



A critical assessment of proposed outbreaks of plague and other epidemic diseases in Ancient Egypt

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ABSTRACT

The current coronavirus disease 2019 (COVID-19) pandemic has reminded us of past epidemics. Pharaonic Egypt has often been associated with epidemics and disasters through the 10 plagues in the Bible. The aim of this study was to examine which epidemics and serious diseases can be effectively proven for Ancient Egypt through mummies and historical source texts. The biblical plagues cannot be proven because there is no agreement on the dating of the Exodus, or the Exodus is a conglomeration of memories of different events. Other diseases such as malaria and schistosomiasis have been proven for Ancient Egypt, while polio and smallpox are still uncertain. There are indications of a bubonic disease from the time of the middle 18th Dynasty, but its exact nature cannot be determined from source texts or mummies, as they are too vague.

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Several popular articles on epidemics and plagues in Ancient Egypt have been published (Pommerening, 2020) during the ongoing coronavirus disease 2019 (COVID-19) pandemic. Mummies offer a unique chance to investigate the past (Cardin, 2014), due to the preservation of soft tissue. Whether there were pandemics in ancient times and how people reacted to them in the past is highly relevant to the present, as all measures we can take to control new pandemics must necessarily rely on past experiences (Habicht et al., 2020).

Egypt is frequently connected with the 10 biblical plagues (hebr. *Makot Mitzrayim*, Exodus 7:14 to 12:36). As one example, the documentary “The Exodus decoded” (Jacobovici and Cameron, 2006; *The Exodus Decoded*, 2020) claims that the Exodus took place at the beginning of the New Kingdom under Pharaoh Ahmose I and was contemporaneous with the Minoan eruption and a postulated related limnic eruption in the Nile Delta (similar to the events at Lake Nyos in Cameroon in 1986). A limnic eruption is a lake overturn with sudden eruption of CO₂ from the lake, leading to the death of all fish, but not frogs, and then to lice and flies, followed by bacterial epidemics, etc. Other publications have tended towards the same conclusions (Trevisanato, 2005). However, it is considered impossible by many that a limnic eruption could ever happen in a river like the Nile, because it is not standing water. Furthermore, such studies are in conflict with the

chronology and political situation: an early exodus at the beginning of the New Kingdom contradicts the Egyptian control over the territory of later Israel/Juda during the whole New Kingdom. It seems more realistic that the biblical plagues and the exodus are a conglomerate memory of independent events at different times merged to describe the Exodus. Due to the political situation, the exodus of Moses may have taken place at the end of the New Kingdom under Ramses XI (Habicht 2020) or later, or not at all (Finkelshajin and Silberman, 2006).

In a proto-historical context, however, we must keep in mind the typical archaeological attributes indicative of a pandemic: mass burials in which all age groups and both sexes were buried together and simultaneously, or ‘rushed burials’ not conforming with established religious–social practices, e.g., in the Ancient Egyptian context, the lack of mummification attempts. Indeed, those are only rarely found in ancient Egypt. Without any evidence-based population statistics available, clear evidence of excessive mortality is missing. The only remaining indicators of possible major disease events are the series of skeletal and mummified human remains, literary sources, and cultural references.

A few literary sources point towards major catastrophic disease events: Papyrus Leiden I 344 “The Admonitions of Ipuwer”, is the most prominent example and is sometimes mentioned to infer possible epidemics at the end of the Old Kingdom. However, this papyrus dates to the Middle Kingdom and describes the social chaos after the collapse of the Old Empire. It is not a contemporary account, but an art form lamenting the reversal of living conditions

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(<http://www.reshafim.org.il>). Consequently, this work must be understood from a sociological–political perspective rather than an epidemiological one.

The alleged mass burial of several queens of the reign of Mentuhotep II in the 11th Dynasty (approximately 2000 BCE) may also be a potential indication of an epidemic. The queens seem all to have died within a very short period and were buried in shaft graves in the king's mortuary temple at Deir el-Bahari. Shortly afterward, a portico of pillars was built over the tomb entrances, and the tombs were no longer accessible, so they must have been buried almost at the same time. Some of the mummies were discovered by Herbert Winlock (1884–1950) in the 1920s and were in excellent condition (Derry, 1942; Winlock, 1942). Any speculation about an epidemic shortly after the reunification of the country at the beginning of the 11th Dynasty (ca. 2050 BCE) is, however, strongly questioned by the following: According to the autopsy of Douglas Derry, Queen Ashayet – one of the queens – supposedly died while giving birth. Unfortunately, the once excellently preserved mummies are today in a deplorable state, mostly decomposed into skeletal remains (Fletcher, 2004).

It is assumed that during the Middle Kingdom (ca. 2100–1800 BCE), the ancient Egyptians may have contracted malaria (*Plasmodium falciparum*) after settling in the Faiyum Oasis and creating channels of stagnant water. Malaria has been sporadically diagnosed in mummies from the New Kingdom (ca. 1800 BCE) (Nerlich et al., 2008; Hawass et al., 2010). However, tracing the development of the disease from the Middle Kingdom to the New Kingdom is complicated by only very few mummies from the Middle Kingdom having been preserved. The Edwin Smith Papyrus (New York, Academy of Medicine) from the beginning of the New Kingdom (ca. 1550 BCE) also describes an annually recurring disease (Stuhr, 2008). The description in spell 6 (column 1914–1918) points to a flare-up at the end of the Nile flood relating to an insect. The disease is described as a breeze of pestilence spreading through the air. It is tempting to associate stagnant water and mosquitoes with malaria, but this assumption cannot be proven conclusively based on source texts alone.

