lunar month, was primarily attributed to famine. However, despite its limited relevance to the Black Death during this period, it invites further exploration into earlier epidemics in Korea as potential precursors to subsequent plague outbreaks.

Recent scholarship has increasingly highlighted the presence of plague outbreaks associated with major Mongol sieges in earlier periods. The siege of Baghdad in 1258, culminating in the fall of the Abbasid Caliphate, represents one significant case, though recent scholarship has critically reexamined the source materials documenting this connection.[4] Likewise, historians such as Hymes have proposed that the Mongols may have introduced plague to northern China during their conquest of the Jin Dynasty in the early thirteenth century.[5] While the precise epidemiological identification of these disease outbreaks remains contested among scholars, the *History of Jin* (金史) documented a severe epidemic during the siege of Bianjing in 1232.[6] Korean scholarship has examined the cultural history of epidemics during the Goryeo Dynasty, covering medical treatment, demographic changes, and Buddhist, Daoist, and Shaman approaches to epidemics.[7]

Emerging paleoepidemiological research has identified potential geographic origins for the pandemic. Genomic studies of *Yersinia pestis*, the causative agent of plague, have pointed to the Qinghai-Tibet Plateau and the Tien-Shan region of eastern Kyrgyzstan as possible sites of the initial outbreak.[8] Notably, these areas were home to Mongol nomadic pop-

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4 Nahyan Fancy and Monica H. Green, "Plague and the Fall of Baghdad (1258)," *Medical History* 65, no. 2 (2021): 157-77; Jonathan Brack et al., "Plague and the Mongol Conquest of Baghdad (1258)? A Reevaluation of the Sources," *Medical History* (2024): 1-19.

5 Robert Hymes, "Epilogue: A Hypothesis on the East Asian Beginnings of the Yersinia Pestis Polytomy," *The Medieval Globe* 1, no. 1 (2014): 285.

6 Wang Xingguang 王星光 and Zheng Yanwu 郑言午, "Yelun Jinmo Bianjing dayi de youyin yu xingzhi" 也论金末汴京大疫的诱因与性质, *Lishi yanjiu* 历史研究 1 (2019): 145-59; *Jinshi* 金史 (Zhonghua shuju, 1975; hereafter *JS*), 17/387.

7 Kim Yeongmi 김영미 et al., eds, *Jeonyeombyeong-ui munhwasa: Goryeo sidae-reul boneun tto hanaui siseon* 전염병의 문화사: 고려시대를 보는 또 하나의 시선 (Hye'an, 2010).

8 Cui Yujun et al., "Historical Variations in Mutation Rate in an Epidemic Pathogen, Yersinia Pes-

ulations during the thirteenth century, suggesting a potential connection between the Mongol expansions and the spread of infectious diseases.

Recent palaeoclimatological research also notes that the Mongol invasions coincided with a relatively warm and wet period in the thirteenth century, particularly in its first half. Historians argue that this climatic condition likely facilitated population growth among the Mongols and their horses, thereby supporting territorial expansion. This was because mild temperatures and increased rainfall provided abundant pastures and water sources. Furthermore, this improved the health and nutrition of the Mongols and their livestock with higher birth rates, better survival rates, and stronger, more numerous horses. Overall, these factors collectively enhance the Mongols' ability to mobilize, sustain large armies, and effectively project power over greater distances, supporting their territorial expansion.[9] Meanwhile, based on paleoclimatic discoveries, historians also argue that these climatic conditions, such as natural disasters and sudden changes in temperature and precipitation, also affected epidemic outbreaks and human populations, albeit with insufficient direct scientific evidence.[10]

The so-called "Columbia Exchange" has long been recognized for facilitating the transoceanic transmission of deadly pathogens, from smallpox to cholera.[11] Similarly, the Mongol expansion across Eurasia in

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tis," *Proceedings of the National Academy of Sciences* 110, no. 2 (2013): 577-82; Maria A. Spyrou et al., "The Source of the Black Death in Fourteenth-Century Central Eurasia," *Nature* 606 (2022): 718-24.

9 Neil Pederson et al., "Pluvials, Droughts, the Mongol Empire, and Modern Mongolia," *Proceedings of the National Academy of Sciences* 111, no. 12 (2014): 4375-79; Nicola Di Cosmo, *Ancient China and Its Enemies: The Rise of Nomadic Power in East Asian History* (Cambridge University Press, 2002); Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties* (Harvard University Press, 2010); Neville Brown, *History and Climate Change: A Eurocentric Perspective* (Routledge, 2001); Ge Quansheng 葛全胜, *Zhongguo lichao qihou bianhua* 中国历朝气候变化 (Kexue chubanshe, 2011).

10 Michael McCormick, "Rats, Communications, and Plague: Toward an Ecological History," *Journal of Interdisciplinary History* 34, no. 1 (2003): 2; Maria A. Spyrou et al., "The Source of the Black Death in Fourteenth-century Central Eurasia," *Nature* 606 (2022): 723.

11 William M. Denevan, *The Native Population of the Americas in 1492* (University of Wisconsin Press, 1976), 1-12; Nathan Nunn and Nancy Qian, "The Columbian Exchange: A History of

the thirteenth and fourteenth centuries enabled the dissemination of diseases to previously less connected regions beyond the Silk Road, often with devastating effects that at times surpassed the impacts of military conflict. Building upon these foundations in the fields of history, paleoepidemiology, and paleoclimatology, this article employs environmental history to examine the interconnectedness between Mongol invasions, climate change, and disease transmission in thirteenth and fourteenth-centuries East Asia.

Responding to recent scholarship, including Monica Green's call to expand the geographic and chronological scope of pandemic studies, this study moves beyond the confines of Europe and the fourteenth-century Black Death.[12] Instead, it situates the epidemics associated with the Mongol invasions in thirteenth-century East Asia within a broader context of world history of epidemics. Building on Philip Slavin's analysis of how landscape change, weather conditions, and seismic activity created the conditions for the plague pandemic in early fourteenth-century Central Asia, this study also employs an approach of integrating biological, climatic, and environmental factors to examine epidemics during the Mongol invasions of East Asia in the thirteenth century.[13] Given the constraints of extant primary sources, which provide only circumstantial evidence regarding specific pathogens and symptoms of diseases in thirteenth- and fourteenth-century East Asia, this study proposes hypotheses concerning possible epidemic outbreaks and their environmental connections. It considers the role of pests—specifically rodents and lice—potentially linked to the Black Death or typhus, as key agents in these outbreaks. By incorporating more-than-human narratives, this article offers

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Disease, Food, and Ideas," *Journal of Economic Perspectives* 24, no. 2 (2010): 163-88; Alfred W. Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Greenwood Publishing Group, 2003).

