Chapter 13
Human lice: Pediculus and Pthirus

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Abstract Lice have probably been associated with humans since the times of our pre-hominid ancestors, and were dispersed throughout the world by early human migrants. It has been suggested that the head louse is the ancestor of the human louse, and that the body louse developed later when hominids started to wear clothing. Lice are mentioned in the Bible as the third plague. From Sumerian, Akkadian, and Egyptian sources it is also evident that the ancient inhabitants of the Middle East were well acquainted with head lice. Head lice and eggs have been found on the hair of Egyptian mummies. Nine-thousand-year-old louse eggs were found in hair samples from an individual who lived in a cave near the Dead Sea in Israel, while large numbers of lice were recovered from a 3,800-year-old female mummy from the Loulan period. Louse combs from Pharonic times in Egypt were used for delousing. Head lice and their eggs have also been found in combs recovered from archaeological excavations in the Judean and Negev deserts of Israel, including from Masada and Qumran. Body lice eggs have been found in pre-historic textiles from Austria; this louse was also recovered from deposits of farmers in Viking Greenland. The remains of a body louse were also found in one of the rooms at the Masada fortress dating from the Roman period. The oldest known pubic lice are from the Roman period in Britain and from post-medieval deposits in Iceland.

13.1 Human Lice

The human louse, *Pediculus humanus*, is probably one of the oldest ectoparasites of man (Zinsser 1935). Humans are parasitised by two sub-species: the head louse *Pediculus humanus capitis*, and the body louse *Pediculus humanus humanus*. A close relative of this species, *Pediculus mjobergi*, is a parasite of South American monkeys of the family Cebidae (Retanda Salazar 1994)

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Lice have probably been associated with humans since the time of our prehominid ancestors, and were dispersed throughout the world by early human migrants (Marsh 1964). It has been suggested that the head louse is the ancestor of the human louse, and that the body louse developed later when hominids started to wear clothing (Maunder 1983).

Reed et al. (2004) proposed an evolutionary history of *P. humanus* based on morphological and genetic analyses, and confirmed that *P. humanus* has two lineages – one comprising the head and body forms with worldwide distribution, and the other consisting of the head louse restricted only to the New World. They came to the conclusion that *P. humanus* originated long before its human host.

Humans went through a population bottleneck around 100,000 years ago, followed by expansion. Population genetics studies of human lice revealed that only the worldwide lineage passed through this bottleneck and subsequent expansion. The New World lineage has not only maintained a relatively stable population size but has followed an evolutionary path distinct from that of the worldwide lineage for the past 1.2 million years. It has also been suggested that these two ancient louse lineages could have embarked on these different evolutionary pathways on a single host. More likely, the New World louse evolved on an archaic form of human before casting its lot with a modern version. While the split between *Homo sapiens* and *Homo neanderthalensis* was too recent (about 700,000 years ago) to support a concurrent split between the worldwide and New World lice lineages, the split between *H. sapiens* and *H. erectus* (about 1.8 million years ago) could have. Reed and colleagues (2004) proposed a scenario in which *H. sapiens* and *H. erectus* carried distinct types of lice owing to approximately 1 million years of separation. As the first waves of modern humans left Africa about 100,000 years ago and modern humans replaced archaic forms, the two forms engaged in enough contact for archaic lice to make the switch to modern human hosts.

Lice are mentioned in the Bible as the third plague visited on the Egyptians when the Pharaoh denied the request of Moses to let the Israelites go. From Sumerian, Akkadian, Egyptian, and Biblical sources it is evident that the ancient inhabitants of the Middle East were well acquainted with head lice (Bodenheimer 1947/1948; Driver 1974; Aufderheide and Rodriguez-Martin 1998). In the sixteenth century B.C., an Egyptian text, known as the Papyrus Ebers, described a remedy for lice prepared from date flour.

In the Near East, head lice and eggs have been found on the hair of Egyptian mummies (Ruffer 1921; Hoeppli 1956; Fletcher 1994). Nine-thousand-year-old louse eggs were found on hair samples from an individual who lived in Nahal Hemar Cave near the Dead Sea in Israel (Mumcuoglu and Zias 1991).

In Asia, large numbers of lice were recovered from a 3,800-year-old female mummy from the Loulan period (Wen et al. 1987).

In Europe, ancient head lice are known from the Roman period onwards (Hall and Kenward 1990; Schelvis 1994; Kenward and Hall 1995; Allison et al. 1999), and there are also records from Iceland (Amorosi et al. 1992; Buckland et al. 1992) and Greenland (Buckland et al. 1983; Bresciani et al. 1983; Hansen and Gullov 1989; Sadler 1990).

