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EVALUATION OF ECTOPARASITES ON THE GUINEA PIG MUMMIES OF EL YARAL AND MOQUEGUA VALLEY, IN SOUTHERN PERU

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Generally, well preserved arthropod remains are rarely found among archaeological materials. The outstanding preservation of some mummified guinea pigs from the excavation of El Yaral, an archeological site in the Moquegua Valley in Southern Peru, gave rise to the idea of recovering ectoparasites, that once infested those guinea pigs. Ectoparasites are arthropods, like lice, fleas and mites, who can be a serious threat to animals and humans by causing skin lesions or even transmitting diseases.

Key words: Guinea pigs, lice, mites.

Excavaciones arqueológicas en el sitio El Yaral, valle de Moquegua, sur del Perú, revelan la presencia de cuyes en excelente estado de conservación. Esto motivo la investigación de ectoparásitos en estos animales. Los ectoparásitos como los piojos, pulgas y ácaros son artropodos que pueden poner en riesgo la salud de las personas y animales ya que pueden causar serias lesiones a la piel e incluso transmitir enfermedades.

Palabras claves: *Cuyes, piojos, acaros.*

The Guinea Pigs of El Yaral

The guinea pig mummies were excavated at the archeological site of El Yaral, which is situated in the Moquegua Valley in Southern Peru. It belongs to a complex of settlements that are dated to the coastal Chiribaya Culture in the Late Intermediate Period. The main excavation was done between the years 1985 and 1988, under direction of Don Rice.

During the excavations there was found a total of 112 guinea pigs, which were buried under the floor of structures 70, 193, 2 and 1. The guinea pigs have been sacrificed by cutting of their heads (Wheeler, personal communication).

The guinea pigs all belong to the species *Cavia porcellus* Linne, 1758 the domesticated guinea pig, that with some probability evolved from the wild ancestor *Cavia aparea* Erxleben, 1777 (Mueller-Haye 1984).

The mummies underwent a process of natural mummification, due to the very dry climate and soil conditions, which leave the area in a semidesert state. Many of the mummies are in extraordinary good shape, so there was a good chance of finding ectoparasitic arthropod remains.

Techniques of Recovery and Mounting

Primarily importance should be attached to the amount of hair preserved with the mummies.

Those with only a small amount of fur left, usually are difficult to study.

As a rule, "mummified", dissecated ectoparasites are recovered with the same techniques as used for recent ones, mainly with special entomological tools, such as feather weight forceps, brooms, needles, etc..

Analysis was complicated by the very fragile condition of the remains. Recovery of "mummified" ectoparasites require an enormous effort of patience, it turns out to be very time consuming to search a fur, full of sand grains, dust and small other particles.

Once found, the parasites should be rehydrated by passing it into a broad vial or petri dish filled with either 30% hydrated ethanol or 30-50 % ethanol (if hydrated ethanol is not by hand). Preferably the remains shouldn't be moved to much, to prevent further damage, which later could result in difficulties to classify the ectoparasites.

After 5-7 days the parasites will sink to the bottom and they can be passed to 70% ethanol for further storage.

Other attempts of rehydratation by using 0.2% sodium hydroxide solution resulted in to much damage to the exoskeleton, so that further mounting could not be done.

When rehydrated, samples are mounted in the following manner, which is a slightly modified method, commonly in use:

First the parasite is passed into a 1% KOH solution, to clear the exoskeleton (the commonly used 10% solution would be to aggressive for these old parasites). The use of Lactophenol, which is also common for this purpose did not bring the expected results.

Daily control of the status of clearance is necessary and the parasites are the passed into 70% ethanol, after thoroughly washing them in distillated water. The samples are passed in an 24 hour series into 80% and finally into 90% ethanol, from which they are transferred to a slide and covered with Berlese solution. The slide is warmed for a couple of hours on a heating plate, so some parasites will stretch out their legs, which gives better results in exact identification. After half a year of drying, the slide can be sealed by using several kinds of lacquer.

Results

Thirty-two of the 112 studied guinea pigs turned out to be positive for arthropod parasitic remains.

To determine the species , various identification keys were used. Nineteen mummies were positive to *Trimenopon hispidum* and 9 to *Gliricola porcelli*, both belong to the ORDER Mallophaga, commonly referred to as the "biting lice" and are said to be very host specific for guinea pigs.

In 4 cases *Ornithonyssus spp.* could be obtained , thus being a blood sucking mite genus, which affects a wide variety of hosts, such as rodents, reptiles and birds. Unfortunately the samples were already lacking important morphological features, that exact identification of species was not possible any more. Studies on recent populations though suggest the possibility of an *Ornithonyssus bacoti*-infestation.

Only in one occasion a flea (ORDER: Siphonaptera) could be found, although studies on other guinea pig mummies from the same geographic region and time showed a high incidence of fleas.