12 Monica H. Green, *Pandemic Disease in the Medieval World: Rethinking the Black Death* (Arc Medieval Press, 2015), 12-14.

13 Philip Slavin, "The Birth of the Black Death: Biology, Climate, Environment, and the Beginnings of the Second Plague Pandemic in Early Fourteenth-Century Central Asia," *Environmental History* 28, no. 2 (2023): 300-34.

an alternative interpretation of the Korean history of epidemics that complements existing scholarship on paleoclimatic analyses and environmental narratives of climatic anomalies during this period.

While the possibility remains that the Mongol invasions introduced new pathogens to the Korean peninsula, I argue that the enduring environmental legacy of these invasions was the establishment of a distinct cultural disease ecology in Korea. Korean historical records frequently reference rodents and lice, which were likely transported by Mongol cavalry and posed threats to daily life during the prolonged periods of Mongol invasions. Meanwhile, the Mongols' nomadic culture, with its affinity to livestock, including horses, cattle, and sheep, also created another environment conducive to bacterial transmission. Even after the cessation of direct military conflict, the disease environments shaped by the Mongol invasions persisted, reinforced by ongoing population movements, which continued to affect the Korean human and animal inhabitants during the thirteenth and fourteenth centuries.

Mongol Invasions and Mortality Crisis

The establishment of the Mongol Empire (1206-1368) by Chinggis Khan (r. 1206-1227) and its transformation into the established Yuan Dynasty (1271-1368) under Khubilai Khan (r. 1260-1279) marked a significant geopolitical shift in medieval Eurasia. Mongol warriors, riding horses and grasping bows and arrows, became unstoppable and united nomadic tribes in northern Asia. They went beyond Central Asia and defeated armies in Iran, Russia, Eastern Europe, China, Korea, and Japan, thus forging the Mongol Empire. Unlike various other political and military studies, this article particularly focuses on the epidemic outbreaks on the Korean peninsula during this period.

Mongols invaded Korea in 1231 and launched several campaigns over the next few decades, eventually leading to Goryeo's submission in 1259 with peace negotiations. Although formal peace was established, the Mongol influence over Goryeo continued, as the Mongol Yuan Dynasty maintained significant control over Korean affairs until the late

1270s and beyond. In 1231, Mongols dispatched governors (darughas) to Goryeo, and after peace, this position became more stable. Goryeo's royal families pursued complex kinship ties via intermarriage in 1274.[14]

The demographic impact of these invasions was severe during this prolonged wartime period. According to the *History of Goryeo*, by 1254, Mongol forces had captured 206,800 Korean prisoners, reaching almost seven percent of the whole population.[15] The devastation extended beyond military casualties, with widespread civilian deaths and displacement. Upon a city collapse, the rest of the population, not only men but also women and children, would be slaughtered.[16] For example, the fall of the Yangsan fortress resulted in the deaths of 4,700 people as those over the age of ten were killed and women and children distributed among Mongol soldiers.[17]

The protracted warfare spanning nearly three decades precipitated famines and epidemics, further exacerbating population decline.[18] To observe the wartime epidemics, Table 1 lists years with documented epidemic outbreaks, drawing data from the *History of Yuan* (元史), the *History of Goryeo* (高麗史), and the *Complete Annals of Vietnam* (大越史記全書).[19]

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[14] Lee Myeongmi 이명미, "Goryeo, Won wangsiltonghon-ui jeongchijeog uimi" 고려, 원 왕실통혼의 정치적 의미, *Hanguk saron* 한국사론 49 (2003): 7-85.

[15] *Goryeosa*, vol. 24, Gojong 41 [1254].12; Kim Sunja 김순자, "Goryeosidae-ui jeonjaeng, jeonyeombyeong-gwa ingu" 고려시대의 전쟁, 전염병과 인구, in *Jeonyeombyeong-ui munhwasa: Goryeo sidae-reul boneun tto hana-ui siseon* 전염병의 문화사 고려시대를 보는 또 하나의 시선, edited by Kim Yeongmi et al. (Hye'an, 2010), 291.

[16] William E. Henthorn, *Korea: The Mongol Invasions* (Brill, 1963), 214.

[17] *Goryeosa,* vol. 101, Gwon sehu yeoljeon 權世侯列傳.

[18] Kim Gu 金坵, *Jipo seonsaeng munjip* 止浦先生文集, vol. 2 (Sungkyunkwan University Press, 1984).

[19] *Dayue shiji quanshu* 大越史記全書 (henceforth *DShQ*), https://ctext.org/wiki.pl?if=gb&res=442611.

Table 1. A Comparison of Epidemic Years in Asia[20]

Countries	Epidemic years
China	1232, 1257-1259, 1297
Korea	1231-1232, 1254-1256, 1262-1264, 1274, 1279, 1281-1282, 1348, 1359-1364, 1366, 1374, 1383, 1391
Japan	1230-1233, 1238, 1259,21 1264, 1266, 1281
Vietnam	1232, 1263, 1278

This table reveals some overlaps of epidemic occurrences in East Asia, particularly in 1232, and 1259-1264. Some of these epidemic years may be linked to military conflicts. For example, 1232 was at the beginning of Mongol invasions of Goryeo and the joint Mongol and Goryeo armies landed in Japan in 1281, and their soldiers also encountered a large loss due to epidemics.[22] However, the apparent absence of outbreaks in intervening years may reflect gaps in historical documentation rather than actual disease patterns. Because some records were lost due to various reasons, the compilation of Goryeo history could not reflect the real frequency of outbreaks, which explains some long periods of seemingly "normal" years. Despite concerns about the accuracy and reliability of the historical records, there is a possible relation between warfare and epidemics in the thirteenth century as shown in the three examples below.

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[20] Epidemics-related records in the Goryeo Dynasty are mainly found in *Goryeosa, Goryeosa jeoryo* 高麗史節要, and *Dongsa gangmok* 東史綱目 by An Jeongbok 安鼎福. For secondary research, see also Lee Seungmin 이승민, "Goryeo sidae 'yeokbyeong'-gwa jayeon jaehae: Han·Jung jaehae girog bunseog-ul jungsimeuro" 고려시대 '역병'과 자연재해: 한·중 재해 기록 분석을 중심으로, *Han'guk jungsesa yeon'gu* 한국중세사연구 71 (2022): 144-47; Kim, "Goryeosidae-ui jeonjaeng," 59-60.

[21] Sin Sukju 申叔舟, "Ilbon kukki" 日本國紀, in *Haedong jegukki* 海東諸國記, manuscript no. 史 233-0002, 10, National Archives of Japan Digital Archive. Accessed January 3, 2025, https://www.digital.archives.go.jp/DAS/meta/listPhoto?LANG=default&BID=F1000000000000097708&ID=M2013072221344581840&TYPE=

[22] *Goryeosa*, vol. 104, Chungnyeorwang 7 [1281]. 7. 3.

