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Malaria parasites in macaques in Thailand: stump-tailed macaques (*Macaca arctoides*) are new natural hosts for *Plasmodium knowlesi*, *Plasmodium inui*, *Plasmodium coatneyi* and *Plasmodium fieldi*

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Abstract

Background: Certain species of macaques are natural hosts of *Plasmodium knowlesi* and *Plasmodium cynomolgi*, which can both cause malaria in humans, and *Plasmodium inui*, which can be experimentally transmitted to humans. A significant number of zoonotic malaria cases have been reported in humans throughout Southeast Asia, including Thailand. There have been only two studies undertaken in Thailand to identify malaria parasites in non-human primates in 6 provinces. The objective of this study was to determine the prevalence of *P. knowlesi*, *P. cynomolgi*, *P. inui*, *Plasmodium coatneyi* and *Plasmodium fieldi* in non-human primates from 4 new locations in Thailand.

Methods: A total of 93 blood samples from *Macaca fascicularis*, *Macaca leonina* and *Macaca arctoides* were collected from four locations in Thailand: 32 were captive *M. fascicularis* from Chachoengsao Province (CHA), 4 were wild *M. fascicularis* from Ranong Province (RAN), 32 were wild *M. arctoides* from Prachuap Kiri Khan Province (PRA), and 25 were wild *M. leonina* from Nakhonratchasima Province (NAK). DNA was extracted from these samples and analysed by nested PCR assays to detect *Plasmodium*, and subsequently to detect *P. knowlesi*, *P. coatneyi*, *P. cynomolgi*, *P. inui* and *P. fieldi*.

Results: Twenty-seven of the 93 (29%) samples were *Plasmodium*-positive by nested PCR assays. Among wild macaques, all 4 *M. fascicularis* at RAN were infected with malaria parasites followed by 50% of 32 *M. arctoides* at PRA and 20% of 25 *M. leonina* at NAK. Only 2 (6.3%) of the 32 captive *M. fascicularis* at CHA were malaria-positive. All 5 species of *Plasmodium* were detected and 16 (59.3%) of the 27 macaques had single infections, 9 had double and 2 had triple infections. The composition of *Plasmodium* species in macaques at each sampling site was different. *Macaca arctoides* from PRA were infected with *P. knowlesi*, *P. coatneyi*, *P. cynomolgi*, *P. inui* and *P. fieldi*.

Conclusions: The prevalence and species of *Plasmodium* varied among the wild and captive macaques, and between macaques at 4 sampling sites in Thailand. *Macaca arctoides* is a new natural host for *P. knowlesi*, *P. inui*, *P. coatneyi* and *P. fieldi*.

Keywords: *Plasmodium knowlesi*, *Plasmodium cynomolgi*, *Plasmodium inui*, *Macaca arctoides*, Zoonosis

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