

THE TRANSOVARIAL TRANSMISSION OF *BABESIA TRAUTMANNI* BY *RHIPICEPHALUS SIMUS* TO DOMESTIC PIGS

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ABSTRACT

DE WAAL, D. T., LOPEZ REBOLLAR, LAURA M. AND POTGIETER, F. T., 1992. The transovarial transmission of *Babesia trautmanni* by *Rhipicephalus simus* to domestic pigs. *Onderstepoort Journal of Veterinary Research*, 59, 219–221 (1992)

Rhipicephalus simus was, for the first time, experimentally proven to be a transovarial vector of *Babesia trautmanni* of domestic pigs. The nymphal and adult progeny of experimentally infected female ticks transmitted the infection to 2 susceptible splenectomized pigs. Features of the infection included a prepatent period of 6–8 days post-tick infestation, a febrile reaction for 3 days and a maximum parasitaemia score of 15 (more than 6 parasites per 300 red blood cells). Other clinical signs in both pigs were mild inappetence and listlessness. Both pigs recovered without any antibabesial therapy.

INTRODUCTION

Porcine babesiosis, caused by *Babesia trautmanni*, was first recorded in Russia by Dementjew in 1911 (cited by Knuth & Du Toit, 1921). The first record in Africa, accompanied by a detailed description of the parasite, was by Trautmann, who studied the condition in Tanzania in 1914 (Knuth & Du Toit, 1921).

In southern Africa 3 outbreaks of porcine babesiosis have been reported in domestic pigs: in Zimbabwe (Lawrence & Shone, 1955); near the Pongola river in the south-eastern Transvaal (Henning, 1956); and in 1958 in the Soutpansberg district in the northern Transvaal (Naudé, 1962).

Although various tick species have been listed as possible vectors, based on circumstantial evidence alone, only one report could be found which described the successful transovarial transmission of the parasite by *Rhipicephalus turanicus* (Kurchatov & Markov, 1940, cited by Neitz, 1956).

It has been speculated that the bushpig (*Potamochoerus porcus*) and warthog (*Phacochoerus aethiopicus*) can act as reservoirs of the parasite. Shone & Philip (1960) have shown that the African bushpig is susceptible to *B. trautmanni*. Blood smears examined from warthogs from the eastern Transvaal Lowveld (Horak, Boomker, De Vos & Potgieter, 1988) and Pilansberg Game Reserve, Boputhatswana (Stewart, Keffen, McCrindle, Duncan & De Waal, 1992), were negative for *B. trautmanni*. However, 7 out of 20 serum samples collected from warthogs were positive for *B. trautmanni* antibodies in an indirect fluorescent antibody test (Stewart *et al.*, 1992).

While bushpigs prefer forests, thickets, riparian undercover, reed beds or heavy cover of tall grass, warthogs frequent open ground, grassland, floodplains, vleis and open areas around waterholes and pans. Both have a fairly limited distribution in South Africa, including parts of the northern and eastern Transvaal, eastern Natal and eastern Cape Province. In the rest of the Afrotropical region they are widespread in suitable habitats, often in close asso-

ciation with farming areas (Smithers, 1983). Bushpigs are nocturnal, omnivorous and usually root and browse for food. Warthogs, on the other hand, are diurnal vegetarians living predominantly on annual and perennial grasses.

The susceptibility of warthogs and bushpigs to *B. trautmanni*, the serological evidence of their infection and their distribution would suggest that *B. trautmanni* is probably endemic in large parts of the Afrotropical region.

This report describes the transovarial transmission of *B. trautmanni* by the nymphal and adult stages of *Rhipicephalus simus*.

MATERIALS AND METHODS

Experimental animals

Three susceptible Large White pigs, 8 weeks old, were obtained from the breeding unit of the Veterinary Research Institute (VRI), Onderstepoort. They were splenectomized and kept under strict tick-free conditions during this study.

Babesia trautmanni isolate

A blood stablate of *Babesia trautmanni*, prepared in 1982 from a naturally-infected domestic pig from a small holdig near the VRI, was used to infect Pig 2204. Nine ml of the thawed blood stablate was injected intravenously, using the great auricular ear vein.

Rhipicephalus simus feeding and maintenance

The Louis Trichardt strain of *Rhipicephalus simus* (a 3-host tick), maintained in the laboratory by feeding all stages on rabbits, was used in this study (Potgieter & Van Rensburg, 1987). All non-feeding stages were maintained in an acaridarium at 25 °C and 85 % relative humidity.

