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ABBREVIATIONS

- AASOR Annual of the American Schools of Oriental Research
ADAJ Annual of the Department of Antiquities of Jordan
AJA American Journal of Archaeology
AfO Archiv für Orientforschung
ANET Ancient Near Eastern Texts Relating to the Old Testament³, ed. J.B. Pritchard, Princeton, 1969
BA The Biblical Archaeologist
BASOR Bulletin of the American Schools of Oriental Research
BT Babylonian Talmud
CAD Chicago Assyrian Dictionary
CIS Corpus Inscriptionum Semiticarum
DJD Discoveries in the Judaean Desert
DSD Dead Sea Discoveries
EI Eretz-Israel: Archaeological, Historical and Geographical Studies
ESI Excavations and Surveys in Israel
IAA Reports Israel Antiquities Authority Reports
IEJ Israel Exploration Journal
JAOS Journal of the American Oriental Society
JBL Journal of Biblical Literature
JCS Journal of Cuneiform Studies
JEA Journal of Egyptian Archaeology
JNES Journal of Near Eastern Studies
KAI W. Donner and W. Röllig: *Kanaanäische und aramäische Inschriften* 1–3, Wiesbaden, 1962–1964; 1^s, 2002
NEAEHL The New Encyclopedia of Archaeological Excavations in the Holy Land (English Edition), Jerusalem, 1993
PEQ Palestine Exploration Quarterly
PT Palestinian Talmud
QDAP Quarterly of the Department of Antiquities in Palestine
RA Revue d'Assyriologie et d'Archéologie Orientale
RB Revue Biblique
RE Pauly-Wissowa's Realencyclopädie der classischen Altertumswissenschaft
RQ Revue de Qumran
VT Vetus Testamentum
ZA Zeitschrift für Assyriologie
ZDPV Zeitschrift des Deutschen Palästina-Vereins

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Head Louse (*Pediculus humanus capitis*) Remains in a Louse Comb from the Roman Period Excavated in the Dead Sea Region*

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ABSTRACT: Two wooden louse combs, most probably from the Roman period, excavated in the ‘Cave of the Pool’, at the western end of the Naḥal David stream in the ‘En Gedi oasis near the Dead Sea, were examined for the presence of head louse remains. In one of the combs, the head and the apical part (tarsus, tibia and femur) of one of the legs of a head louse were found. On the basis of measurements and a comparison to today’s head lice, this louse was identified as belonging to the first nymphal stage.

INTRODUCTION

LICE have probably been associated with humans since our pre-hominid ancestors, and were dispersed throughout the world by early human migrants (Marsh 1964). Lice are mentioned in the Bible as the third plague visited upon the Egyptians when 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 1947–48; Driver 1974; Aufderheide and Rodriguez-Martin 1998). In the sixteenth century BCE, an Egyptian text known as the Papyrus Ebers described a remedy for lice prepared from date flour (Mumcuoglu 2008).

The oldest combs, which are similar to today’s louse combs, are known from 1500 BCE (Zias and Mumcuoglu 1989). Royal combs from Pharaonic 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 CE (Palma 1991). Head lice and eggs were also found on the hair of Egyptian mummies (Ruffer 1921: 372; Hoeppli 1956; Fletcher 1994).

* We are grateful to the Institute of Archaeology, the Hebrew University of Jerusalem, for allowing us to publish the finds of Avigad’s excavations in the Naḥal David caves, ‘En Gedi. Thanks are also extended to N. Liphshitz for identifying the wood from which the combs were made.

In Israel, *c.* 9,000-year-old head louse eggs were found in hair samples from an individual who lived in Naḥal Ḥemar Cave near the Dead Sea (Mumcuoglu and Zias 1991). Head lice and their eggs were also found in combs recovered from archaeological excavations in the Judaeen and Negev Deserts, including from Masada and Qumran (Mumcuoglu and Zias 1988; Mumcuoglu 2006; 2008).

In the course of excavations of the 'Cave of the Pool', during 1960–1961, several combs were found and were examined for the presence of head louse remains.

MATERIALS AND METHODS

The Cave

The 'Cave of the Pool' is located near the Dead Sea, at the western end of Naḥal David, *c.* 150 m. above the river bed. The entrance to this natural cave (*c.* 33 m. long; 3–7 m. wide) faces east and is hidden from sight. The floor of the cave is covered by rocks that fell from its ceiling and by layers of animal droppings. These findings are similar to other caves examined in the Judaeen Desert, which were used for refuge in various periods. The 'Cave of the Pool' was named after the plastered pool of *c.* 12 m.³ that was built near the cave's entrance and was filled by rainwater via a plastered gutter.