1. Pan-East Asian Outbreaks in 1232

The year 1232 marked a significant period of widespread epidemics across multiple Asian countries, at least in Korea, China, and Vietnam, as evidenced by historical records. First, the vulnerability of people to the outbreaks in 1232 was likely driven by the synergistic effects of abnormal climate change. The Northern Hemisphere Ice-Volcanic Index indicates one temperature spike around 1230, leading to a succession of cold years.[23] This climatic shift manifested in various ways across Asia. Japan experienced the Kangi famine (1229-1232), an unprecedented subsistence crisis caused by cold weather. According to Farris, the devastation caused by the Kangi famine was the first recorded subsistence crisis caused by cold weather.[24] In parallel, Goryeo faced irregular precipitation patterns, particularly severe droughts in 1231 and 1232, prompting multiple court-ordered rain prayer ceremonies.[25] Vietnam also recorded a windstorm in the eighth month accompanied by severe epidemics among the civilian people resulting in numerous fatalities.[26] The similar geographical characteristics of the affected regions, including their northern hemisphere latitudes and monsoon climates, resulted in comparable impacts on irregular humidity and temperature patterns. These climatic anomalies, characterized by wet and cold conditions, led to more frequent natural disasters, including floods and droughts, creating conditions conducive to famines. Without sufficient food, people would be more vulnerable, and any single disease outbreak could kill them let alone severe epidemic outbreaks.

Secondly, concurrent with these climate changes, Mongol invasions exacerbated the situations of epidemics in central China and Goryeo.

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[23] Michael Sigl et al., "Timing and Climate Forcing of Volcanic Eruptions for the Past 2,500 Years," *Nature* 523, no. 7562 (2015): 545.

[24] William W. Farris, *Japan's Medieval Population: Famine, Fertility, and Warfare in a Transformative Age* (University of Hawai'i Press, 2006), 38-39.

[25] *Goryeosa*, vol. 23, Gojong 18 [1231]. 4.

[26] *DShQ*, vol. 5. 1232. 8.

While the Jin Dynasty (1115-1234), ruled by the Jurchen people, still held power in northern China, its power was significantly weakened due to the ongoing Mongol invasions. The Mongol armies besieged Biancheng fortress (modern-day Kaifeng) in 1232 and the Jin Dynasty eventually fell in 1234. At the same time, an epidemic outbreak occurred in the early fourth month of 1232, lasting approximately for three months. One record documented extreme cold in the fifth month, unusual for summer weather, resulting in frostbite among soldiers. Subsequent flooding worsened living conditions and contaminated water sources.[27] Cao and Hymes both suggest the outbreaks in the early 1230s could have been the plague prevalent among Mongols prior to the Second Pandemic.[28]

On the Korean peninsula, Ögedei Khan (1186-1241) ordered the invasion of Goryeo in 1231 with a pretext that Koreans killed their envoy earlier in 1225. Mongol troops encircled Hamsinjin (咸新鎭, i.e. Uiju) in the eighth month of 1231 and continued their offensive in 1232. The Mongols occupied fortresses and looted the towns, leaving behind ruins.[29] On the other hand, although the central court relocated to Ganghwa Island in response to the Mongol threat, the Mongols also encountered determined resistance from Goryeo troops as Goryeo people strengthened fences around Ganghwa Island to prevent Mongol invasion in the seventh month of 1232.[30] Despite Goryeo's resistance, Mongol advances resulted in widespread destruction, including the killing of officials and civilians, and the burning of settlements.[31]

Goryeo records from the fourth month of 1232 indicate widespread deaths due to famines and epidemics, which further led to a notable shortage of craftsmen.[32] The Mongol invasions severely disrupted daily life, creating unfavorable conditions conducive to the spread of diseases,

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[27] Wang and Zheng, "Yelun Jinmo Bianjing dayi de youyin yu xingzhi," 151.

[28] Cao and Li, *Shuyi*, 63-65; Hymes, "Epilogue," 285.

[29] Henthorn, *Korea*, 60-71.

[30] *Goryeosa*, vol. 23, Gojong 19 [1232]. 7. 1; 7. 3; 7. 6; 7. 7.

[31] *Goryeosa*, vol. 23, Gojong 18 [1231].11.28.

[32] *Goryeosa*, vol. 23, Gojong 19 [1232]. 4.12.

such as displacement, famines, and population mobility. More likely, those fleeing the conflicts inadvertently spread diseases along their routes. Due to the lack of detailed records describing epidemic situations in Goryeo, a comparison with Chinese records on the previously mentioned epidemics at Biancheng fortress, Kaifeng, the capital of Jin, gives some clues to understanding outbreaks in Goryeo. Akin to the Chinese case, numerous deaths caused by famines and epidemics could be attributed to the restless battles, including civil rebellions in Goryeo and extreme climate anomalies widely influenced in the northern hemisphere.

2. Pan-East Asian Outbreaks in the 1260s

In 1264, at a banquet with a Mongol envoy and an interpreter, Goryeo King Wonjong (1260-1274) discussed the prolonged aftermath of warfare, famines and epidemics, and displacement. He stated, "Looking at the situations in our land, wars, famines, and epidemics lasted for thirty years, and almost everything became collapsed and dying. Innocent people fled to the mountains and sea. How could we call them back within four to five years?"[33] As described here, the 1260s marked another period of significant demographic upheaval in Goryeo, largely attributed to the prolonged Mongol invasions and subsequent famines and disease outbreaks.

Epidemics struck the capital in the tenth month of 1262, persisting until 1264.[34] A poem titled "Illness Chronicles" in the diary *Travelogue of Dong'an Geosa* (動安居士行錄), authored by Yi Seunghyu 李承休 (1124-1300), provides a vivid account of an epidemic in a small village along Dutasan Mountain (頭陀山) and shows the impacts of this infection on his family in Gangwon Province from late 1262 to early 1263.

Cultivating farms to serve my mother. By the early days of the first

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[33] *Goryeosa*, vol. 26, Wonjong 5 [1264]. 5.16.

[34] *Goryeosa*, vol. 55, Wonjong 3 [1262].10.

