**Syphacia** sp. (Nematoda: Oxyuridae) in coprolites of *Kerodon rupestris* Wied, 1820 (Rodentia: Caviidae) from 5,300 years BP in northeastern Brazil

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We present the results of paleoparasitological analyses in coprolites of *Kerodon rupestris*, rodent endemic to rocky areas of Brazil’s semiarid region. The coprolites were collected from excavations at the archaeological site of Toca dos Coqueiros, in the National Park of Serra da Capivara, southeastern of state of Piauí. *Syphacia* sp. (Nematoda: Oxyuridae) eggs were identified in coprolites dated at 5,300 ± 50 years before present. This is the first record of the genus *Syphacia* in rodent coprolites in the Americas.

Key words: *Kerodon rupestris* - *Syphacia* - paleoparasitology - coprolites

*Kerodon rupestris* is a caviid rodent endemic to rocky regions of Brazil’s semiarid. Known popularly as the mocó (rock cavy), the species is distributed across the states of Brazil’s Northeast and some parts of northern state of Minas Gerais, where it is restricted to rocky hill areas (Moojen 1952). Another species, *Kerodon acrobata*, has been described in the vicinity of the São Mateus River, state of Goiás (Moojen et al. 1997). Mocó rock cavy coprolites are easily identified, differing from those of other rodents in shape and size and by the presence of a groove running from one end to the other of the concave face (Chame 2003). These animals habitually use collective latrine sites (Fig. 1), where faeces accumulate on the rocks over long periods of time and are preserved by the dry climate (Chame 2003). Also characteristics is that, as the faeces accumulate at a single site, the action of various other factors, such as urine, heat and occasionally rainfall, leads to the formation of resin-like concretions of faeces running down the rocks.

In previous studies, larvae of *Strongyloides ferreirai* (Nematoda: Rhabdiasoidea) have been found in mocó rock cavy coprolites from the state of Piauí (PI), Brazil and dated at 8,000 ± 2,000 years BP (Araújo et al. 1989) and *Trichuris* sp. (Nematoda: Trichuridae) eggs dated at 30,000 BP (Martins & Cameron 1960). The presence of the genus *Syphacia* (Oxyurida: Oxyuridae) was reported by Vaz & Pereira (1934), who mention the presence of *Syphacia criceti* in present-day *Kerodon* sp. material from the Instituto Biológico de São Paulo and by Quentin (1971), who also observed the presence of this genus in present-day material from *Kerodon* sp. in Bolivia. This study describes the first record of the genus *Syphacia* in rodent coprolites in the Americas.

The Toca dos Coqueiros site, a rock shelter in the Serra da Capivara National Park, is one of the numerous archaeological sites that make up the São Raimundo Nonato Archaeological Area, in southeast PI. Excavations at the site have yielded a male human skeleton dated at between 11,120-11,025 years BP (Bernardo & Neves 2009), found in association with lice-infested hair (Araújo et al. 2000). The archaeological layers from which the rodent coprolites were collected date from 5,300 ± 50 years BP.

Some 163 samples containing animal coprolites were collected by the team of archaeologists of the Museum Fundação Museu do Homem Americano Man and sent to the paleoparasitology laboratory for analysis. Ninety three samples from *K. rupestris* coprolites were separated for this study. Two grams (approximately 20 coprolites) from each sample separately were rehydrated for 72 h in solution of 0.5% trisodium phosphate (Cullen & Cameron 1960). After rehydration, samples were spontaneous sedimented (Lutz 1919) and 20 slides of each sample was examined using an optical microscope at 100X and 400X magnification, as recommended by Araújo et al. (1998). The eggs encountered were photographed and measured with the assistance of Image Pro™ software and their dimensions and morphology were compared with data from the literature in order to identify the lowest possible taxon.

The three samples examined were positive for asymmetrical, yellowish ova in the form of sharp-ended, smooth-membraned, thin-walled cylinders, with dark-yellow embryonic mass occupying all the interior space, and some segments visible (Fig. 1). Three eggs were found, but only one with morphological characteristic preserved measuring 101 x 35.7 μm (Fig. 2). Deformed or broken eggs were not measured. From their morphology, and length and width measurements, the eggs were identified as belonging to the genus *Syphacia*.

*Syphacia* sp. is cosmopolitan in distribution and forms part of the parasitic fauna of mammals (Vicente et al. 1997). Direct-route infection occurs by ingestion of the eggs.