The presumed plague (*Yersinia pestis*?) at the end of the Bronze Age can be reviewed indirectly in Egypt in different ways. The earliest hints of this plague may be that Pharaoh Amenhotep III (who ruled ca. 1379–1340 BCE) ordered hundreds of statues of the lion-headed goddess Sekhmet to be made; Sekhmet was thought to bring epidemics, but also to remove them from society. These Sekhmet statues are now on display in numerous museums around the world (Norrie, 2016). Except for one Amarna-letter (EA II) written under his son Akhenaton (who ruled ca. 1340–1323 BCE), which mentions a plague in the time of his father, we have no direct historical evidence of an epidemic in the time of Amenhotep III. Some researchers have suggested that the bubonic plague may have originated in India and spread over to the Middle East, and eventually reached Egypt (Norrie, 2016). The decision of Amenhotep III to relocate his palace to Malqata on the western bank near Thebes, in a somewhat isolated location, might be one of the first known mitigating strategies of isolation known in history (Norrie, 2016). It is possible that a decade later, an epidemic broke out in the new residence of Akhenaton in Tell el-Amarna during the 14th year of the king's reign. Not only numerous inhabitants, but also members of the royal family died: three daughters of Akhenaton and his wife Nefertiti died and were buried in the Royal Tomb (Neferneferure, Setepenre, and Maketaton). Shortly afterwards, the queen mother Tjye also died. However, her mummy shows no clear evidence of any infectious disease. In the time of Amenhotep III or Akhenaton, the village of the necropolis workmen in Deir el-Medina (Thebes-West) was destroyed by a fire. This may have been by accident or, in view of an epidemic, an attempt to purge the village from a disease (Norrie, 2016).

After the death of Tutankhamun (ca. 1323 BCE), a military conflict between Egypt and the Hittite Empire led to an equally unclear epidemic among the Egyptian army, which spread to the Hittites. The Hittite king Šuppiluliuma I (who ruled ca. 1350–1322 BCE) and his successor Arnuwanda II (who ruled ca. 1322–1321 BCE) both died of this disease. As a result, the war against Egypt collapsed. The plague apparently disappeared under the next ruler Muršili II (who ruled ca. 1321–1290 BCE). The story of the plague is handed down in literature in the Hittite plague prayers (KUB XIV 10 and KUB XXVI 86) (Kimball et al., 2020): translation “And the land of Hatti has been sorely, greatly oppressed by the plague. Under my father (and) under my brother there was constant dying . . .” (Kimball et al., 2020). However, an exact identification of the disease is not possible as the descriptions are too vague to identify any one particular disease: hi-in-ga-na-az – noun; ablative singular of < hinkan > plague – by the plague (Puhvel, 1991; Kimball et al., 2020).

The question of the presence of poliomyelitis (poliovirus) has also not been clarified, since the often-consulted mummy of King Siptah (who ruled ca. 1196–1190 BCE) shows a shortened leg, but without an established aetiology (Harris and Weeks, 1973; Harris and Wente, 1980; Galassi et al., 2016).

Also, the question of smallpox (*Variola major/Variola minor*) in ancient Egypt remains unresolved. In the early 1980s, during the World Health Organization eradication campaign, the mummy of Ramses V (who ruled ca. 1150–1145 BCE) was postulated to be the first known victim of the epidemic (Hopkins, 1980). To this day, however, smallpox has not been identified at a molecular level in Ramses V, although the pustules on multiple areas of his body (face and lower abdomen in particular) might be considered indicative of a smallpox-like disease (Habicht et al., 2019). Thus, the relation to the now eradicated strains of smallpox of the modern age is quite uncertain (Duggan et al., 2016).

Schistosomiasis (aka bilharzia, caused by *Schistosoma* sp) was discovered in Egyptian mummies more than 100 years ago, as the parasites could be identified microscopically (Ruffer and Moodie, 1921). As the description and the determinative signs of the ‘aAa-disease’ (aAa is described as poison) in the famous Ebers Papyrus may be matched with schistosomiasis, this identification also seems likely but not certain (Stuhr, 2008). The recipe for the prescribed cure for aAa-disease includes honey (antibacterial) and the Sams-plant, which is perhaps *Anacyclus pyrethrum* (pellitory, Spanish chamomile, a medicinal herb used in Ayurvedic medicine, where it is known for its blood cleansing properties).

To summarize, the philological source texts are generally not specific enough to identify particular diseases or epidemics of Ancient Egypt with enough certainty. On the other hand, there are established medical diagnoses for preserved mummies that point to infectious diseases, despite some pathogens, e.g., viruses, often not leaving disease-specific marks on the preserved human tissues. In fact, the philological, Egyptological, and paleopathological sides rarely come together, especially due to the lack of evidence-based medical diagnoses for mummies matching Egyptologically documented events with sufficient accuracy. A study from the Ottoman period suggests that at least two centuries ago, the plague reoccurred frequently, culminating in a massive outbreak in 1791 CE (Mikhail, 2008). We can assume that certain epidemics reoccurred frequently, but were only mentioned in sources if the outbreak was massive.

As shown, a closer look at the existing scientific evidence for epidemic incidents in ancient Egypt may put many previously published statements and opinions into perspective. Nevertheless, a systematic recording of paleo-epidemiological data from ancient populations over a long time promises a better understanding of possible factors underlying host–pathogen co-evolution, either leading to a mostly controlled coexistence, as in the case of

tuberculosis, or to periodic outbreaks and even pandemic disasters, as in the case of smallpox or the bubonic plague.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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