> month of the *gyehae year* (1263), illness struck our home. My widowed mother lay on her sickbed, wheezing and barely clinging to life for another morning the next day. Some of the household servants died from the illness. I, too, was bedridden, unable to get up. There was no one to send on errands. Alone, I attended to the decoctions and medications, staying up all night till dawn, also caring for the servants. By mid-month, the illness slightly eased. Not long afterward, I fell ill again, with a fever that felt like burning flames. My widowed mother lay on her sickbed, her thoughts muddled and confused. The decoctions and medications were still hard to prepare. Where could I find the shady comfort of daylilies to calm her? Master Zeng sighed in vain, calling out helplessly to the departed souls of Chu. The servants lay stiff in the house, resembling turtles. My frail body had no rest, how could I provide for roasting and cooking? Night after night, I held the candle alone, waiting for dawn. My kins were still away, traveling on the road. Who would share in the misfortunes and disasters?[35]

As noted, almost all his family and relatives died of this infectious disease, and he was sick as well, unable to get up. This provides clear clues of a highly lethal infection. Yi Seunghyu's account describes symptoms including fever, respiratory distress, and near-unconsciousness among afflicted individuals. While definitive identification of the pathogen is challenging based solely on these descriptions, the high mortality rate and apparent respiratory involvement suggest a severe infectious disease, possibly of respiratory origin.

While the epidemic was rampant, other natural disasters were sweeping the Korean peninsula. Reports from northeastern areas to the central court in the eighth month of 1263 indicate concurrent floods and famines, suggesting a widespread nature of the calamities across the Korean peninsula. The report documented that, "Many of the towns in the north-east suffered from floods and crops were destroyed. People were

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[35] Yi Seunghyu 李承休, "Byeonggwasi" 病課詩, in *Dong'an geosa haengnok* 動安居士行錄.

floating or drowned with few survived but were threatened again by famines." Provisions were thus transported there to relieve people.[36]

Historical records also provide some figures to suggest the demographic changes caused by Mongol invasions and wartime epidemics. An elite, Kim Gu 金坵 (1211-1278), depicted his observation of the aftermath in his diary *Jipo seonsaeng munjip* 止浦先生文集. In a record of 1263, when epidemics struck, no more than one or two of a hundred people survived and the rest of the population still had to worry about surviving the next day.[37] According to Goryeo ministers, there used to be 40,000 soldiers but nearly all of them died of warfare and epidemics within the last thirty years. Although there were still hundreds and thousands of households registered, this was not a reliable figure.[38] Overall estimates suggest that approximately 46% of the population perished by 1259 when Goryeo surrendered to Mongol rule, including the captives, deaths in the battles, and by starvation and epidemics.[39]

In comparison, this estimated mortality rate in Goryeo is comparable to other events in world history around the same time—at least 40% mortality from epidemics during the siege of Kaifeng in 1331.[40] In 1334, this disease claimed almost 90% of the population of Hebei Province. During the Black Death of the 1350s, 30 to 60% of the population decreased in Europe.[41] These statistics suggest a dramatic demographic decrease in thirteenth and fourteenth-centuries Goryeo.

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[36] *Goryeosa*, vol. 80, Myeongjong 18 [1263]. 8.

[37] Kim, *Jipo seonsaeng munjip*, 1263. 4.

[38] *Goryeosa*, vol. 102, Yi Jangyong yeoljeon 李藏用列傳.

[39] Kim, "Goryeosidae-ui jeonjaeng," 291; *Songshi* 宋史 recorded that there were 2.1 million residents on the Korean peninsula around the 1130s. In the early Joseon Dynasty, approximately four million residents from eight provinces were recorded in the 1461 *Sejong sillok jiriji* 世宗實錄地理志. The period from 1231 to 1281 during the Mongol invasions of Korea must have witnessed a dramatic decline in population. Excluding these years, the increasing rate of the population within the rest of 280 "peaceful" years is around 23%. However, this figure does not include people who were not registered in the household, such as young children.

[40] Hymes, "Epilogue," 291.

[41] J. N. Hays, *The Burdens of Disease: Epidemics and Human Response in Western History* (Rutgers University Press, 2009), 37.

Historical records from the Song Dynasty document an epidemic outbreak among Mongol armies in Sichuan and Hubei Provinces from the fifth to seventh month of 1259.[42] Song general Wang Deng (?-1259) reported that his soldiers, when confronting Mongol armies right before this battle, succumbed to an illness characterized by "bleeding from the five organs."[43] Robert Hymes has also noted that Chinese medical writings recorded some new symptoms of large purulent lumps or sores among those infected people during the Mongol incursions in the early to middle thirteenth century.[44] This symptomatology suggests a possible case of bubonic plague progressing to septicemia and potentially pneumonic plague, although we cannot rule out that soldiers and horses could not adapt to the climate in Sichuan, which was different from the central plains, dying from other diseases such as dysentery as numerous soldiers were reported to have contracted this disease.[45]

However, "bleeding from the five organs" seems to be the symptom of bubonic plague, which later may have resulted in septicemia and worsened to a pneumonic plague or other organ damage through blood circulation. Judging from the timeline that Song soldiers died immediately after their interconnections with Mongol warriors at the warfare, these poor soldiers were highly likely to have been infected by Mongols under hard living conditions in the fields. Given the location, legality, symptoms, and simultaneous deaths of numerous horses, Cao interprets the epidemic as the bubonic plague, and Hymes provided more sources and detailed explanations to examine the hypothesis of bubonic plague in Song China.[46]

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[42] *Yuanshi* 元史 (Zhonghua shuju, 1976; henceforth *YS*), vol.155, Shi Tianze zhuan 史天澤傳

[43] *Songshi* 宋史 (Zhonghua shuju, 1979), vol. 412. Wang Deng zhuan王登傳

[44] Robert Hymes, "A Hypothesis on the East Asian Beginnings of the Yersinia Pestis Polytomy," *The Medieval Globe* 1, nos.1-2 (2014): 285-308; Robert Hymes, "A Tale of Two Sieges: Liu Qi, Li Gao, and Epidemics in the Jin-Yuan Transition," *Journal of Song-Yuan Studies* 50 (2021): 295-363; Robert Hymes, "Buboes in Thirteenth-Century China: Evidence from Chinese Medical Writings," *The Medieval Globe* 8 (2022): 51.

[45] *YS*, vol.129, Niulin zhuan 紐鱗傳.

[46] Cao, "Dili huanjing," 188; Hymes, "Epilogue," 285-308. This view of bubonic plague differs

Although Mongol invasions of Goryeo had concluded, the continued presence of Mongol troops and ongoing diplomatic communications maintained potential transmission routes, such as the abovementioned conversations between the Goryeo king and Mongol envoys in 1264. The possible respiratory symptoms observed among Goryeo patients in 1262 bore similarities to those reported in China, suggesting a possible common pathogen. Meanwhile, infectious diseases remained an important mortality cause between 1150 and 1280 in Japan, alongside warfare and other famine-related illnesses.[47] In the sixth and seventh months of 1263, Japanese records also confirmed epidemic-related deaths among the population in the capital.[48]

In parallel, Đại Việt (modern-day northern Vietnam) kept intensive communications both with the Mongols in northern China and the Song state (960-1279) in the south. Vietnamese dispatched diplomatic missions to the Mongol Empire in the spring of 1263, while 2,000 people from the Song Dynasty arrived in the twelfth month, establishing potential routes for disease transmission.[49] The *Complete Annals of Vietnam* also recorded epidemics in the ninth month of that year. The bidirectional connections and epidemic outbreaks were against another background that the Mongol Empire launched four military campaigns against Vietnam in 1258, 1282-1284, 1285, and 1287-1288.[50] Despite the military defeats of the Mongols, continuous warfare weakened the health of local people. Their living conditions were further exacerbated by more climate anomalies,

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from the perspective of Rashid-al-Din Hamadani (1247-1318), who attributed it to an outbreak of cholera—a disease introduced to China only after 1820.