During excavations, a few flints from the Pre-Pottery Neolithic period, as well as sherds, flint stones, bone implements and fragments of mats and nets from the Chalcolithic period, were found. The cave was reused during the Iron Age (*c.* seventh century BCE); objects dating from this period include pottery vessels, such as bowls, cooking pots, juglets, lamps and perforated clay balls (Sandel 1907: 82–83; Aharoni 1958: 40–45; Avigad 1961: 8–10; 1962: 169–181; Cohen 2005; 2009).

During the Early Roman period, the cave was inhabited from the first century BCE to the second century CE. Finds include sherds of storage jars and cooking pots, as well as lamp and glass fragments. A few bronze coins of Agrippa I, Tyre (127–128 CE) and Bar Kokhba, as well as one bronze arrowhead and three arrow shafts, were found. Organic finds include wooden combs, wooden spindles, remains of woven materials, wickerwork baskets and ropes, mammal and bird bones, as well as food remains, such as date palm and olive pits, carbonised dates, carobs, pomegranates, walnuts and almonds.

The Combs

Three wooden combs, made of boxwood (*Buxus sempervirens*), were uncovered in the cave in 1961 by Avigad (1962). The first (3×7 cm.) was one-sided, with 15 partially broken teeth (6 teeth per cm.) (fig. 1), while the second one (3.5×4.5 cm.) was two-sided, one side with 11 teeth (5.5 teeth per cm.), and the other with 21 teeth (8.75 teeth per cm.). The third comb was lost.



Fig. 1. Wooden comb excavated in the 'Cave of the Pool'

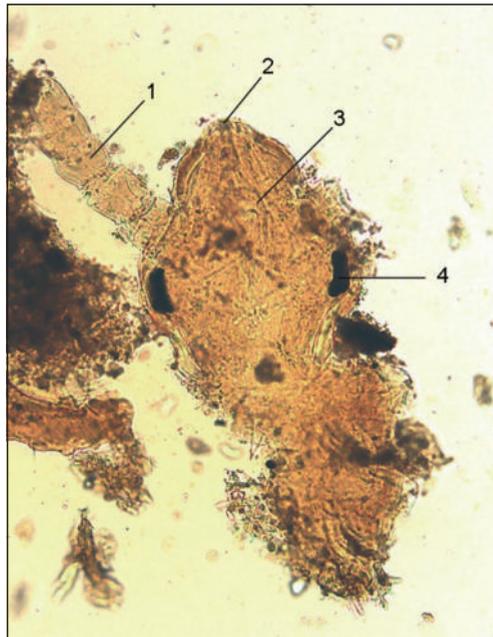
Examination of the Combs

The combs were introduced in 70% ethyl alcohol, and the organic and inorganic debris present between the teeth were removed with the help of a needle under a stereo microscope. The isolated material was examined under the stereo microscope ($\times 40$), and suspected louse and eggs remains were embedded in Hoyer's medium to prepare permanent slides. The slides were later examined under a light microscope ($\times 100$ – $\times 400$).

RESULTS

From the material examined from the first comb, the head (fig. 2) and the apical part (tarsus, tibia and part of the femur) of one of the legs (fig. 3) of a head louse were found. On the basis of measurements and comparison to today's head lice, this louse was identified as belonging to the first nymphal stage. No lice/eggs or their remains could be found in the second comb.

Fig. 2. Head of first instar nymph of *Pediculus humanus capitis*, found in wooden comb from the 'Cave of the Pool'; visible details include antenna (1), haustellum with teeth (2), stylets (3) and eyes (4)



