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Pediculosis in *Macaca sylvanus* of Gibraltar

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Abstract

Pedicinus spp. parasitize several species of nonhuman primates. This is the first published report confirming the presence of *Pedicinus albidus* (Rudow) infestation in the free-ranging macaques (*Macaca sylvanus*) of Gibraltar. The diagnosis of pediculosis was based upon finding adult lice and nits on host animals.

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1. Introduction

The Rock of Gibraltar, a peninsula attached to southern Spain, is home to the only free-ranging nonhuman primates in Europe: *Macaca sylvanus*, the “Barbary Ape”. *M. sylvanus* is also found in Morocco and Algeria. The exact origin of the Gibraltar macaques is unknown, but records dating to the 17th century allude to their presence. When the macaque population dwindled precipitously in the early 20th century, additional animals were imported from North Africa. Phylogenetic analysis suggests that the current population is composed of long-term residents as well as individuals whose origins can be traced to recent

importation from North Africa (Modolo et al., 2005). The most recent census of Gibraltar’s macaques (2005) estimated the population at 219, divided among 5–7 groups (Perez and Bensusan, 2005). The Gibraltar Ornithological and Natural History Society (GONHS) is responsible for the daily management of Gibraltar’s macaque population. GONHS traps macaques randomly throughout the year in order to screen for disease, administer antiparasitic medication using 1% ivermectin (IVOMEC[®], Merial) and insert identifying microchips. GONHS also has attempted to limit the growth of the macaque population by implanting subcutaneous hormonal contraceptives in females that have successfully reared offspring.

Gibraltar’s macaques reside in the Upper Rock Nature Reserve and have, over the years, become a major tourist attraction, with an estimated 800,000 tourists visiting the Reserve annually from around the globe (Perez and Bensusan, 2005). Though the local

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Tourist Board, through GONHS and the Gibraltar Veterinary Clinic, has erected signs that explicitly prohibit visitors from feeding macaques many visitors do offer food to the macaques, and some visitors use food to lure macaques onto their head or shoulders (Fuentes, in press).

Previous work on disease transmission between humans and macaques in Asia suggested that transmission of infectious agents both from human-to-macaque and from macaque-to-human occurred in contexts when humans and free-ranging macaques came into contact (Engel et al., 2002; Jones-Engel et al., 2001, 2004, 2005a,b). It is hypothesized that macaque bites and scratches as well as mucosal contact with body fluids can lead to cross-species transmission. Additionally, vector-mediated transmission of *Plasmodium knowlesi* from macaques to humans has been documented (Sing et al., 2004; Jongwutiwes et al., 2004) where humans are commensal. Contact between macaques and humans in Gibraltar raises the possibility that cross-species transmission, including vector-mediated transmission, can occur in this setting.

Parasitic lice belong to the insect order Phthiraptera, which includes the monophyletic suborder Anoplura known as the sucking lice. Sucking lice are common parasites of nonhuman primates (Fiennes, 1967) and are usually passed from host to host through a hair bridge (Georgi and Georgi, 1990) which they grip using distinctive pretarsal claws. The size of these claws may be related to the diameter of the host's hair shaft, and is a factor in maintaining host-specificity of some species of sucking lice. *Pediculus* spp. infests humans and New World nonhuman primates, but is only known from chimpanzees (*Pan* spp.) among the Old World primates. There are 14 species of *Pedicinus* that parasitize Old World monkeys, amongst which *P. albidus* was first characterized by Rudow in 1869 as a parasite of *M. sylvanus* in Morocco (Rudow, 1869) and was later reported by other parasitologists collecting samples from captive *M. sylvanus* in European zoological and museum collections and in free-ranging populations in Northern Africa (Durden and Musser, 1994; Ferris, 1951; Kuhn and Ludwig, 1967).

Pediculosis in domestic animals may be asymptomatic. More severe infestations can cause significant pruritus and produce alopecia and dermal irritation. A generally unthrifty appearance, rough coat and lowered production in farm animals are common. Extreme cases of anopluran infestations can cause anemia (Aiello, 1998). There are no reported symptoms of pediculosis in the cases among nonhuman primates in the literature.

This may be due to the fact that affected animals were treated before symptoms developed.

The treatment of lice infestations in laboratory colonies of nonhuman primates has previously been described. Pyrethroid shampoo or ivermectin at 0.2 mg/kg SC, repeated at a 14-day interval have been equally effective in the treatment of rhesus macaques infested with *P. eurygaster* (Mader et al., 1989).

2. Methods and materials

Over a 4-day period in June of 2004, as part of ongoing research into cross species transmission of infectious agents between nonhuman primates and humans, 40 *M. sylvanus* were trapped, sedated, examined and then recovered and released back into their natural groups. Study and data protocols were reviewed and approved by the University of Washington's Institutional Animal Care and Use Committee (3143-03).

On day 3 of data gathering a louse was found in a fecal sample as an incidental finding, and subsequent physical examinations of trapped and sampled macaques (less than 20) included a specific search for lice using a lice comb.