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They are readily found in laboratory rodents (Van der Gulden 1967, Baker 1998, Pinto et al. 2001) because of cage stocking density and improper sanitary conditions, which favour the transmission mechanism (Stone & Manwell 1966, Michels et al. 2006, Taylor 2010). There are recorded cases of human infection by *Syphacia obvelata* (Riley 1919) and *Syphacia muris* (Stone & Manwell 1966) in laboratory technicians (Taylor 2010). There are also records of *S. obvelata* eggs being found in mummified human bodies from Nubia dated at 700-300 years BP (Harter 2003).

In Brazil, various *Syphacia* species have been recorded in rodents, goats, sheep and primates (Vicente et al. 1997), as well as reptiles (VRA Lagaggio et al., unpublished observations). Seven species - *Syphacia alata*, *S. criceti*, *Syphacia evaginata*, *Syphacia mesocriceti*, *S. muris*, *S. obvelata* and *Syphacia venteli* - have been described in rodents in Brazil. Only *S. criceti* has been recorded in the genus *Kerodon*, as already mentioned, although it has been recorded in *Oryzomys subflavus* Rodentia: Muridae, *Calomys callosus* Rodentia: Cricetidae and *Mesocricetus auratus* Rodentia: Cricetidae (Travassos 1937, Quentin 1969, Robles & Navone 2010).

*S. criceti* is the only species found to date parasitizing *Kerodon* sp. Thus it was though that this would possibly be the nematode found in the *K. rupestris* coprolites from Toca dos Coqueiros. However, given the variation in egg measurements described for *S. criceti* in various hosts and the fact that only one egg could be analyzed the species identity of the parasite infecting the coprolites was not possible.

The finding of *Syphacia* sp. eggs indicates that *K. rupestris* in southeast PI were infected with *Syphacia* sp. at least 5,300 years BP. This observation also opens up new prospects for parasitological studies of *K. rupestris* from various periods, as little is known about this rodent’s helminthological fauna, which raises the possibility of further occurrences in this host.
### TABLE
Comparison of *Syphacia* spp egg measurements recorded in Brazil and elsewhere

| Species                  | Host                          | Egg measurements (µm) | Site                               | Reference                                      |
|--------------------------|-------------------------------|-----------------------|------------------------------------|------------------------------------------------|
| *Syphacia alata*         | *Necromys lasiurus*           | 106-75 x 20-31        | Argentina, Pernambuco (PE)/Brazil, | Quentin (1998), Robles (2008)                  |
| *S. alata*               | *Sigmodontinae*               | 106-75 x 20-31        | Colombia                           | Quentin (1969, 1971), Robles (2008)            |
| *Syphacia criceti*       | *Calomys callosus*            | 83-87 x 27-34         | PE/Brazil                          | Quentin (1971)                                 |
| *S. criceti*             | *Kerodon sp.*                 | 90-98 x 34-36         | São Paulo/Brazil                   | Vaz and Pereira (1934)                         |
| *S. criceti*             | *Kerodon sp.*                 | 83-87 x 27-34         | PE/Brazil                          | Quentin (1971)                                 |
| *S. criceti*             | *Mesocricetus auratus*        | 111-120 x 43-48       | Rio de Janeiro (RJ)/Brazil         | Pinto et al. (2001)                            |
| *S. criceti*             | *Orzyzomys subflavus*         | 83-87 x 27-34         | PE/Brazil                          | Quentin (1971)                                 |
| *Syphacia evaginata*     | *Oryzomys sp.*                | 75 x 30               | Pará/Brazil                        | Hugot and Quentin (1985)                       |
| *Syphacia mesoecriceti*  | *Mesocricetus auratus*        | 130-140 x 40-50       | RJ/Brazil                          | Pinto et al. (2001)                            |
| *S. mesoecriceti*        | *Sigmodontinae*               | 130-140 x 40-50       | Brazil                             | Hendrix and Robinson (2006)                    |
| *Syphacia muris*         | Muridae and Cricetidae        | 72-82 x 25-36         | Cosmopolitan                       | Hendrix and Robinson (2006), Taylor (2010)     |
| *Syphacia obvelata*      | Muridae and Cricetidae        | 72-153 x 25-55        | Cosmopolitan                       | Doyle et al. (2006), Hendrix and Robinson (2006) |
| *Syphacia ventelli*      | *Melanomys caliginosus*       | 75-87 x 25-31         | Colombia                           | Quentin (1969)                                 |
| *S. ventelli*            | *Nectomys squamipes*          | 75-87 x 25-31         | Brazil and Argentina               | Travassos (1937), Robles and Navone (2010)    |

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