

ARE ASIAN MONKEYS THE ORIGINAL MAMMALIAN HOSTS OF *TRYPANOSOMA CONORHINI*?

LEONIDAS M. DEANE*, MARIA P. DEANE** & RICARDO LOURENÇO-DE-OLIVEIRA*

It is hypothesized that Asian monkeys were the original hosts of Trypanosoma conorhini because they have been found naturally infected, the vector among rats is a tropicopolitan triatomine bug that belongs to a complex of Asian species, and primates were shown to be more susceptible than rats.

Key words: *Trypanosoma conorhini* – *Triatoma rubrofasciata* – primates – rats

The true identity of *Crithidia conorrhini* Donovan, 1909 as a mammalian parasite and member of the genus *Trypanosoma* was established by the finding of trypomastigotes in the blood of mice inoculated with the "Crithidia" from the intestinal tract of the hematophagous bug *Triatoma rubrofasciata* (De Geer, 1773) (Hemiptera, Reduviidae). The flagellate was then called *Trypanosoma boileyi* Lafont, 1912, the name being later amended to *Trypanosoma conorhini* (Donovan, 1909) by Shortt & Swaminath, in 1928 (in Hoare, 1972).

The bug belongs to the "rubrofasciata complex", a group restricted to Asia (Lent & Wygodzinsky, 1979) with the only known exception of the mentioned species *Triatoma rubrofasciata*, which is also the only known tropicopolitan species of the sub-family Triatominae. Its present distribution spreads chiefly along the coast of continental areas and islands, specially in sea ports, in the Far East, Africa and the New World (Dias & Seabra, 1943). This distribution of *T. rubrofasciata* and its usual co-habitation with the domestic rat *Rattus rattus* suggest an old association between bug and rodent. In every place where they have been examined, both the bug and the rat were found to harbour the flagellate identified as *T. conorhini*. So, it is quite reasonable to speculate that the trio – the trypanosome and both its vertebrate and invertebrate hosts – have migrated together, an occurrence probably unique among digenetic protozoa. In the American Continent this association seems to be kept exclusive since, up to the present, there are no reports of natural infections by *T. conorhini* in any other mammal or in any other triatomine of the rich local fauna, despite the extensive and continuing studies of reservoirs and vectors of Chagas' disease and the susceptibility of various triatomine species to the experimental infection.

Therefore, the usual definition of *Trypanosoma conorhini* as a parasite of *Rattus rattus* transmitted by *Triatoma rubrofasciata* appears justified (Dias & Seabra, 1943; Hoare, 1972).

However, the natural infection of rats, usually detected through xenodiagnosis, is much less frequent than it could be expected from the high rates found in the triatomine. Experimental infection of laboratory rodents produces low level parasitemia of short duration and trypomastigotes have been the only forms detected in the blood. With the exception of the rare rounded forms with several nuclei and kinetoplasts found by M.P. Deane (1969) in visceral inprints of inoculated mice, no indications of multiplication of the flagellate in the vertebrate were found. It was suggested that in rodents *T. conorhini* only would grow from the small metacyclic to the large bloodstream trypomastigote; its true mammalian host would be another still non identified animal, or the flagellate might be a parasite of the insect with occasional passages through rats (Morishita, 1935; Shortt & Swaminath, 1928).

Experiments to test the susceptibility of other mammals to the flagellates of naturally infected *T. rubrofasciata*, included guinea-pigs, rabbits, mongoose and Asian monkeys of the genus *Macaca*; only the monkeys were found infected: one in one *M. fascicularis* (= *M. cynomolgus*) in Mauritius (Lafont, 1912), one in one *M. mulatta* (= *M. rhesus*) in Rio de Janeiro (Dias & Seabra, 1943) and 16 in 16 *M. cyclopis* in Formosa (Cross, Hsu & Hung, 1983).

On the other hand, the natural infection of macaques by trypanosomes that develop in triatomines were reported from Indonesia (Weinman & Wiratmadja, 1969) and Formosa (Cross, Hsu & Hung, 1983). The first of these findings reopened an old controversy about the presence of *Trypanosoma cruzi* in Asian primates and was thoroughly discussed by Hoare (1969, 1972) and by Weinman who, in 1977, made a review of other similar findings in Asia. Based on the published

Instituto Oswaldo Cruz, *Departamento de Entomologia and **Departamento de Protozoologia, Caixa Postal 926, 20000 Rio de Janeiro, RJ, Brasil.

data and illustrations and on our own previous experience with *T. conorhini* (Deane, 1947; Deane & Kirchner, 1963) we agree with Hoare's opinion that at least some of trypanosomes isolated from Asian primates most probably belong to this species.

If so, those animals would be the only mammals to be found naturally infected with *T. conorhini* besides house rats.

In the New World, as mentioned before, there is no record of a natural infection by *T. conorhini* in any mammal other than the rat and the susceptibility of neotropical primates had not been tested.

In a previous paper (Deane, Deane & Lourenço-de-Oliveira, 1985) we report the experimental infection of Brazilian marmosets (Primates, Callitrichidae) by a strain of *T. conorhini* isolated from a *T. rubrofasciata* caught (by A.B. Galvão) in Rio de Janeiro, in 1960 and since maintained in culture and irregular passages through mice and triatomines.

The experiments included one *Callithrix penicillata*, four *C. jacchus* (Primates, Callitrichidae), one *Cebus* sp. (Primates, Cebidae), three young opossums, *Didelphis marsupialis*, besides rats and mice. The inocula were cultures or the intestinal contents of triatomines (*Rhodnius prolixus* and *Dipetalogaster maximus*) used to maintain the strain. Inoculations were subcutaneous or intraperitoneal except for one *C. jacchus* that ingested two nymphs of the infected bugs.