The species is *Pulex simulans*, a flea that also feeds on humans. The fact of finding just one of the species could perhaps be explained by the fact that the guinea pigs were used as offerings during a religious ceremony, that usually takes some time. As fleas do detect even slight changes in host temperature, they will leave the host immediately when it cools down after death.

In this case no statistic analysis was done, because the sample size was to small and there occurred to much diagenetic factors, so data about real infestation rates could not be obtained.

Summary and Comments

Parasite infestations of domestic livestock have always been a problem, not only involving the domesticated animals if not the human population to which they are associated .

It is a problem, that mainly arouse and increased with a sedentary life, when people started to concentrate in certain regions and so did their domestic livestock (Cohen and Armelagos 1984).

This usually resulted in poor sanitary conditions for both humans and animals, thus giving a favorable climate for ectoparasite invasion of the populations. Ectoparasites can have wide ranging direct and indirect effects on the health of humans and animals. They are notorious offenders and their chronic feeding on host tissues lowers the host's first line of defense against a variety of diseases.

In this case the infestation with the 2 different species of biting lice can be interpreted as a rather common problem in guinea pigs, that occurs even in well kept pet guinea pigs today. The parasites spread by contact, e.g. when animals gather together while sleeping . Their bites mostly results in discomfort, which leads to scratching and skin lesions. If an infestation is heavy or persisting it can lead to permanent scratching and finally the animal loses weight because it can't feed properly. This makes

it more susceptible to certain infections and it can result in an increased mortality of the stock. This is a more indirect side effect on the human population as in this case it would have taken away an important food supply for the ancient Peruvians.

The infestation with both *Ornithonyssus spp.* and *Pulex simulans* on the other hand clearly indicate a more sanitary related problem. Unlike other parasites, fleas like *Pulex simulans* pass their entire pre-adult life off the host. The development of their early stages usually takes place in the host's dwelling (Noble and Noble 1976). Poor hygienic conditions, like huts filled with guinea pig excrement enforce the development of heavy flea "plagues", that can result in persistent anemia and severe skin lesions among the guinea pigs and even in sudden deaths, as those small animals often have a nervous disposition.

Ornithonyssus spp. normally only feeds in the darkness, during daytimes it stays hidden in cracks and floors. But if the animals are kept in permanently dark and damp conditions, as it often occurs even today in traditional farm houses, this blood sucking mite will feed all over the day, thus doubling and tripling its production rate. So in a very short time a heavy infestation will occur, bringing similar results as the first mentioned species and their sucking action can kill new borne guinea pigs. Both of the latter mentioned species also attack man. *Ornithonyssus bacoti* causes a sharp, itching pain when biting and skin sensitive persons may develop a severe dermatitis as a sign of a heavy immune response (Roberts and Janovy 1996). *Pulex simulans* has a similar disturbing pattern when biting man.

But there is another danger, coming from the latter 2 species. Blood sucking arthropods often act as vectors for a wide range of diseases.

Since the times of the great outbreaks of plague (also called pest or black death) fleas have a reputation as vectors. Pest, caused by the bacteria *Yersinia pestis*, is a disease of rodents which is contracted by humans through the bites of fleas, particulary *Xenopsylla cheopis* but there are also reports indicating that *Pulex irritans* and *P. simulans* can transmit plague mainly from person to person (Twigg 1984).

Nevertheless I found in recent studies a high infestation rate of guinea pigs with *P. irritans* and *P. simulans* with high insecticide resistance. Since guinea pigs are susceptible to plague, this has important public health implications.

Murine Typhus can be transmitted by both fleas and *Ornithonyssus bacoti*. It is a disease caused by *Rickettsia typhi* which is morphologically indistinguishable from *Rickettsia prowazeckii*, the agent for the epidemic, or lice borne typhus. Usually *X. cheopis* is considered to be the primary vector, although experimentally also *Ornithonyssus bacoti* is able to transmit the disease. This mite experimentally also have been shown to transmit plague, rickettsial pox, Q fever (Roberts and Janovy 1996).

To my knowledge neither plague nor murine typhus previous to conquest times has been reported from South America. However both above mentioned species are not very host specific. Keeping this in mind and the high susceptibility of guinea pigs to a wide range of human diseases, as proven through wide use as laboratory animal and the unique fact of a very close relation of those animals to humans in South America, there exists a good possibility that the mentioned ectoparasites could have

played its role in spreading out diseases in pre-conquest, as in conquest times.

Needed urgently in this field are the applications of modern laboratory technology. Bones and feces for paleopathological or paleoepidemiological studies are usually in large supply, but ectoparasitic remains in large numbers and good shape are hard to find. Under favorable conditions blood and it's contents may be preserved rather well and highly sensitive procedures are able to trace even the slightest remain of a pathogen. Following this idea, it might give us an even more detailed picture of diseases and it's impact on human populations. It might elucidate relations between domestication and human health as well as increasing our knowledge of epidemiological mechanisms and epidemics.

The studies on the guinea pig are only taken as an example to explain the possibility of another direction of paleoparasitological research , there are other ongoing studies with dogs and camelids.

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