In North America, head lice and their eggs have been found on mummified remains of prehistoric Indians from the American Southwest (Ewing 1924; Graham 1965; Horne 1979; Cockburn and Cockburn 1980; Cockburn 1983). Lice have been found in hunter-gatherer and agricultural sites in the Unites States (the Great Basin of Utah and surrounding states, and the Colorado Plateau) and in central Mexico (El-Najjar 1998). The prehistoric peoples in these areas appeared to control the lice by eating lice groomed from hair (a common method of louse control among tribal cultures, even today) as adult lice have been found deep in the matrix of coprolites (Fry 1977; Reinhard et al. 1986; Reinhard and Largent 1989; Reinhard 1990).

In South America, lice were found on the mummy of an Inca prince, who lived approximately 500 years ago (Horne and Kawasaki 1984) as well as on mummified pre-Columbian Indians from Peru (Fletcher 1994; Reinhard and Buikstra 2003). Head louse eggs were recovered from human hair found in Brazil and were carbon dated to approximately 10,000 years old (Araujo et al. 2000). Hair samples from seven mummies from Camarones, Chile, carbon-dated to ca. 1900–1500 B.C., were examined and head lice eggs were found in six of them (M.A. Rivera, K.Y. Mumcuoglu, R.T. Matheny and D.G. Matheny, manuscript submitted) (Fig. 13.1).

The oldest combs similar to today's louse combs date from 1500 B.C. (Zias and Mumcuoglu 1989). Royal combs from Pharonic times in Egypt were used for delousing (Kamal 1967). Head lice were recovered from the debris found between the fine teeth of a wooden comb excavated in Antionoe, Egypt and dated between the fifth and sixth centuries A.D. (Palma 1991).

Fig. 13.1 Operculated egg found on the scalp of a mummy from the Chinchorro Tradition, Camarones, Northern Chile

Head lice and their eggs have also been found in combs recovered from archaeological excavations in the Judean and Negev deserts of Israel, including from Masada and Qumran (Fig. 13.2). Most of the combs were two-sided (Fig. 13.3), while some were also single-sided (Fig. 13.4). One side of the comb was used to open the knots while the second side with the fine teeth was used to remove lice and eggs. Most combs found in archaeological excavations were made out of wood; some were made from bones and ivory, yet all bear a resemblance to modern day combs. Lice were found in 12 out of 24 combs examined from the Judean and Negev Deserts. In a comb from Wadi Farah, 4 lice and 88 eggs were found; 2 of them were operculated, showing that at this stage the eggs were viable with an embryo inside. In one comb from Qumran, 12 lice and 27 eggs were found, 10 of them operculated (Mumcuoglu and Zias 1988).

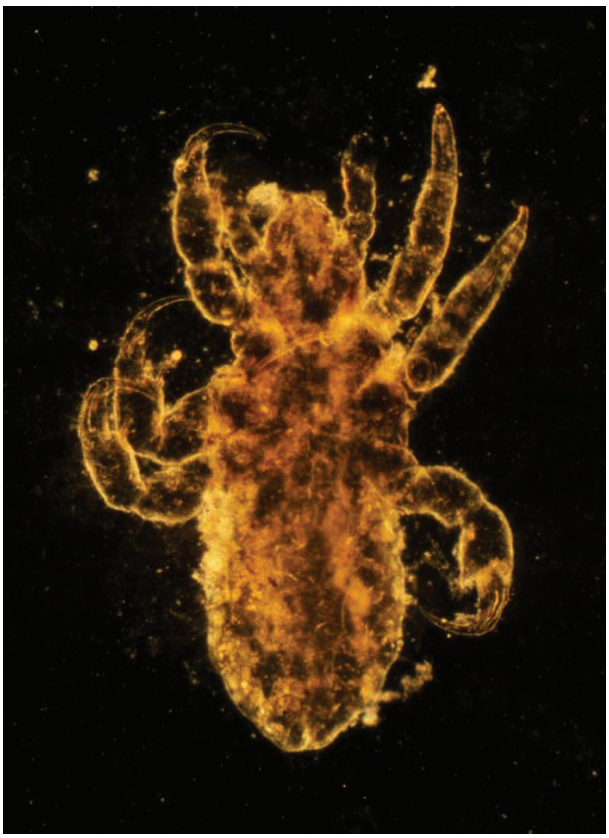

Fig. 13.2 Second nymphal stage of a head louse from a comb from Qumran, Israel (68 A.D.)

Fig. 13.3 Two-sided wooden comb from the Judean desert, Israel (135 A.D.)

Fig. 13.4 Single-sided wooden comb from the Jordan Valley in Israel (eighth century A.D.)

Body lice eggs were found in a pre-historic textile from Hallstaetter Salzberg in Austria (Hundt 1960). This louse was also recovered from deposits of farmers in Viking Greenland and dated to 986–1350 A.D. (Sadler 1990).

