

Polyplax brachyrrhyncha (Anoplura: Polyplacidae) and *Rhipicephalus turanicus* (Ixodidae: Rhipicephalinae) in an Ancient Louse Comb

Kosta Y. Mumcuoglu,^{1,4} Naama Sukenik,² and Guy Bar-Oz³

¹Parasitology Unit, Department of Microbiology and Molecular Genetics, The Kuvim Center for the Study of Infectious and Tropical Diseases, The Hebrew University-Hadassah Medical School, Jerusalem 91120, Israel, ²Israel Antiquities Authority, National Treasures Department, Jerusalem 91004, Israel, ³Laboratory of Archaeozoology, Zinman Institute of Archaeology, University of Haifa, Haifa 3498838, Israel, and ⁴Corresponding author, e-mail: kostasm@ekmd.huji.ac.il

Subject Editor: Michael Rust

Received 30 October 2019; Editorial decision 6 January 2020

Abstract

A fine-toothed comb found in the Judean Desert and resembling an ancient louse comb was examined. Based on radiocarbon dating, it ranged between 1660 AD and 1950 AD. From the material accumulated between the teeth, an oribatid mite, a pseudoscorpion, exuviae of beetle larvae, a sucking louse (*Polyplax brachyrrhyncha* Cummings, 1915), as well as a fully engorged larva and a nymph of the ixodid tick *Rhipicephalus turanicus* Pomerantzev, 1936 were recorded. Additionally, the comb included numerous hairs of a spiny mouse (*Acomys* sp.). Although finding mites, beetle larvae, and a pseudoscorpion on a louse comb could be regarded as contamination, the findings of *P. brachyrrhyncha*, as well as of a larva and nymph of *R. turanicus*, are noteworthy. We hypothesize that the presence of animal lice and ticks could indicate some sort of pet grooming.

Key words: *Polyplax brachyrrhyncha*, *Rhipicephalus turanicus*, *Acomys* sp., louse comb

The oldest louse combs known are from 1500 BC (Zias and Mumcuoglu 1989). Combs for delousing purposes are known from ancient Egypt (Kamal 1967, Palma 1991). In Israel, louse combs recovered from archaeological excavations in the Judean and Negev Deserts, including Masada and Qumran were examined for the presence of lice. In the two-sided combs, one side with the larger distance between the teeth was apparently used to open hair knots, while the other side with more dense teeth was used to remove lice and louse eggs. Most archaeological louse combs were made of wood, while some were made from bones or ivory. Lice were found in 12 out of 24 combs examined from these areas. In one comb from Wadi Farah, 4 lice and 88 eggs were collected, while in another one from Qumran 12 lice and 27 eggs were found (Mumcuoglu and Zias 1988, Mumcuoglu 2008). In subsequent studies, head lice were found in one of six combs from an unidentified period from Nahal Zeelim, while lice and eggs were found in two out of five combs from the Roman period excavated in Ein Rachel (Mumcuoglu 2006). Lice were also found in a wooden louse comb, most probably from the Roman period, excavated close to Ein Gedi Oasis, near the Dead Sea (Mumcuoglu and Hadas 2011). A louse egg was collected from a wooden louse comb dated from the First Century BC to the First Century AD, excavated in Wadi Kedron near the Dead Sea (Mumcuoglu and Gunneweg 2012).

Recently, a louse comb was intercepted by the Robbery Prevention Unit of the Israel Antiquities Authority, which was found by antiquity robbers probably in one of the caves in the Judean Desert. Assuming that the fine-toothed comb was an ancient one and was used for delousing purposes, the aim of this study was to examine it for the presence of head lice and eggs.

Materials and Methods

Comb

The comb was made of one piece of wood with a plain, rounded shape without decoration and with only one set of teeth resembling to some ancient louse combs, for example, from Jericho dated to the Middle Bronze age (Kenyon 1960) and from Wadi Murabba'at dated also to the Middle Bronze age (Benoit et al. 1961). The comb did not have a separate handle, but it was made ergonomically, for easy use and holding (Fig. 1). Though incomplete in length but most of the teeth (35) were preserved and measure 15–20 mm in length, they were spaced with a gap of 0.3–0.4 mm, i.e., 8 teeth per cm. In its present form, the comb measured 45 mm in height and 48 mm in width. The thickness at the teeth's lower edge was 2 mm and 7 mm in the area of the handle.