Lice were preserved in 100% ethanol and examined microscopically by a trained parasitologist (Smith). Selected specimens were prepared for non-destructive DNA extraction and the exoskeletons were slide-mounted as vouchers using the protocol outlined in Cruickshank et al. (2001). Identification was confirmed morphologically by reference to specimens loaned from the collections of the Natural History Museum, London, and by reference to the original taxonomic descriptions of *Pedicinus* species in Ferris (1934).

3. Results

On the 3rd day of the study, during a fecal examination of an adult female macaque, a virtually complete adult louse was identified (Fig. 1). Subsequently, adult lice were detected on the fur of several additional animals. No pathologic sequelae, including anemia or secondary infection, were noted in the infested animals. Three of the live lice were removed from the macaques and preserved in 100% ethanol. Morphological examination of the lice in comparison to reference specimens held at the Natural History Museum, London, revealed that they were *Pedicinus albidus* (Rudow), a species almost identical to *P. longiceps* (Piaget), and *P. hamadryas* (Mjöberg), except for the female sub-genital plate, which is considerably

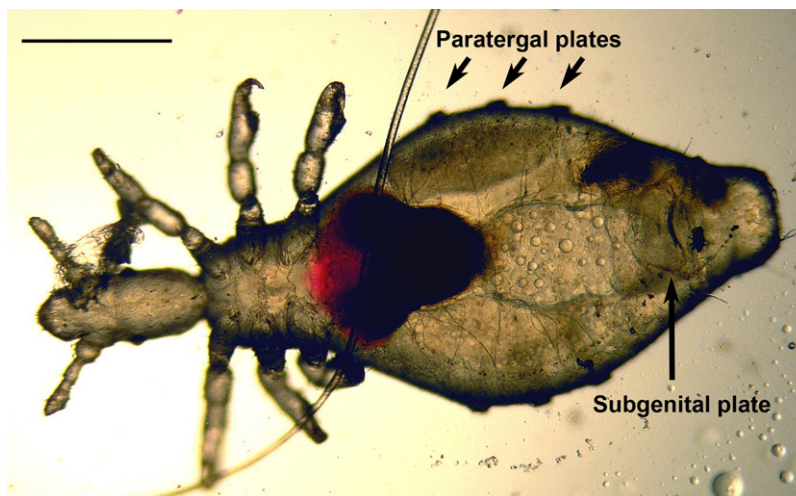


Fig. 1. Unmounted adult female specimens of *Pedicinus albidus* collected from a free ranging macaque (*Macaca sylvanus*) in Gibraltar. Arrows highlight the three paratergal plates and a large crescent-shaped subgenital plate that together with the louse's size, distinguish this specimen from other species of *Pedicinus*. Scale bar 0.5 mm.

156 smaller and not deeply emarginated. The specimens
157 were readily distinguished from *P. eurygaster* (Burme-
158 ister), another species of *Pedicinus* present on *Macaca*
159 sp. on account of their larger size (*P. albidus* is
160 approximately 1 mm longer than the 1.5 mm total
161 length of *P. eurygaster*) and by the presence of three
162 distinct pairs of paratergal plates on the abdomen (*P.*
163 *eurygaster* has just two pairs, see Fig. 1). Confirmation
164 of the identification was made with reference to a key
165 for the species of *Pedicinus* in Ferris (1951). Two adult
166 female specimens (one slide mounted in Canada balsam
167 and the other in 100% ethanol) have been deposited in
168 the collections of the Natural History Museum, London.
169

4. Discussion

170 Vector-borne transmission of disease from humans
171 to nonhuman primates has been previously suggested in
172 a number of contexts (de Thoisy et al., 2004; Bryant
173 et al., 2003; Wolf et al., 2001). Since physical contact
174 between Gibraltar macaques and humans is common, it
175 is important to consider the zoonotic potential of this
176 parasite. Although *Pedicinus* is a sister taxon of the two
177 genera of lice that parasitize humans (*Pediculus* and
178 *Pthirus*) (Reed et al., 2004), persistent infestation of a
179 human is unlikely because human scalp hair is
180 potentially unsuitable for *Pedicinus* and because
181 humans generally have far less body hair than nonhu-
182 man primates. Notwithstanding, it is conceivable that a
183 *P. albidus* louse, finding itself on a human, would
184 indulge in a blood meal.
185

186 There have been no reports of transmission of
187 rickettsial diseases by lice from nonhuman primates to

humans or visa versa (Toft and Eberhard, 1998). The
188 significance of *P. albidus* infestation among Gibraltar's
189 macaques is unknown. Though no sequelae were
190 detected among the infested individuals, deleterious
191 effects could not be ruled out based on the data
192 gathered.
193

194 In an effort to control the louse problem among the
195 populations of Barbary macaques the animals are being
196 treated with oral and injectable formulations of
197 ivermectin (Merial), 0.2 mg/kg. However, the fact that
198 the Barbary macaques are free ranging means that it is
199 virtually impossible to treat all the animals at the same
200 time. Despite repeated attempts with oral ivermectin
201 (IVOMECS[®], Merial) injected into fruits or biscuits) and
202 an ongoing trap, treat and release program the louse
203 problem remains constant.

Uncited reference

Fuentes (2006).

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211

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