Title: Nonhuman Primate Malarias in Thailand

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Objective:

There are few, if any, records of primate malarias in Thailand. The discovery of plasmodia in monkeys and gibbons in Thailand is of interest not only because of possible transmission to man but also because comprehensive studies on newly isolated strains may illuminate some of the problems related to human malaria. Furthermore, the presence of primate malaria in an area may complicate identification of the vector of human malaria in that same area.

Description:

Blood films of all primates purchased by the Veterinary Department are sent to the Parasitology Department for routine examination. To date 124 blood films from wild, caught cynomolgus and irus monkeys have been examined. Of these 18 (14.5%) have found to be infected. In all cases the parasite was tentatively identified as P. inui. It would thus appear that the infection rate may be high. It has been shown (Ann. Rep., 1966) that the Thai strain of P. inui is reabily transmitted by Anopheles balabacensis. Since this mosquito is also implicated as a major vector of human malaria it would be of importance to identify the species of sporozoite in infected wild-caught mosquitoes.

One hundred and seventy four slides from wild-caught gibbons have been examined and 2 (1.14%) were found to be positive. One infection was from a gibbon that came from the area near Chumporn in S. Thailand. The strain is being maintained in the laboratory and has been identified as P. jefferyi.

The other isolate came from Trat, N. Thailand and is also being maintained in gibbons. Identification of this parasite has proved most difficult since during the course of infection it shows morphologic characteristics similar to all four plasmodia described as natural gibbon infections; P. jefferyi, P. eylesi, P. youngi, and P, hylobati. Dr. McWilson Warren of the NIH and ourselves were first of the opinion that it was a double infection of P. eylesi and P. jefferyi. Prof. Garnham thought it a double infection of P. eylesi and, because of some small gametocytes, P. hylodati (a parasite described only once by Rhodain some 20 years ago). However, careful sequential examination during the course of infection has revealed peculiar transitional forms and so the possibility of a remarkably pleomorphic parasite cannot be entirely ruled out. Eylesi forms with stippling and multiply infected erythrocytes appear early in the infection and gradually give way to predominantly jefferyi and youngi-hylobati types.

The morphology and schizogonic cycle was studied in detail in P16, the second blood subpassage, from the 79th to 86th days of infection. Thin blood films were taken at 4-hourly intervals during this entire period and from this the periodicity and morphology studied. At least 100 parasites, taken at random, were drawn from each blood film. Photographs were made of typical parasites at different growth stages and then drawn in semi-stylized fashion from projections of color slides (Plate 1).

Only parasites resembling P. jefferyi were observed to be present at this time. While the morphology generally conformed to the description of Warren, Coatney and Skinner (J. Parasit. 1966, 52)

certain differences were observed. Firstly, double infections were seen in about 2%-3% of all parasitized erythrocytes (Fig. 3) and secondly, true stippling of the infected erythrocytes was absent at all stages. Furthermore, it is our present belief that the parasite may be pleomorphic and growth may proceed through somewhat different forms. The most typical sequence seems to be as follows: The merezoite enters the erythrocyte (Figs 1 & 2) and a fine ring with a prominent single compact nucleus develops (Fig 3). The ring enlarges (Fig. 6) and amasses cytoplasm (Figs 7, 8, 11). These older trophozoites are not amoeboid and accumulate a find dust-like golden pigment along their periphery. There is a large vacuole. The parasite occupies the entire erythrocyte, often destroying and growing beyond the original rbc boundary (Figs 17, 18, 19). At this stage the nucleus becomes band-like preparatory to division. The next stage, proceeding to the pre-schizont and early schizont, involves a disappearance of the vacuole and consolidation of the cytoplasm (Figs 21-25). Typically, this form is seen to occupy about half the space of that of the mature trophozoite and only the outline or ghost of the original, now destroyed erythrocyte cell wall is evident. The pigment may be either finely particulate or clumped in prominent golden-colored masses.

A variation in development is that the ring, early in development, shows a tendency toward amoeboidicity and irregularity. This amoeboid behaviour is apparrent throughout its progessive development even to the schizont which has wispy strands of cytoplasm rather than being compact. The successive stages of this type of development are shown in Figs 12, 13, 14, 15, 16 and 28.

A second growth variation is that the rather huge mature trophozoite stage (Fig. 18) may be by-passed. The progression of events here is that the small ring rapidly acquires both cytoplasm and pigment (Fig. 4). It grows to the late and mature trophozoite occupying about half or two thirds of the erythrocyte and without destroying it (the remaining rbc material appears to be normal). Finally, the schizont of this "miniature" form also occupies only a portion of an otherwise normal appearing erythrocyte (Figs 26, 27).

A rather unusual form of growth is shown in Figs 10 and 16 and 20. The compact nucleus is within the center of the growing ring. The trophozoite amasses cytoplasm and the nucleus undergoes a pre-divisional development until the form seen in fig 20 is attained.