47 Farris, *Japan's Medieval Population*, 28.

48 Tōkyō daigaku shiryō hensanjo 東京大学史料編纂所, ed., *Shiryō sōran* 史料綜覧 (Tokyo University Press, 1923-63), https://clioimg.hi.u-tokyo.ac.jp/viewer/view/idata/T38/1264/06-1-3/5/0049?m=all&s=0049.

49 *DShQ*, vol. 5, 1263. 9.

50 James A. Anderson, "Man and Mongols: The Dali and Đại Việt Kingdoms in the Face of the Northern Invasions," in *China's Encounters on the South and Southwest: Reforging the Fiery Frontier over Two Millennia,* edited by James A. Anderson and John K. Whitmore (Brill, 2014), 106-34.

such as the extreme rain hail weather in the second month and rainstorms in the twelfth month of 1263. All of these conditions added to the vulnerability of locals to epidemics.

In the Middle East, a severe famine and pestilence coincided with a local rebellion in late 1261 but lasted longer than that, leading to significant agricultural failure in Syria. Some scholars argue that an infestation of rodents exacerbated the resultant poor harvests and food shortage, while others also consider this outbreak as a plague and connect it with Mongol incursions there in 1258.[51]

Aside from Mongol invasions as the common reason for pan-East Asian epidemics in the early 1260s, recent geographical and historical studies have examined the interconnection between volcanism and global plague pandemics. These studies offer a new perspective on the complex interplay between volcanic activity, climate change, Mongol invasions, and the epidemics of the 1260s.[52] The Samalas eruption of 1257 is hypothesized to have triggered rapid climate change in the late thirteenth and early fourteenth centuries.[53] The tree ring data from the Mongol region indicates abnormally low temperatures around 1260, specifically in 1259, 1261, 1262, and early 1263.[54] Climatic reconstructions based on ice-core volcanic signals also provide a clear post-volcanic summer cooling in 1258.[55] In addition, the combined effects of the Mongol invasions and extremely low temperature caused by the massive eruption of Samalas in 1257, may have further contributed to the spread of a new strain of

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[51] Peter Thorau, *The Lion of Egypt: Sultan Baybars I and the Near East in the Thirteenth Century*, translated by P. M. Holt (Longman, 1992), 143; Jonathan Brack et al., "Plague and the Mongol Conquest of Baghdad (1258)?," 1-19; Nahyan Fancy and Monica H. Green, "Plague and the Fall of Baghdad (1258)," 157-77.

[52] Henry G. Fell et al., "Volcanism and Global Plague Pandemics: Towards an Interdisciplinary Synthesis," *Journal of Historical Geography* 70 (2020): 36-46.

[53] Fell et al, "Volcanism and Global Plague Pandemics," 40-43.

[54] Tian Peizhong 田沛忠, "13 shiji Menggu diguo jiangyu bianhua yu qihou bianhua de guanxi yanjiu" 13世纪蒙古帝国疆域变化与气候变化的关系研究 (MA Thesis, Northeast Normal University, 2021), 41.

[55] Michael Sigl et al., "Timing and Climate Forcing of Volcanic Eruptions for the Past 2,500 Years," 545-47.

Yersinia pestis, the causative agent of plague.[56] These East Asian countries experienced similar climate anomalies and Mongol invasions, which likely contributed to parallel patterns of epidemics in the early 1260s. This pattern, nonetheless, may merely reflect a coincidence suggested by historical records rather than a definitive causal relationship.

3. Mongol Invasions of Japan and the 1281 Epidemics

In the 1270s, following negotiations between the Mongol Empire and Goryeo, the Mongol Empire demanded Goryeo's military support for an invasion of Japan. This alliance led to two major campaigns. The first attack in 1274 targeted northern Kyushu, resulting in a defeat that necessitated a Mongol retreat. A second, larger invasion was launched in the third month of 1281. The 1281 campaign was characterized by intense combat with fluctuating fortunes. A victory by the Goryeo-Mongol forces resulted in approximately 50 casualties of the Japanese soldiers and a subsequent Japanese counterattack claimed around 300 allied lives of the joint Goryeo and Mongol armies.[57] These figures highlight the brutal nature of the conflict and the significant loss of life on both sides.

Compared to the deaths in battles, a more devastating threat of epidemics emerged within the invading forces. A severe epidemic occurred among the Goryeo-Mongol armies in the sixth month of 1281, claiming over 3,000 lives of soldiers in a short period.[58] The rapid spread and high mortality rate of the epidemic suggest that crowded, unsanitary conditions were typical among large military encampments. The sudden loss of over 3,000 soldiers to disease also had a significant impact on the invasion's military effectiveness and morale. Mongols also quickly withdrew to Iki on the thirtieth day of the sixth month followed by a stale-

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[56] Fell et al., "Volcanism and Global Plague Pandemics," 42.

[57] Stephen Turnbull, *The Mongol Invasions of Japan 1274 and 1281* (Osprey, 2010).

[58] *Goryeosa*, vol. 104, Chungnyeorwang 7 [1281]. 7. 3.

mate at Hakata later in the eighth month of 1281.[59] This large-scale epidemic outbreak also indicated that Mongols underestimated the role of non-combat factors, particularly infectious diseases, in shaping the outcomes of historical military campaigns.

Mongol invasions of Japan, Korea, and Vietnam should be viewed within the larger framework of Mongol expansionism in the thirteenth century, which represents one of the most ambitious maritime military operations of the medieval period. It was not only warriors on horseback who swept across the lands but also the epidemic outbreaks caused a wave of devastation and grief. The epidemic outbreak during this invasion is consistent with patterns observed in other Mongol campaigns across Eurasia, where diseases often accompanied military movements.