Fig. 1. Fine-toothed louse comb made of *Ziziphus* wood and carbon-dated to 1660–1950 AD.

The wood was identified by the PaleoResearch Institute as *Ziziphus*, a shrub from the buckthorn family Rhamnaceae (Supp Appendix 1 [online only]). These shrubs grow in tropical and subtropical areas. *Ziziphus spina christi* (Rhamnaceae: Rosales) trees occur naturally in the oases in the Negev Desert, the Jordan Valley, and Dead Sea area (Zohary 1972). The wood is heavy and durable, and serves for artistic woodwork (Saied et al. 2008).

Radiocarbon Analysis

Based on radiocarbon dating (made by the PaleoResearch Institute) the comb provides a calibrated date (sigma 2) in the range 1660 AD to 1950 AD (Supp Appendix 1 [online only]).

Examination of the Comb for Arthropods and Hair

The material between the teeth of the comb was removed with a needle and a regular toothbrush. The separated material was examined under a stereo microscope and arthropods were slide-mounted in Hoyer's medium prior to examination by light microscopy. An image of a single louse, extracted from the material was sent to Dr. Lance Durden (Georgia Southern University, Statesboro, GA) for identification, while the publication of Feldman-Muhsam (1952) was used for the identification of the ticks.

The matrix removed between the teeth of the comb was further examined under a Zeiss (Discovery V8) microscope to search for mammalian hair. Taxonomic identification followed Teerink (1991).

Results

An oribatid mite, a pseudoscorpion, exuviae of beetle larvae, a sucking louse (*Polyplax brachyrrhyncha* Cummings, 1915) (Fig. 2), as well as a fully engorged larva (Fig. 3) and a nymph (Fig. 4) of the hard tick *Rhipicephalus turanicus* Pomerantzev, 1936, were collected. The chelicerae and hypostome of the larval tick were missing.

Additionally, the ancient comb includes numerous hairs that could be reliably identified to a spiny mouse (*Acomys* sp. [Rodentia: Muridae]) that have exceptionally spiny enlarged awl hairs. These hairs have concave morphology and are greatly enlarged in the shape of a spine (Fig. 5). Other hairs included are long guard hairs and zigzag hairs that are shorter than guard hairs and characterized by multiple bends (Fig. 6). It appears that these hairs also derive from a spiny mouse. Such a combination of hair types is typical of the spiny mouse lower back.

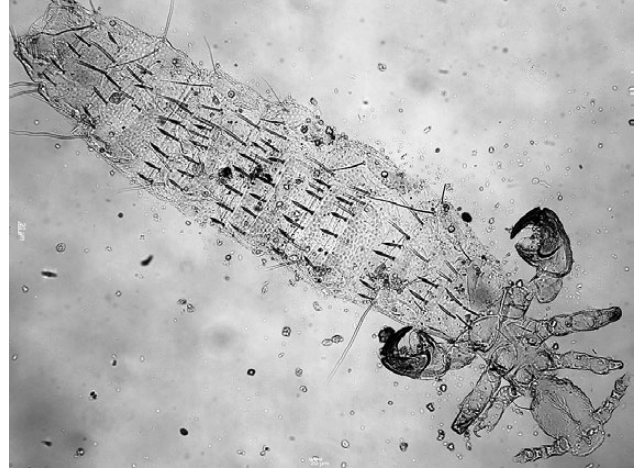


Fig. 2. Female of the sucking louse *Polyplax brachyrrhyncha* removed from the louse comb.

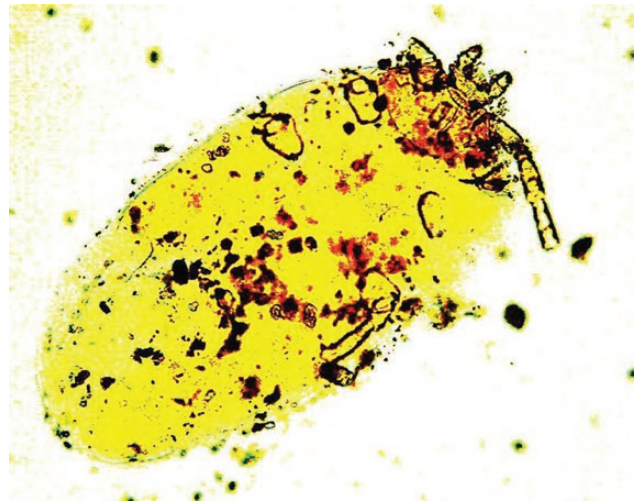


Fig. 3. Engorged larva of *Rhipicephalus turanicus*.