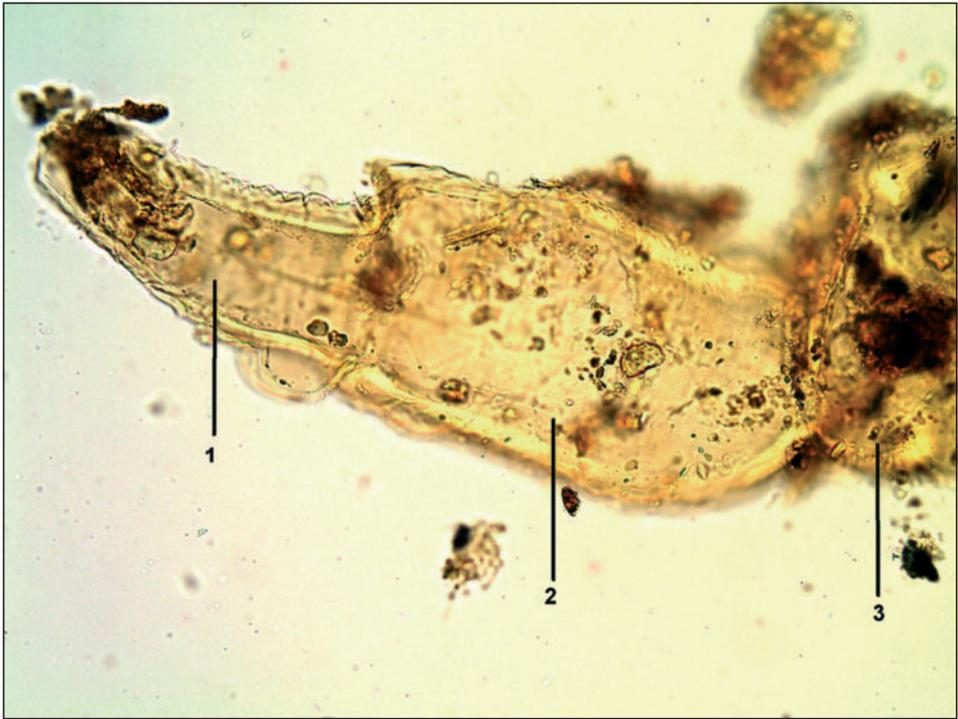


Fig. 3. Apical part of leg of first instar nymph of *Pediculus humanus capitis*, found in wooden comb from the 'Cave of the Pool': tarsus (1), tibia (2) and femur (3)

DISCUSSION

In ancient times, several physical and chemical methods were used to control head lice. These included the physical removal of lice with the fingernails, as well as shaving the head and body hair to prevent infestation (Mumcuoglu 1996). Celsus (30 CE) proposed sandarac (a gum obtained from an African tree), soda scum and bryony (a climbing plant in the Yam family) with oil and vinegar for lice control. Pliny (23–79 CE) recommended that viper broth be applied to all parts of the body. Galen (121–201 CE) used herbal remedies such as staves, acre seeds and *Delphinium* sp., which contain alkaloids and have some insecticidal action. Avicenna (980–1037 CE) treated patients with a combination of quicksilver and oil of roses. Other remedies for lice have included carbolic acid solutions, cresol powder, naphthalene, sulfur, mercury powder and kerosene (Mumcuoglu 1996).

Head louse combs, similar to today's fine-toothed combs for louse control, have been known for over 3,500 years (Zias and Mumcuoglu 1989). Combs from the Early and Middle Bronze Ages have been found in the Dead Sea region (Adovasio and Andrews 1965). In the Cave of Horror (Naḥal Hever), many combs from the Bar Kokhba period were excavated (Aharoni 1962).

Head lice and their eggs were also found in combs recovered from archaeological excavations in the Judaeian and Negev Deserts, including from Masada and Qumran (Mumcuoglu and Zias 1988; Mumcuoglu 2008). Most of the combs were two-sided, while a few were single-sided. One side was used to open knots in the hair, while the other was used to remove lice and eggs. Most combs uncovered in archaeological excavations were made of wood; some were made of bone or ivory and are quite similar to modern-day combs. Lice were found in 12 out of 24 combs examined from the Judaeian and Negev Deserts. In the comb from Wadi el-Far^{ah}, four lice and 88 eggs were found; two 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, ten of them operculated. In a recent study, three head lice were found in one of six combs from an unidentified period from Naḥal Zeelim. Lice and eggs were also found in two of five combs from the Roman period excavated at ^{Ein} Raḥel, while from one comb from an unidentified period from ^{En} Gedi, no lice or eggs could be isolated (Mumcuoglu 2006).

The precise age of the comb on which the louse of the present study was found is not known, because the cave was never sealed. Two-sided combs have been found dating from as early as the Hellenistic period; one, found in the Agora of Athens, dates from the second quarter of the sixth century BCE (Thompson 1955: 272). Wooden combs of the first century CE have been found at Masada and ^{En} Gedi (Hadas 1994). The 'Roman' combs found at the Bar Kokhba sites from the second century CE are smaller than the square 'Greek' ones and have an oblong shape and shorter teeth; they are rarely decorated.

Based upon the remains found in the cave and a comparison to combs excavated at other archaeological sites with known dates, it may be concluded that the two combs examined here should be dated to the Roman period. They were most probably used by inhabitants of the village of ^{En} Gedi, who were preparing a place of refuge in the cave, which would have been well equipped with food in baskets, storage jars and a large water pool before the end of the Bar Kokhba Revolt in 135 CE.

In conclusion, the findings demonstrate once again that louse combs were used throughout history for the physical removal of lice and their eggs. In two-sided combs, the side with the lower density of teeth was used to disentangle the hair, while the opposite side, with a greater density of teeth, was used for delousing. It is assumed that the number of lice and eggs originally stacked between the teeth of the comb was higher, but was diminished by the circumstances of burial and excavation. Moreover, in most cases only fragments of the combs were preserved and partially cleaned during museum storage and other studies. The arid climate of the Dead Sea region allowed the organic material from which the combs were made and the debris surviving between the teeth to remain in an excellent stage of preservation.

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