Possible Zoonotic Stages of the Epidemics

1. Rodents and Plague

"Banners and flags illuminate the traveler's path. The sound of drums and horns invigorates the human spirit. Field mice leap and hide among the bamboo, while startled deer flee in search of the forest."[60]

This citation from the diary of Goryeo minister Yi Gyubo 李奎報 (1168-1241) describes the massive disturbance caused by Mongol troops, particularly the unusual behaviors of rats. Although traditional rural life was always associated with rats and fleas, historical records, including these personal accounts and official Goryeo documents, contain increasingly frequent references to rodent-related damage. These accounts describe incidents such as the theft of government-stored crops from warehouses and the destruction of buildings.[61] Such accounts may partially

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[59] James P. Delgado, *Khubilai Khan's Lost Fleet: In Search of a Legendary Armada* (University of California Press, 2008), 93.

[60] Yi Gyubo, *Dongguk Yi sangguk jip* 東國李相國集, vol. 9, Yi pyeongjang Gyubo ha李平章奎報下.

[61] For example, see *Songdoji* 松都誌, vol. 3, Gwansa 官舍, Bunbongsangsi 分奉常寺; *Junggyeongji* 中京誌, vol. 5, Hakgyo 學校, Seonggyungwan 成均館. More rodent-related information can be

indicate an increase in rodent populations during the thirteenth to fourteenth centuries. World history has witnessed that the amplifying rats ruined cities many times. For example, in Roman history, grass rats might have played a role in sustaining or transmitting plague in the Roman and medieval world, while the black or ship rat, *Rattus rattus*, is the prime suspect in the two plague pandemics.[62] Given that rats were important in transmitting new pathogens, it is natural to consider the possibility of zoonotic epidemics happening during the periods mentioned above. If not bubonic plague, then outbreaks during this period might have been caused by typhus, transmitted through lice.

Bubonic plague was unable to survive without vectors and hosts, and rodents were known as the carriers of plague bacillus. The rodents were the sylvatic (wild) rodents represented by marmots as well as commensal (domestic) rodents like mice and rats.[63] While it is difficult to distinguish the exact type of these rodents, the Mongol invasions of Korea created conditions conducive to increased rodent-human contact and thus potential disease transmission.

Similar to the case of the human population during the Mongol invasions of Korea, Mongol invasions also disrupted sylvatic rodent populations, bringing them into closer contact with human settlements. As described in historical records, warfare exposed the hiding places of rodents and forced them to relocate as "wild field rats jumping to the bamboo grove." The rodents described here were probably sylvatic rodents thriving on grass. They were within close distance from soldiers in the wildness, or they could come closer to the residential areas where commensal mice accumulated. Yet, either through direct contact with humans or indirect contact via domestic mice, sylvatic rodents were brought into clos-

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found in *Gaegyeong gicho jaryo* 개경 기초자료, https://db.history.go.kr/id/gk.

62 McCormick, "Rats, Communications, and Plague," 2.

63 Historical records did not differentiate between rats and mice; however, this distinction is irrelevant to their classification as rodents. The documented accounts of rat sightings can be interpreted as evidence that the Goryeo people may have been exposed to plague through contacts with rodents carrying the disease.

er proximity to humans.

Commensal mice and rats typically reside near human settlements, as they rely on human dwellings and food storage for survival. During times of war, when people were forced to flee and became displaced, these mice and rats inevitably moved along with the humans they relied on, increasing their proximity to humans. Wartime disruptions to agriculture and human settlements likely altered food availability for rodents, potentially driving them even closer to human habitations. Goryeo minister Yi Gyubo captured these issues in his poetry, such as pieces titled "Craziness of Rats" (鼠狂) and "Curse on Mice" (呪鼠文), which described the problems caused by the frequent presence of rats.

> Keeping a cat is not merely to slaughter your kind, but to make you fear the cat and force you into hiding. Why do you not flee and remain concealed? You have been used to tunneling through walls and crevices. Your mischief was already apparent when you roamed outside, and now, your behavior has grown increasingly reckless and chaotic. Your sibilance disturbs my sleep, and your cunning theft deprives people of their food. If a cat is present, how dare you continue? You act this way only because the cat has been lenient. Though the cat may neglect its duties, your offenses are still numerous. While the cat can be scolded and driven away, you are difficult to catch and restrain. Oh, mice, if you do not repent, I will seek out an even fiercer cat to punish your insolence.[64]

The interruption caused by their rustling voices of stealing food was annoying, but they posed more threats to human life than that. The mice were rampaging through towns, not only stealing the crops but also tearing the clothing. Thus, the minister even wrote another poem to curse them.[65] Rats usually held the nocturnal habit. But, when they dared to scurry everywhere during the daytime, they must be hungry or there were

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[64] Yi Gyubo, *Dongguk Yi sangguk hujip* 東國李相國後集, vol. 1, Seogwang 鼠狂.

[65] Yi, *Dongguk Yi sangguk hujip*, vol. 20, Juseomun 呪鼠文.

a large number of rats to feed. Scientific experiments prove that twenty-five grey rats could eat as much as one person does, but given that they also foul much more food, the amplifying population of rats and mice would be harmful to crop harvest especially when the Goryeo economy was based on land tax imposition.[66] Although humans tried to grab them for punishment, they would always escape because of their exceptionally sensitive hearing of human's coming.

The rodent population was expanding with rats newly joined from the wildland. In the first month of 1261, records note that "according to the locals in the north, crowds of rats crossed the river and entered our boundary."[67] Although metaphors of mice have referred to enemies and villains, the year 1261 was not a year of attack since the Mongol invasions of Korea had ended in 1259. The record is not specific on how the rodents came to the Korean peninsula, but two earthquakes in the first month of 1261 may provide some clues regarding the cross-border migration of rodents.[68] Scholars have demonstrated that strong earthquakes can have impacts on the spread of plague as seismic activity disrupts the living environment of rodent populations, resulting in their death and dislocation.[69] The concurrence of earthquakes and rodent mobility in the northern borderland of the Korean peninsula during the first month of 1261 further suggests that the epidemic outbreaks of the early 1260s may have been precipitated by a plague and potentially linked to the displaced rodents.

The expansion of ranches and grasslands following the Mongol invasions created favorable ecological conditions for the proliferation of rodent population. The subsequent political relationship between the Mongols and Goryeo evolved into a tributary-vassalage system, formal-

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66 Data from modern Turkey suggest commensal rodents consume or damage 5 to 15 percent of grain and legumes in storage. For more, see McCormick, "Rats, Communications, and Plague," 2.

67 *Goryeosa,* vol. 8, Wonjong 2 [1261]. 1.

68 *Goryeosa*, vol. 25, Wonjong 2 [1261]. 1. 9; *Goryeosa*, vol. 55, Wonjong 2 [1261]. 1.19.