Discussion

Polyplax brachyrrhyncha Cummings, 1915 has a Palearctic distribution, and is known from Egypt, Benin, Ethiopia, Libya, Kenya, Togo, Uganda, Saudi Arabia, Iran, Pakistan, and Greece (Durden et al. 1990, Durden 1991, Durden and Musser 1994, Haitlinger 2005). In Israel, *P. brachyrrhyncha* has been found on the Cairo spiny mouse, *Acomys cahirinus* Geoffrey, 1803, and golden spiny mouse, *Acomys russatus* Wagner, 1840 (Theodor and Costa 1967).

The main host of *P. brachyrrhyncha* is *A. cahirinus* but this louse has also been recorded from *A. russatus*, Percival's spiny mouse (*Acomys percivali* Dollman, 1911), grey spiny mouse (*Acomys cineraceus* Heuglin, 1877), Wilson's spiny mouse (*Acomys wilsoni* Thomas, 1892), and Crete spiny mouse (*Acomys minous* Bate, 1906) (Durden and Musser 1994, Haitlinger 2005).

In Israel, the common spiny mouse, *A. cahirinus* is found in all rocky areas of the Jordan and Arava valleys, while the golden spiny mouse, *A. russatus* is found in rocky deserts south and east of the 100-mm isohyet (Mendelssohn and Yom-Tov 1987, Weissbrod et al. 2014).

In areas where food is abundant, e.g., agricultural areas and the vicinity of human settlements, *A. cahirinus* is much more prevalent than *A. russatus* (Shargal et al. 2000).

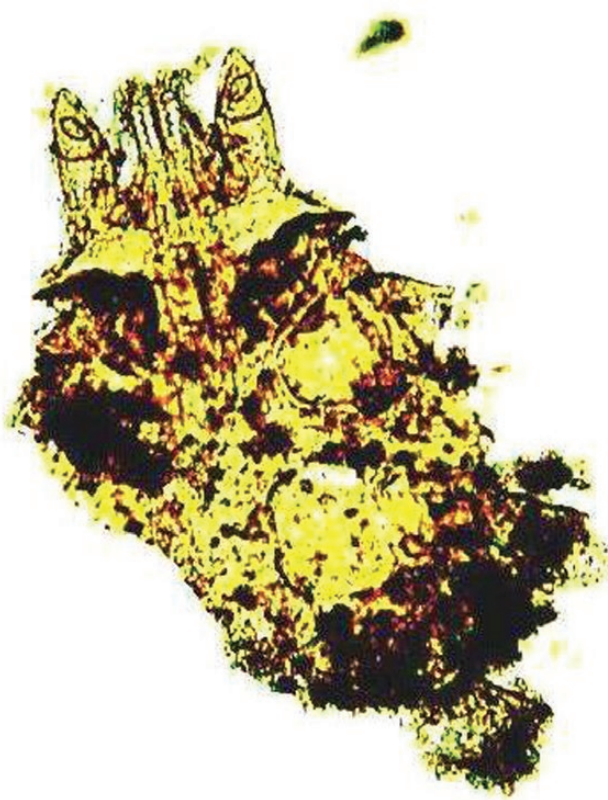


Fig. 4. Nymph of *Rhipicephalus turanicus*.

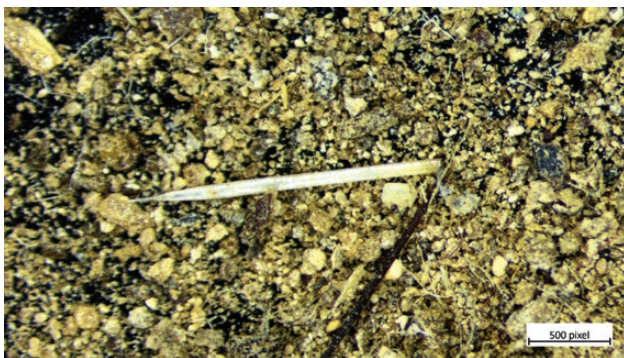


Fig. 5. A spiny mouse (*Acomys* sp.) hair removed from the comb.

