

PREVALENCE OF MALARIA IN PANAMANIAN PRIMATES*

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ABSTRACT: Over a 35-year period, 1,994 Panamanian primates representing seven species have been examined for malaria at the Gorgas Memorial Laboratory. *Plasmodium brasilianum* was the only species found. The prevalence rates for the various species were: *Ateles geoffroyi* (30.3%), *A. fusciceps* (10.6%), *Alouatta villosa* (4.0%), and *Cebus capucinus* (2.2%). No infections were found in *Saimiri oerstedii*, *Aotus trivirgatus*, and *Saguinus geoffroyi*.

Malaria in primates has interested workers at Gorgas Memorial Laboratory for the past 35 years. Clark (1930, 1931) surveyed Panamanian primates for malaria and other parasites. Clark and Dunn (1931) reported an attempt to transfer the malaria parasite of *Ateles geoffroyi* to man. Taliaferro and Taliaferro (1934a, b, c, 1944) and Taliaferro and Kliver (1940a, b) studied *Plasmodium brasilianum* in Panamanian primates. Taliaferro and Taliaferro (1934d) and Taliaferro and Cannon (1934) attempted the transmission of *P. falciparum* to the Panamanian howler monkey (*Alouatta villosa*). Since these early reports, much additional information has been obtained. Nearly 2,000 Panamanian primates have been examined on receipt at the laboratory from 1931 to 1957 and during the past year. The purpose of this paper is to summarize the information on the prevalence of malaria in these animals.

MATERIALS AND METHODS

Records kept at the laboratory include information on species, geographic origin, age, and sex of the primate. Primates examined were *Ateles fusciceps* (black spider monkey), *Ateles geoffroyi* (red spider monkey), *Cebus capucinus* (whiteface monkey), *Alouatta villosa* (black howler monkey), *Saimiri oerstedii* (squirrel monkey), *Aotus trivirgatus* (night monkey), and *Saguinus geoffroyi* (titi marmoset). Weight was the principal factor used in separating infants from juveniles. One thousand grams was used as a separation weight for *Ateles* and *Alouatta*, 750 g for *Cebus*, 300 g for *Saimiri* and *Aotus*, and 200 g for *Saguinus*. Juveniles were separated from adults by lack of sexual maturity.

Until last year, all primates entering Gorgas Memorial Laboratory were examined on at least 5 consecutive weekdays for malaria parasites and monthly thereafter. In most cases, the initial period of five daily examinations now is followed by weekly examinations. Thick blood films are made, stained with Giemsa, and examined microscopically.

RESULTS

Nineteen hundred and ninety-four primates were examined. *Plasmodium brasilianum* was the only malaria species found. Table I shows the prevalence of *P. brasilianum* in the different species. It was most prevalent in the *Ateles* species. Thirty and three-tenths per cent of 145 *A. geoffroyi* and 10.6% of 311 *A. fusciceps* were infected. Only 2.2% of 276 *Cebus capucinus* and 4.0% of 278 *Alouatta villosa* were infected. None of 30 *Saimiri oerstedii*, 205 *Aotus trivirgatus*, and 749 *Saguinus geoffroyi* was infected.

The prevalence by age is shown also. The adults of the two *Ateles* species had a higher prevalence rate than the infants and juveniles. The infants and juveniles of *Cebus capucinus* had prevalence rates exceeding that in the adults. None of 55 adults of *Alouatta villosa* examined was infected.

Primates were obtained from all of the provinces of Panama. The two provinces supplying enough primates for comparative purposes, Darien and Panama, showed similar prevalence rates by species and age.

DISCUSSION

Dunn and Lambrecht (1963) summarized the reports of *P. brasilianum* in New World primates. A comparison of our findings with the summary of Dunn and Lambrecht (1963) reveals that *Ateles* species are infected with

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TABLE I. Prevalence of *Plasmodium brasilianum* in Panamanian primates on arrival at Gorgas Memorial Laboratory 1931-57 and 1965-66.

Host	Infant		Juvenile		Adult		Totals	
	No. exam.	Per cent pos.	No. exam.	Per cent pos.	No. exam.	Per cent pos.	No. exam.	Per cent pos.
<i>Ateles fusciceps</i>	61	8.2	162	1.9	88	11.4	311	10.6
<i>Ateles geoffroyi</i>	42	6.2	73	26.0	30	46.7	145	30.3
<i>Cebus capucinus</i>	40	2.5	123	3.3	113	0.9	276	2.2
<i>Alouatta villosa</i>	167	4.8	56	5.4	35	0.0	278	4.0
<i>Saimiri oerstedii</i>	3	0.0	6	0.0	21	0.0	30	0.0
<i>Aotus trivirgatus</i>	17	0.0	43	0.0	145	0.0	205	0.0
<i>Saguinus geoffroyi</i>	89	0.0	147	0.0	513	0.0	749	0.0
Total of primates							1,994	4.7

P. brasilianum in Panama and elsewhere; *Cebus* and *Alouatta* are infected in Panama but not reported infected elsewhere; *Saimiri* have not been found infected in Panama but are infected elsewhere; *Aotus* and *Saguinus* (= *Oedipomidas*) have never been reported infected in Panama or elsewhere.

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