69 Slavin, "The Birth of the Black Death," 322; Fell et al, "Volcanism and Global Plague Pandemics," 36-46.

ized in 1270 after the conclusion of military conflicts. This period was characterized by regular diplomatic exchanges and intermarriages between the ruling families. It is conceivable that the rats, traveling with the Mongols, could have crossed the river into the peninsula by hiding in the provision carts, similar to how rats were transported to Europe and transmitted the plague.[70] Once the groups of rodents were transported to the Korean peninsula, their population must have profited from the abundance of forests, ranches, and grassland. The expanded ranches as environmental legacies of Mongol invasions of Korea provided an appropriate environment for horses and the newly coming sylvatic rodents.[71] Rats are omnivores. And, feeding on luxuriant grass, they could reproduce at a fast speed. With a dramatic increase in their population, they could travel much further via land transportation. Without human assistance, the overland rats would only proceed at a rate of about 20 km per century.[72]

There were four main potential transmission routes of the possible plague. First, increased rodent populations heightened the risk of direct human-rodent contact, particularly during activities such as hunting or in times of food scarcity when humans might consume rodents. One poem illustrated the serious drought-induced famines, which decreased the harvests of various kinds of flora and fauna in the mid-fourteenth century. People were starving for a long time as well, so they had no food but "to grab the field mice and numerous people contracted epidemics."[73] Warfare, natural disasters, and famine multiplied the number of displaced people entering the forests, which were natural habitats for rodents. They rested in proximity to rodents' burrows or searched for rodents and consumed them. People would be infected if these rodents carried the *Yersinia pestis* bacteria as they always did. Suppose that a sylvatic rodent

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[70] See also McNeill, *Plagues and Peoples*, 138-39.

[71] John Lee, "A State of Ranches and Forests: The Environmental Legacy of the Mongol Empire in Korea," in *Forces of Nature: New Perspectives on Korean Environments*, edited by David Fedman, Eleana J. Kim, Albert L. Park (Cornell University Press, 2023), 60-76.

[72] McCormick, "Rats, Communications, and Plague," 10.

[73] Won Cheonseok 元天錫, *Ungok haengnok* 耘谷行錄, vol. 2, Gohan 苦旱.

carries Yersinia pestis, the moment when humans get close to it, no matter by fighting in battles or hunting in the wild, forms the first transmission route of direct contact because the bacteria can enter human bodies through the skin or mucous membranes.[74]

Second, fleas feeding on infected rodents could transmit the disease to humans or domestic animals. Third, cats and other domestic animals could serve as intermediaries, becoming infected through contact with rodents, especially oral ingestion, and subsequently transmitting the disease to humans. If the cat owner were bitten by the infected cat, then it would be the fourth transmission route. Once introduced to human populations, the disease could easily spread through direct contact or respiratory droplets, particularly in densely populated areas. The 1261 report of rodent migration from the other side of the Yalu River to northern Korea coincides with epidemic outbreaks in the winters of 1262 and 1263, affecting various regions across the Korean peninsula.[75] The southward or nationwide progression of epidemics was likely to have followed patterns of human-to-human transmission along with rodent dispersal.[76]

Historical accounts describe symptoms consistent with bubonic plague. At the beginning of bacterial infection, mammals showed the symptoms of bubonic plague with fever, headache, general weakness, and others. Without effective treatment, it further turned into a septicemic plague, of which representative characteristics were abdominal pain,

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[74] For more research on royal hunting during the Goryeo Dynasty, see George Kallander, *Human-Animal Relations and the Hunt in Korea and Northeast Asia* (Edinburgh University Press, 2023). For more scientific analysis on the transmission of bubonic plague, see also Idir Bitam, Katharina Dittmar, et al., "Fleas and Flea-borne Diseases," *International Journal of Infectious Diseases* 14, no. 8 (2010): 672.

[75] Kim, *Jipo seonsaeng munjip*, vol. 2, 1263. 4.

[76] There are two main arguments regarding person-to-person dissemination. One argument is that person-to-person dissemination by droplets allows far more rapid propagation of the disease than the comparatively slow long-distance movements of rats over land and sea. See Frank M. Snowden, *Epidemics and Society: From the Black Death to the Present* (Yale University Press, 2019), 51. According to scientific research, human-to-human infection occurs mainly in the pneumonic expression of *Yersinia pestis*, but the bubonic plague does not spread as easily as historians have imagined despite its deadliness. See McCormick, "Rats, Communications, and Plague," 1.

diarrhea, bleeding, and, as noted before, "bleeding from the five organs." Through blood circulation, the bacteria would gradually spread to the lungs and thus result in the pneumonia plague showing symptoms of breathing difficulties, chest pain, and fever, while the historical records also match these commonly seen symptoms, although the symptoms of the plague in the modern era may differ from those in the premodern period.[77] The patients can much more easily spread the epidemic via droplets as the human-to-human transmission route, which explains a large-scale infection within a family or in the capital within a few months. By comparison, the epidemic outbreaks in thirteenth-century Korea under Mongol invasion can also find some suitable explanations from the four transmission routes of the bubonic plague and different symptoms, which hints at the possibility of the plague in the history of the Goryeo Dynasty.

As definitive proof is lacking, the correlation between the increased rodent activity, Mongol invasions, and epidemic outbreaks could only suggest a possible link to bubonic plague. One hypothesis is that the new exotic rodents carried new germs, exchanged bacteria with the domestic rats, and transmitted the possible plague to the Goryeo people. This hypothesis offers a plausible explanation for some epidemic outbreaks observed in thirteenth to fourteenth-century Korea and underscores the possible interconnection between warfare, environmental changes, and zoonotic disease transmission.

The nomadic culture of the Mongols led to the inclusion of livestock in tributary practices with Goryeo, and these cross-border animals introduced another potential route for disease transmission. Aside from horses riding by Mongols to the peninsula, the Mongol Empire bestowed Goryeo 500 sheep in 1263, and ten camels as gifts in 1264.[78] Of particular interest are the Bactrian camels, which have been identified as possible plague pathogen hosts due to their susceptibility to flea infestations.[79]

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[77] See Snowden, *Epidemics and Society*, 51; McCormick, "Rats, Communications, and Plague," 1.

[78] Kim, *Jipo seonsaeng munjip*, vol. 2, 1263. 4; 1264.10.18.

[79] Tsutsui, "Landscapes in the Dark Valley," 75.

It is also important to note that a wide range of animals can be affected by plague, including rock squirrels, ground squirrels, wood rats (木鼠), prairie dogs, chipmunks (花鼠), mice (老鼠), voles (田鼠), and rabbits. Wild carnivores can become infected by consuming other smaller animals with infection. However, the relatively small number of these animals introduced to the Korean peninsula suggests this transmission route may have been limited. Further research is required to explore the role of cross-border livestock in disease transmission.

