



Confusing a Pollen Grain with a Parasite Egg: Infection or Traditional Medicine?

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Abstract: Camacho & Reinhard stated in the December 2019 issue of the KJP (57: 621-625) that we confused a pollen grain with an *Enterobius* egg found in the grave of a female adolescent residing in ancient Tehran 7,000 years ago. We want here to clarify and answer to the outlined points in their article.

Key words: *Enterobius* egg, palynology, pollen, pinworm, archaeology

Sir,

We read with great interest the paper by Camacho & Reinhard published in the December issue of the KJP about our paper "Paleoparasitological evidence of pinworm (*Enterobius vermicularis*) infection in a female adolescent residing in ancient Tehran" [1,2]. Camacho & Reinhard are claiming that this Tehrani woman of 7,000-year-ago was not parasitized and we want here to clarify and answer to the outlined points in their article. In November 2014, a student in archeology accidentally stumbled upon some pottery and a pile of bones at the bottom of a construction site of the Tehran's Water and Wastewater Company. Archaeological excavations were immediately undertaken and led to the discovery of the skeleton of a woman who lived 7,000 years ago. The Department of Parasitology and Mycology, School of Public Health, Tehran University of Medical Sciences, conducted a series of paleoparasitological examinations on the biological remains. From these investigations it was concluded that the woman had enterobiasis. This diagnosis was based on the observation of a single element, identified as an egg of *Enterobius vermicularis* by several qualified parasitologists. In their recent publication Camacho & Reinhard argue that we would have confused a pollen grain of *Ephedra* sp. with a pinworm egg. Their interpretation is based on several remarks to which we want to provide our

answers here. First, they are stating that *E. vermicularis* eggs "are oval, elongate, asymmetric, slightly flattened, and wider in one of the sides, making a rough "D" shape. In long dimension, one end tapers more pronouncedly than the other. This taper occurs near the end where the larva exits". We agree with this description. However, if these characters can easily be observed on fresh or relatively recent eggs, 7,000 years of taphonomic processes can certainly modify them and particularly the presence of a cap, a fissure or an operculum. The picture of the *Enterobius* egg from Durango, Mexico, of about 1,200 to 1,400 years ago (Fig 1. A of Camacho & Reinhard's paper) cannot be considered as a good comparative example with the much older egg of the Tehrani skeleton. On our picture, the eggshell has not the usual D shape and no embryo is visible. But pinworm eggs may appear symmetrical or not, following different views, and the absence of an embryo cannot be considered as an evidence because some eggs can be non-embryonated, depending on their degree of maturity after oviposition by the female. Second, Reinhard who has extensively studied pollens in archeological sites and must be acknowledged for his experience [3,4] evokes the possibility that this object could be a pollen grain. Here we want to point out that the pictures of *Ephedra* pollens published in their paper are very different from our picture. When examining and comparing it (Fig. 2) with the drawings of *Ephedra* pollens (Fig. 3A, B) or with the pollen grain from an archeological coprolite from Utah, USA, we cannot detect on our object any "microsulchi". Finally, we could not find in the published literature images of *Ephedra* pollens like our object on which none of the typical feature of the *Ephedra* pollens is otherwise visible. In addition, the dis-

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covery of one single pollen grain in all the studied samples might be more in favor of a parasite egg rather than a pollen grain. This because the consumption of edible plants would certainly lead to a high number of pollens in the fecal samples [9]. If there is possibly a doubt on the egg diagnosis, the arguments given by our distinguished colleagues to assume that the egg is a pollen grain are not more convincing. Anyhow, we agree with Camacho & Reinhard when recommending a multidisciplinary approach to study archaeological sediments including parasitologists and palynologists. As our colleagues certainly think, we believe that any discovery deserved to be reported and that it is legitimate that the authors may propose an interpretation. If this finally leads to stimulate the discussion this is certainly beneficial for all. And especially when this can open the way to fruitful collaborations. In order perhaps to initiate this collaboration, we will add these few comments. As mentioned by Camacho & Reinhard, in 1968 Arlette Leroi-Gourhan found *Ephedra* pollens in Shanidar Neanderthal burial in Iraq [5]. Plants of the genus *Ephedra* have traditionally been used by indigenous people for a variety of medicinal purposes, including treatment of asthma, hay fever and the common cold as they are containing ephedrine and pseudoephedrine alkaloids [6,7]. The finding of *Ephedra* pollens in the grave of this adolescent from the Bronze age would be even more interesting than finding an egg of *Enterobius vermicularis* because it could suggest the use of *Ephedra* as a traditional medicine. However, concerning Shanidar Neanderthal grave, Sommer hypothesized that "the pollen was deposited by the burrowing rodent *Meriones persicus*, which is common in the Shanidar microfauna" [8]. In conclusion, diagnosis of ancient eggs in coprolites or archeological sediments is always difficult and always questionable and we could have been more suspicious in our paper. Nevertheless, it would have been more realistic if Camacho and Reinhard had entitled their paper "Pos-

sible confusion of a pollen grain with a parasite egg".

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study.

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