The remains of a body louse were also found in one of the rooms at the Masada fortress known as the "Casemate of the Scrolls". Originally constructed during the last decade of King Herod's reign, the Casemate Room was converted into a dwelling unit during the first Jewish revolt against the Romans. Following the conquest of Masada, the room was used by Roman soldiers as a dumping area. The context and nature of the textiles associated with the louse clearly suggest a rebel origin (Mumcuoglu et al. 2003).

The oldest pubic lice (*Pthirus pubis*) found in archaeological deposits are from the Roman period (mid-first or second centuries A.D.) in Britain (Buckland et al. 1992). Pubic lice have also been found in post-medieval deposits in Iceland and from samples collected from archaeological remains from eighteenth century London (Girling 1984; Kenward 1999, 2001). There are early Chinese, Greek and Roman sources, which have been interpreted as referring to pubic lice (Busvine 1976; Hoeppli and Chi'ang 1940), including the treatment of infestation of eyelashes, which, although rare, also occurs in present times (Burns 1987).

Thirty-seven mummies from San Pedro de Atacama, dated up to 2,000 years old, were examined for parasites. Pubic hair was present in four mummies, and eggs were found attached to the pubic hair in one adult male mummy. Specimens of this parasite were also found on the pubic hair of a mummy from Chiribaya Bajan (Peru), which was dated to 1050–800 B.C., and in the pleats of a piece of cloth associated with a female mummy (Rick et al. 2002).

References

Allison EP, Kenward HK, Tomlinson PR (1990) Environmental analysis of samples from Area 86.53H, Peel Castle, Isle of Man. Environmental Archeology Unit Report 90/7, York

Amorosi T, Buckland PC, Olafsson G, Sadler JP Skidmore P (1992) Site status and the palaeoecological record: a discussion of the results from Bessastadir, Iceland. In: Morris CD, Rackham JD (eds) Norse and later settlement and subsistence in the North Atlantic. Department of Archaeology, University of Glasgow, pp 169–192

Araujo A, Ferreira LF, Guidon N, Maues de Serra Freire N, Reinhard KJ, Dittmar K (2000) Ten thousand years of head lice infection. Parasitol Today 16:269

Aufderheide A, Rodriguez-Martin C (1998) Cambridge encyclopedia of human paleopathology. Cambridge University Press, Cambridge

Bodenheimer FS (1947/1948) A survey on the ancient Sumerians and Assyrians. Arch Int Hist Sci 1:261–269

Bresciani J, Haarlov N, Nansen P, Moller G (1983) Head louse *Pediculus humanus capitis* from mummified corpses of Greenlanders about A.D. 1460. Act Entomol Fenn 42:24–27

Buckland PC, Sveinbjarnardottir G, Savory D, McGovern TH, Skidmore P, Andreasen C (1983) Norseman at Nipaitsoq, Greenland: a palaeoecological investigation. Norw Archeol Rev 16:86–98

Buckland PC, Sadler JP, Sveinbjarnardottir G (1992) Palaeoecological Investigations at Reykholt, Western Iceland. In: Morris CD, Rackham DJ (eds) Norse and Later Settlement and