2. Lice and Typhus

The potential for typhus outbreaks during the Mongol invasion merits further investigation, particularly in light of historical accounts and contemporary understanding of disease transmission. In Yi Seunghyu's 1263 poem on illness, he also described the severe living conditions of "mosquitoes flying around the sideburns" with a sound "as loud as thunder" preceding familial illness.[80] Although this description does not suggest a direct link between the outbreak and these mosquitoes, this observation notes the harsh living environment in winter and the vulnerability of people, which provided the conditions for epidemic transmission.

Given the reported severity of the cold, which purportedly caused distress among the author's family members, the presence of mosquitoes seems incongruous. This discrepancy suggests two possible interpretations—either the winter was unexpectedly mild, facilitating mosquito activity, or the author misidentified the insects in question. The latter hypothesis is more plausible, considering the environmental conditions and the known behavior of disease vectors. Midges look similar to mosquitos, and they can bear a relatively cooler temperature than mosquitos. They usually carry infectious diseases among animals.[81] Another poten-

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[80] Yi Seunghyu 李承休, *Dong'an geosa haengnok* 動安居士行錄, vol. 1, Byeonggwasi 病課詩.

[81] Tim W. R. Möhlmann, Matt J. Keeling, Uno Wennergren et al., "Biting Midge Dynamics and Bluetongue Transmission: A Multiscale Model Linking Catch Data with Climate and Disease Outbreaks," *Scientific Reports* 11 (2021).

tial candidate for misidentification is the flea, a known vector for bubonic plague. Fleas, while capable of jumping, do not fly, which aligns more closely with the described behavior. This observation is consistent with established epidemiological knowledge regarding the transmission of bubonic plague, which typically originates from rodent populations and spreads to humans via insect bites, rather than through direct human-to-human contact. While the role of fleas in the Black Death pandemic is well-documented, their specific involvement in Korean peninsula epidemics remains a subject of ongoing research.

Alternatively, the observed insects could have been lice, which, like fleas, are incapable of flight but can crawl and are associated with typhus epidemics. Historical records, such as those of Minister Yi Gyubo, provide evidence for the prevalence of lice even among elite households, suggesting a potential vector for typhus transmission. Yi Gyubo's writings vividly illustrate the ubiquity of lice: "Despite being a poor minister, I did not stink that much. How dare the lice come to bite my hands?"[82] He was so delighted by the pure and clean clothes because the clothes could protect him away from the lice.[83]

The documented presence of lice in these historical accounts merits particular attention given the unsanitary conditions of premodern rural environments, which was further exacerbated by warfare.[84] Body lice serve as vectors for multiple bacterial diseases, including typhus, relapsing fever, and trench fever. These vector-borne diseases have historically constituted significant factors in combat-associated mortality rates.

The harsh conditions during the Mongol invasions, characterized by prolonged periods of conflict and disrupted social structures, generated an environment conducive to lice infestations and, consequently, the

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82 Yi, *Dongguk Yi sangguk hujip*, vol. 4, Munseul 捫蝨.

83 Yi, *Dongguk Yi sangguk hujip*, vol. 12, Goyulsi 古律詩.

84 For more studies on lice and warfare, see also Hans Zinsser, *Rats, Lice, and History: A Chronicle of Pestilence and Plagues* (Black Dog & Leventhal Publishers, 1996), 150-65; Robert N. Wiedenmann, "Lice in War and Peace," in *The Silken Thread: Five Insects and Their Impacts on Human History* (Oxford University Press, 2021), 125-40.

spread of typhus. The convergence of multiple epidemiological risk factors featured in wartime scenarios, including crowded living conditions, limited access to sanitation, and large-scale population movement, would have facilitated the rapid transmission of louse-borne diseases. While definitive evidence for typhus epidemics during the Mongol invasions remains elusive in the historical record, the confluence of historical accounts, environmental conditions, and modern epidemiological understanding of disease transmission mechanisms suggests the possibility of such outbreaks.

While it is also impossible and, in many respects, undesirable to provide a modern label for the exact type of epidemics, there is a need to understand these epidemics through the premodern perceptions of epidemics in Goryeo. Aside from the records on the symptoms of infection among Yi Seunghyu's family, the other previously provided descriptions mainly focused on massive deaths, but they cannot lead to a decisive conclusion as to whether these outbreaks were "infectious diseases" or not. According to modern epidemiology, massive sickness among soldiers who had little food could have been due to scurvy, which is not an infectious disease. Long-term exposure to the harsh wartime environment made people extremely vulnerable and any illness could be deadly. To address these unsolved myths, further interdisciplinary research, combining historical analysis with epidemiological modeling, could provide valuable insights into the potential impact of typhus and other vector-borne diseases during this tumultuous period in East Asian history.

Conclusion

Contrary to previous narratives focusing solely on Mongol military history, this analysis has underscored the complex interconnectedness between climate change, geopolitical upheaval, the environment, and the transmission of infectious diseases during the thirteenth century. Conjuring images of Mongol warriors sweeping across the plains on horseback, this study has highlighted a devastating new "weapon" wielded by the expansionist empire—epidemics. The examination of official chronicles,

personal accounts, and cross-regional comparative sources has painted a comprehensive picture of the epidemiological impacts wrought by the climate anomalies and environmental deterioration and legacies brought by Mongol invasions across East Asia.

The study has identified several key junctures where the Mongol conquests, combined with anomalous climate patterns, precipitated widespread outbreaks of disease. Examples include the pan-Asian epidemic of 1232, the prolonged crises of the 1260s, and the devastating outbreak that decimated the 1281 Goryeo-Mongol invasion forces in Japan. In each case, the movement of Mongol armies, their interactions with local populations, and the environmental stresses imposed by warfare and climatic anomalies appear to have catalyzed the emergence and transmission of epidemics.

While the precise identities of these historical disease agents remain elusive, the historical evidence points to the distinct possibility of zoonotic diseases, potentially including plague transmitted by rodent or flea vectors, or commonly seen louse-borne typhus in warfare. The Mongol conquests, with their disruption of ecosystems and forced displacement of human and animal populations, likely facilitated the transmission of microbes. However, the East Asian historical records cited in this study provide only circumstantial evidence for a direct interconnectedness of epidemics across these countries. The scarcity of surviving records prior to the Goryeo period further complicates efforts to compare the prevalence of pests and their impacts on daily life before and after the Mongol invasions of Korea. This challenge is compounded by the fact that living conditions were persistently harsh, and the devastation wrought by warfare further exacerbated these vulnerabilities. A single research discipline alone cannot fully elucidate the complicated processes underlying the transmission of epidemic pathogens or definitively identify the specific diseases that may have afflicted thirteenth-century Korea. Therefore, advancing our understanding of these issues requires more collaborative work, involving paleoepidemiology, paleoclimatology, archaeology, and history to demonstrate the dynamics of epidemics during this period.

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