Rhipicephalus turanicus has been recorded from a very large variety of animals and most geoclimatic areas of Israel. Dogs, cats, cattle, horses, and a variety of wild animals such as roe deer, red fox, boar, and rodents are hosts for the adult and immature stages of this tick (Feldman-Muhsam and Saturen 1961, Mumcuoglu et al. 1993). In Saudi Arabia, *R. turanicus* was found on *A. dimidiatus* (Al-Asgah 1990).

Although finding mites, beetle larvae, and a pseudoscorpion on a louse comb could be regarded as contamination, the findings of *P. brachyrrhyncha*, as well as of a larva and nymph of *R. turanicus*, are noteworthy. A survey in Google showed that there are several amulets and wallets which are made with the skin of rodents such as rats and mice, while combs are used in the fur industry to strain the hair and remove dirt particles. In addition, louse combs are used to remove fleas from pets. In the present study, it is not clear why the fur of an *Acomys* was combed with a dense-toothed comb. Keeping

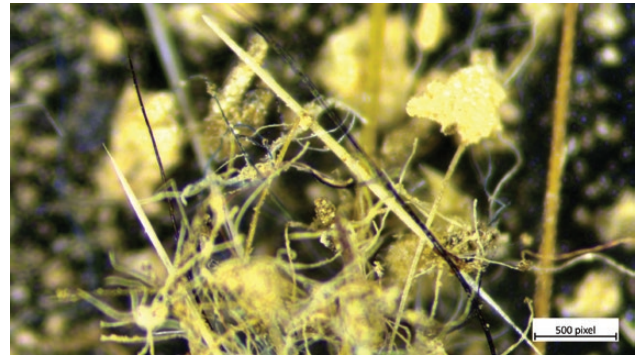


Fig. 6. Spiny mouse (*Acomys*) guard and zigzag hairs, typically found on the lower back of the animal.

spiny mice as pets and removing their ectoparasites with a densely toothed comb could be a far-fetched possibility. The missing chelicerae and hypostome of the tick larva could be the result of the inappropriate removal of the tick from the host skin, e.g., with a louse comb, suggesting that the remains presented here might represent some sort of pet combing. More solid evidence is needed, however, to support this explanation.

Acknowledgments

We thank the PaleoResearch Institute (Colden, CO) for the radiocarbon analysis of the comb, Dr. Lance Durden (Department of Biology, Georgia Southern University, Statesboro, GA) for the identification of *P. brachyrrhyncha*, and Clara Amit, who took the picture of the comb (courtesy of the Israel Antiquities Authority).

References Cited

- Al-Asgah, N. A. 1990. Seasonal dynamics of *Rhipicephalus turanicus* (Acari: Ixodidae) on sheep and goats in the Al-Sarawat Mountains of Makkah Province, Saudi Arabia. *Bull. Inst. Zool. Acad. Sinica*. 29: 113–119.
- Benoit, P., J. T. Milik, and O. P. de Vaux. 1961. Discoveries in the Judaeian Desert: volume II. Les Grottes de Murabba'at. Clarendon Press, Oxford, United Kingdom.
- Durden, L. A. 1991. New records of sucking lice (Insecta: Anoplura) from African mammals. *Afr. J. Zool.* 105: 331–342.
- Durden, L. A., and G. G. Musser. 1994. The sucking lice (Insecta, Anoplura) of the world: a taxonomic checklist with records of mammalian hosts and geographical distributions. *Bull. Am. Mus. Nat. Hist.* 218: 1–90.
- Durden, L. A., R. Traub, and K. C. Emerson. 1990. Sucking lice (*Anoplura*) from Pakistan mammals, with notes on zoogeography. *Entomol. News.* 101: 225–235.
- Feldman-Muhsam, B. 1952. On the identity of *Rhipicephalus sanguineus* Lat. *Bull. Res. Council. Israel.* 2: 187–193.
- Feldman-Muhsam, B., and I. M. Saturen. 1961. Notes on the ecology of ixodid ticks of domestic stock in Israel. *Bull. Res. Council. Israel.* 10B: 53–61.
- Haitlinger, R. 2005. *Polyplax oxyrrhyncha* Cummings, 1915 and *P. brachyrrhyncha* Cummings, 1915 (Anoplura: Polyplacidae) two species new to the fauna of Greece, collected on *Acomys minous* Bate, 1906 (Rodentia: Muridae). *Türk. Entomol. Derg.* 29: 243–246.
- Kamal, H. 1967. A dictionary of pharonic medicine. The National Publication House, Cairo, Egypt.
- Kenyon, K. M. 1960. Excavations at Jericho, vol. 1. British School of Archaeology, Jerusalem, Israel.
- Mendelssohn, H., and Y. Yom-Tov. 1987. Mammals. In A. Alon (ed.), *Plants and animals of the land of Israel* (in Hebrew). Ministry of Defense, Tel Aviv, Israel.
- Mumcuoglu, K. Y. 2006. Human parasites from Qumran and the surrounding regions in Israel, pp. 123–127. In J. Gunneweg, C. Greenblatt, and