Subsistence in the North Atlantic. Department of Archaeology, University of Glasgow, pp 149–168
Burns DA (1987) The treatment of *Phthirus pubis* infestation of the eyelashes. Br J Dermatol 117:741–743
Busvine JR (1976) Insects, hygiene and history. Althone, London
Cockburn A (1983) Mummies, disease and ancient cultures, abridged edn. Cambridge University Press, Cambridge
Cockburn A, Cockburn E (1980) Mummies, disease and ancient culture, 1st edn. Cambridge University Press, Cambridge
Driver GC (1974) Lice in the Old Testament. Palest Explor Q 106:159–160
El-Najjar MY (1998) Mummies and mummification practices in the southwestern and southeastern United States. In: Cockburn A, Cockburn E, Reyman T (eds) Mummies, disease, and ancient cultures, 2nd edn. Cambridge University Press, Cambridge, pp 121–137
Ewing HE (1924) Lice from human mummies. Science 60:389–390
Fletcher I (1994) A tale of hair, wigs and lice. Egypt Archaeol 5:31–33
Fry GF (1977) Analysis of prehistoric coprolites from Utah. University of Utah Anthropological Papers 9
Girling MA (1984) Eighteenth century records of human lice (Phthiraptera, Anoplura) and fleas (Siphonaptera, Pulicidae) in the City of London. Entomol Mon Mag 120:207–210
Graham SA (1965) Entomology: an aid in archaeological studies. Am Antiq Mem 19:167–174
Hall AR, Kenward HK (1990) Environmental evidence from the Colonia: General Accident and Rougier Street. In: Addyman PV (ed) The Archaeology of York. CBA, London, pp 289–434
Hansen JPH, Gullov HC (1989) The mummies from Qilakilsoq – paleopathological aspects. Meddr Grønland Man Soc 12:69–82
Hoeppli R, Ch'iang IH (1940) The louse, crab louse and bed-bug in old Chinese medical literature, with special consideration on phthiriasis. Chin Med J 58:338–362
Horne P (1979) Head lice from an Aleutian mummy. Paleopathol News 25:7–8
Horne PD, Kawasaki SQ (1984) The prince of El Plomo. A paleopathological study. Bull N Y Acad Med 60:925–931
Hoeppli R (1956) The knowledge of parasites and parasite infections from ancient times to the 17th century. Exp Parasitol 5:398–412
Hundt HJ (1960) Vorgeschichtliche Gewebe aus dem Hallstaetter Salzberg. Jahrb Roemisch-Germanischen Zentralmuseums Mainz 7:126–141
Kamal H (1967) A dictionary of Pharonic medicine. National Publication House, Cairo
Kenward H (1999) Pubic lice (*Pthirus pubis* L.) were present in Roman and Medieval Britain. Antiquity 73:911–915
Kenward H (2001) Pubic lice in Roman and medieval Britain. Trends Parasitol 17:167–168
Kenward HK, Hall AR (1995) Biological evidence from Anglo-Scandinavian deposits at 16–22 Coppergate. In: In: Addyman PV (ed) The Archaeology of York. CBA, London, pp 435–797
Marsh DC (1964) Pre-Columbian insects from Tamaulipas, Mexico. Phytoprotection 45:134
Maunder JW (1983) The appreciation of lice. Proc R Inst G B 5:1–31
Mumcuoglu KY, Zias J (1988) Head lice, *Pediculus humanus capitis* (Anoplura: Pediculidae) from hair combs excavated in Israel and dated from the first century B.C. to the eighth century A.D. J Med Entomol 25:545–547
Mumcuoglu KY, Zias J (1991) Pre-pottery neolithic B head lice found in Nahal Hemar Cave and dated 6,900–6,300 B.C.E. (uncalibrated). Atikot 20:167–168
Mumcuoglu KY, Zias J, Tarshis M, Lavi M, Stiebel GD (2003) Body louse remains in textiles excavated at Massada, Israel. J Med Entomol 40:585–587
Palma RL (1991) Ancient head lice on a wooden comb from Antinoe, Egypt. J Egypt Archaeol 77:194
Reed DL, Smith VS, Hammond SL, Rogers AR, Clayton DH (2004) Genetic analysis of lice supports direct contact between modern and archaic humans. PLoS Biol 2:e340, DOI: 10.1371/journal.pbio.0020340

Reinhard K (1990) Archaeoparasitology in North America. Am J Phys Anthropol 82:145–163
Reinhard KJ, Buikstra J (2003) Louse infestation of the Chiribaya culture, southern Peru: variation in prevalence by age and sex. Mem Inst Oswaldo Cruz 98:173–179
Reinhard KJ, Largent FB (1989) Diet and environment determined from analysis of prehistoric coprolites from an archaeological site near Zape Chico, Durango, Mexico. J Paleopathol 1:151–156
Reinhard K, Confalonieri U, Herrmann B, Ferreira LF, Araujo A (1986) Recovery of parasite remains from coprolites and latrines: aspects of paleoparasitological technique. Homo 37:217–239
Retanda Salazar AP (1994) Filogenia de los piojos (Insecta: Anoplura) de los monos del Viejo Mundo (Catarrhini). Rev Biol Trop 42:633–638
Rick FM, Rocha GC, Dittmar K, Coimbra CEA, Reinhard K, Bouchet F, Ferreira LF, Araujo A (2002) Crab louse infestation in Pre-Columbian America. J Parasitol 88:1266–1267
Ruffer MA (1921) Studies in the paleopathology of Egypt. University of Chicago Press, Chicago, IL
Sadler JP (1990) Records of ectoparasites on humans and sheep from Viking-Age deposits in the former western settlement of Greenland. J Med Entomol 27:628–631
Schelvis J (1994) Caught between the teeth. A review of Dutch finds of archeological remains of ectoparasites in combs. Proceedings of the Section Experimental and Applied Entomology of the Netherlands Entomological Society 5:131–132
Wen T, Zhaoyong X, Zhijie G, Yehua X, Jianghua S, Zhiyi G (1987) Observation on the ancient lice from Loulan. Investigatio et Studium Naturae (Museum Historiae Naturae, Shanghaiense) 7:152–155
Zias J, Mumcuoglu KY (1989) How the ancients de-loused themselves. Bibl Archaeol Rev 15:66–69
Zinsser H (1935) Rats, lice and history. Little Brown, Boston