The opossums and two of the marmosets were always negative, even by xenodiagnosis and blood culture. The *Cebus* sp. was positive by xenodiagnosis. In three of the marmosets inoculated in the peritoneum there was a patent parasitemia at least up to days 28, 35 and 55 after inoculation. In *C. penicillata* parasitemia was fairly high from the 3rd day on, reaching a peak of 934 flagellates per 5mm³ of blood on the 10th day, including, besides the usual type of bloodstream trypomastigotes, large epimastigotes, some in division on the 3rd and 4th days.

This was the first time that epimastigotes of *T. conorhini* were found in circulation and dividing forms were detected in the peripheral blood of a vertebrate.

It should be reminded here that according to Hoare's classification, *T. conorhini* belongs in sub-genus *Megatrypanum*, which reproduces in the epimastigote stage in the mammalian host (1972). Deane & Deane (1961) have observed both epimastigotes and trypomastigotes dividing by equal binary fission in cultures grown at 37°C. However, under the artificial conditions, this could be a case of differentiation before division of epimastigote was completed.

Among the several laboratory rodents (rats and mice) receiving inocula identical to those that infected the marmosets and the many others that throughout the years we have inoculated with cultures or triatomine intestinal contents, patent parasitemia, when present, was usually of short duration and never of such high level as in the above mentioned marmoset, *C. penicillata*. This coincides with the experience of most workers.

We conclude by: 1) stressing the need for more studies of the trypanosomes of Asian primates and their possible association with the local species of triatomines; 2) suggesting the possibility of the spreading of *T. conorhini* to Brazilian primates, since this trypanosome can develop in several species of our triatomines and can infect marmosets (which are frequently kept as house pets); and 3) presenting the hypothesis that *T. conorhini* might be primarily a parasite of Asian primates which, following adaptation to the cycle *T. rubrofasciata*-house rats, became world-wide in distribution.

RESUMO

Os autores apresentam a hipótese de que os hospedeiros originais do *Trypanosoma conorhini* poderiam ser macacos asiáticos, porque a infecção natural destes tem sido achada, o vetor entre ratos é um triatomíneo tropicopolita que pertence a um complexo de espécies asiáticas e os primatas têm-se mostrado mais suscetíveis ao parasito do que os ratos.

REFERENCES

- CROSS, J.H.; HSU, M.Y.K. & HUNG, C.K., 1983. Studies on trypanosomes in the Taiwan monkey. *Southeast Asian J. trop. Med. publ. Hlth.*, 14 :536-542.
- DEANE, L.M.; DEANE, M.P. & LOURENÇO-DE-OLIVEIRA, R., 1985. Susceptibility of marmosets (Primates, Callitrichidae) to *Trypanosoma conorhini*. *XII Reunião Anual sobre Pesquisa Básica em Doença de Chagas*, Caxambu, Minas Gerais, Brasil, p. 39.

- DEANE, M.P., 1947. Ocorrência do *Trypanosoma conorhini* em "barbeiros" e em rato na cidade de Belém, Pará, e seu cultivo em meio NNN. *Rev. Serv. esp. Saúde públ.*, 1 :433-442.
- DEANE, M.P., 1969. On the life-cycle of trypanosomes of the *lewisi* group and their relationship to other mammalian trypanosomes. *Rev. Inst. Med. trop. S. Paulo*, 11 :34-43..
- DEANE, M.P. & DEANE, L.M., 1961. Studies on the life cycle of *Trypanosoma conorhini*. "In vitro" development and multiplication of the blood-stream forms. *Rev. Inst. Med. trop. S. Paulo*, 3 :149-160.
- DEANE, M.P. & KIRCHNER, E., 1963. Life-cycle of *Trypanosoma conorhini*. Influence of temperature and other factors on growth and morphogenesis. *J. Protozool*, 10 :391-400.
- DIAS, E. & SEABRA, C.A.C., 1943. Sobre o *Trypanosoma conorhini*, hemoparasito do rato transmitido pelo *Triatoma rubrofasciata*. Presença do vetor infectado na cidade do Rio de Janeiro. *Mem. Inst. Oswaldo Cruz*, 39 :301-330.
- HOARE, C.A., 1969. Does Chagas' disease exist in Asia? (Further contribution to this problem). *J. trop. Med. Hyg.*, 72 :282-284.
- HOARE, C.A., 1972. *The trypanosomes of mammals*. A Zoological Monograph. Blackwell Sci. Publ., Oxford & Edinburgh, 749 p.
- LAFONT, A., 1912. Trypanosomide d'un Réduvide (*Conorhinus rubrofasciatus*) inoculable au rat et à la souris. *Ann. Inst. Pasteur (Paris)*, 26 :893-922.
- LENT, H. & WYGODZINSKY, P., 1979. Revision of the Triatominae (Hemiptera, Reduviidae), and their significance as vectors of Chagas' disease. *Bull. Am. Mus. Nat. Hist.*, 163 :123-520.
- MORISHITA, K., 1935. An experimental study of the life-history and biology of *Trypanosoma conorhini* (Donovan), in the alimentary tract of *Triatoma rubrofasciata* (De Geer) in Formosa. *Jap. J. Zool.*, 6 :459-546.
- SHORTT, H.E. & SWAMINATH, C.S., 1928. Preliminary note on three species of *Trypanosomidae*. *Ind. J. med. Res.*, 16 :241-244.
- WEINMAN, D., 1977. Trypanosomiasis of man and macaques in South Asia. In *Parasitic Protozoa, I*, J.P. Kreier ed., Academic Press, pp. 329-355.
- WEINMAN, D. & WIRATMADJA, N.S., 1969. The first isolates of trypanosomes in Indonesia and in history from primates other than man. *Trans. R. Soc. trop. Med. Hyg.*, 63 :497-506.