- A. Adriaens (eds.), Bio- and material cultures at Qumran. Fraunhofer IRB Verlag, Stuttgart, Germany.
- Mumcuoglu, K. Y. 2008. Human lice: *Pediculus* and *Pthirus*, pp. 215–222. In D. Raoult and M. Drancourt (eds.), Paleomicrobiology – past human infections. Springer, Berlin.
- Mumcuoglu, K. Y., and J. Gunneweg. 2012. A head louse egg, *Pediculus humanus capitis* found in a louse comb excavated in The Christmas Cave, which dates to the 1st c. B.C. and A.D. In: J. Gunneweg and Ch. Greenblatt (eds.). Outdoor Qumran and the Dead Sea. Its impact on the Indoor Bio- and Material Cultures at Qumran and the Judean Desert manuscript. Proceedings of the joint Hebrew University and COST Action D-42 Cultural Heritage Workshop held at the Hebrew University of Jerusalem in 25–26 May 2010.
- Mumcuoglu, K. Y., and G. Hadas. 2011. Head louse (*Pediculus humanus capitis*) remains in a louse comb from the Roman period excavated in the Dead Sea area of Israel. *Isr. Expl. J.* 61:223–229.
- Mumcuoglu, K. Y., and J. Zias. 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, K. Y., K. Frish, B. Sarov, E. Manor, E. Gross, Z. Gat, and R. Galun. 1993. Ecological studies on the brown dog tick *Rhipicephalus sanguineus* (Acari: Ixodidae) in southern Israel and its relationship to spotted fever group rickettsiae. *J. Med. Entomol.* 30: 114–121.
- Palma, R. L. 1991. Ancient head lice on a wooden comb from Antinoe, Egypt. *J. Egypt. Archaeol.* 77: 194.
- Saied, A. M., J. Gebauer, K. Hammer, and A. Buerkert. 2008. *Ziziphus spina-christi* (L.) Willd.: a multipurpose fruit tree. *Genet. Resour. Crop Evol.* 55: 929–937.
- Shargal, E., N. Kronfeld-Schor, and T. Dayan. 2000. Population biology and spatial relationships of coexisting spiny mice (*Acomys*) in Israel. *J. Mammal.* 81: 1046–1052.
- Teerink, B. J. 1991. Hair of West-European mammals: atlas and identification key. Cambridge University Press, Cambridge.
- Theodor, O., and M. Costa. 1967. A survey of the parasites of wild mammals and birds in Israel. Part I. Ectoparasites. Israel Academy of Sciences and Humanities, Jerusalem, Israel.
- Weissbrod, L., D. Malkinson, T. Cucchi, Y. Gadot, I. Finkelstein, and G. Bar-Oz. 2014. Ancient urban ecology reconstructed from archaeozoological remains of small mammals in the Near East. *PLoS One.* 9: e91795.
- Zias, J., and K. Y. Mumcuoglu. 1989. How the ancients deloused themselves. *Bibl. Archaeol. Rev.* 15: 66–69.
- Zohary, M. 1972. Flora palaestina, vol. II. The Israel Academy of Sciences and Humanities, Jerusalem, Israel.