The points which lead us to the conclusion (tentative) that these are all morphologic variations of one species are: (1) There is no anisocytosis of the host erythrocyte nor is it stippled (enlarged parasitized rbc are seen but there is a severe anemia with this infection and at times as many as 20% or more of the erythrocytes are reticulocytes). (2) The pigment in all developmental types is of a fine dust-like golden appearance consolidating into clumps at later stages. (3) Schizonts of all types are rare in the peripheral blood and development is usually completed in the deep circulation system.

The periodicity is shown in Fig. 31. Since schizongony is not usually completed in the peripheral circulation the best evidence of periodic behavior is the percentage of very young rings found. There appears to be a triple brood of parasites (a double brood was noted in the gibbon studied by Warren et al). There is a distinct main brood exhibiting regular tertian periodicity. The main peak of these small ring forms appear of quite regularly at 1100 to 1500 and the other peaks occurred 0300 and 1500) on alternate days to the main brood.

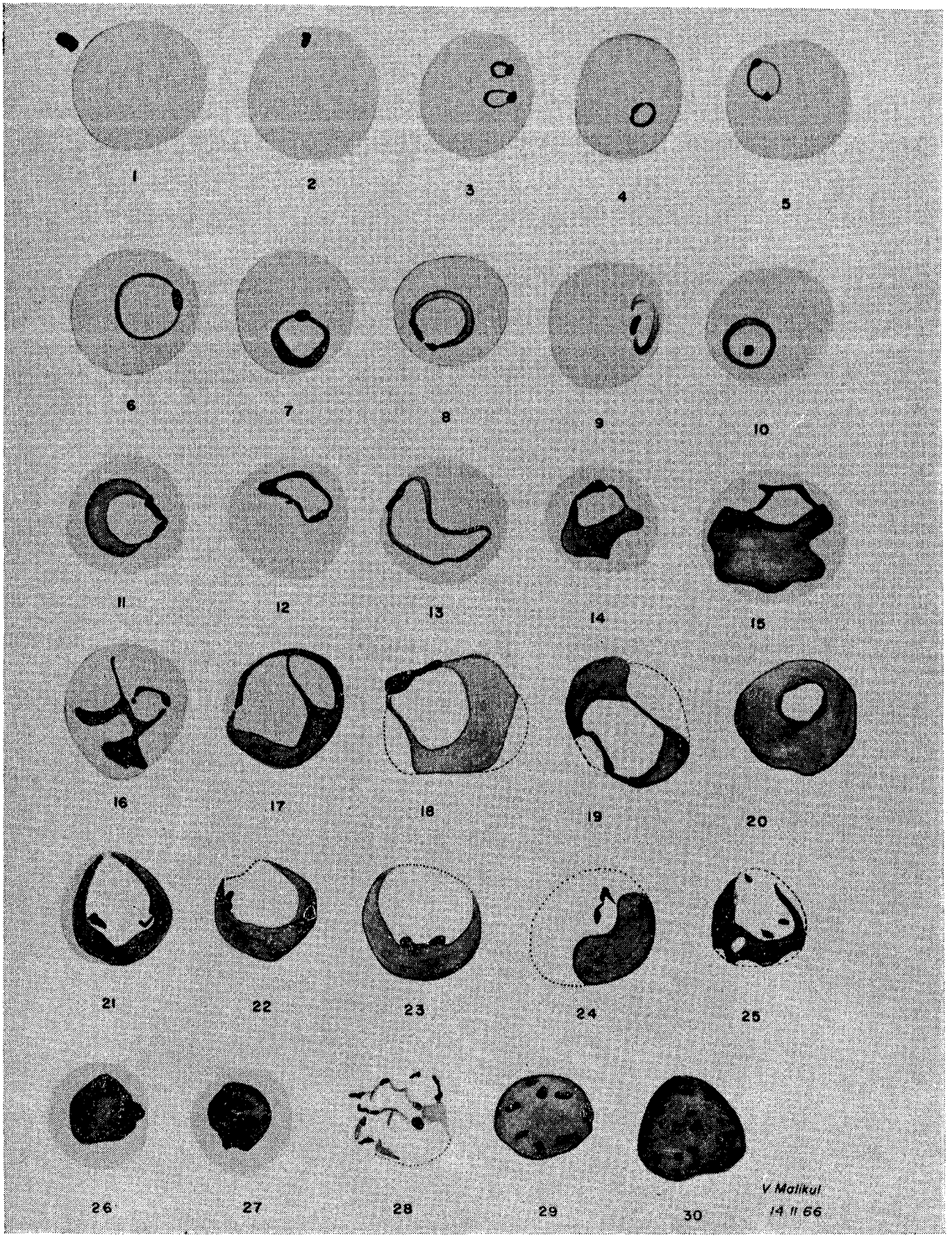
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Fig.2.GIBBON P-16.

DIFFERENTIAL PARASITE COUNTS MADE AT 4-HR. INTERVALS