For the purpose of this study larval ticks, and sometimes nymphae, were fed on rabbits in plastic containers according to the method described by Heyne, Elliott & Bezuidenhout (1987). During the transmission studies both nymphal and adult stages were fed in calico bags on the backs of the pigs. To secure a calico bag to a pig the bristles on its lumbar region were shaved with an electric hairclipper and

the bag was then glued to the clipped area with a contact adhesive.

Babesia trautmanni infection

Blood smears, thick and thin, were made daily and quantified as described by De Waal & Potgieter (1987). Rectal temperatures were taken daily between 08:00 and 10:00.

Infection and transmission of *Babesia trautmanni*

On Day -1 pre-infection, 35 *R. simus* adults (10 males, 25 females) were used to infest Pig 2204. The engorged female ticks were collected and treated as described by De Waal & Potgieter (1987). Between Days 5-13 post-engorgement these female ticks were screened for *B. trautmanni* infection. A leg of each tick was amputated and haemolymph smears were prepared, as described by Burgdorfer (1970). The smears were air-dried, fixed in methanol, stained with 10% Giemsa's stain for 35 min and examined for the presence of kinetes of *B. trautmanni*. Twenty-four days after hatching, the progeny of 2 of these female ticks were fed on a rabbit. The engorged larvae were collected and allowed to moult in the acaridarium. Thirty-five days after moulting, 100 nymphae were used to infest susceptible Pig 2200. The engorged nymphal ticks were collected and allowed to moult.

To determine the potential of adult ticks to transmit the infection, 200 *R. simus* nymphae (from the larval progeny of the 2 females above) were fed on a rabbit 4 months after moulting. The engorged nymphae were collected and allowed to moult. Twenty-five days after moulting 40 adult ticks (10 males, 30 females) were used to infest susceptible Pig 2224. The engorged female ticks were collected and allowed to lay eggs.

RESULTS

Infection of ticks with *B. trautmanni*

Pig 2204 developed a patent *B. trautmanni* parasitaemia on Day 3 after infection with the blood stabilate. A patent parasitaemia was recorded for 9 days during which the parasite score varied between 1 and 15 (parasites detected in thick blood smear only = 1; more than 6 parasites in a field of 300 red blood cells = 15). The first rise in temperature was detected on Day 7 with a peak of 40.9 °C on Day 12. Twenty-one engorged female ticks were collected on Days 6-10 from this pig. All the haemolymph smears made from these engorged females were negative for *B. trautmanni* kinetes.

Transovarial transmission by *R. simus* from adult to nymphae

Approximately 300 engorged larvae were collected from the rabbit 5-7 days after infestation. A total of 60 engorged *R. simus* nymphae were recovered from Pig 2200 between Days 4 and 6. The first *B. trautmanni* parasites were seen in the thick blood smears on Day 8 post-infestation. A febrile reaction that persisted for 3 days was recorded on Day 13, the highest rectal temperature recorded being 40.9 °C. The maximum parasitaemia recorded was a score of 10 (1-6 parasites in a field of 300 red blood

cells) on Day 13 post-infestation. The splenectomized pig recovered without treatment.

Transovarial transmission by *R. simus* from adult to adult

One hundred and fifty engorged nymphae were collected from the rabbit 4 days after infestation. A total of 28 engorged *R. simus* females were collected from Pig 2224 from Days 6-12 post-infestation. The first *B. trautmanni* parasites were seen in the thick blood smear on Day 6 post-infestation. A febrile reaction (maximum 40.3 °C) was first recorded on Day 8 and persisted for 3 days. The maximum parasitaemia was a score of 10 from Days 8-14 post-infestation. The splenectomized pig recovered without treatment.

DISCUSSION

As far as is known our findings represent the first evidence that *R. simus* can act as a transovarial vector of *B. trautmanni*. *R. simus* has been recovered from warhogs in northern Namibia (Horak, Biggs, Hanssen & Hanssen, 1983), the eastern Transvaal (Horak *et al.*, 1988; Boomker, Horak, Booyse & Meyer, 1991) and Pilansberg National Park (Stewart *et al.*, 1992), and from bushpigs in Natal (Horak, Boomker & Flamand, 1991). *R. simus* was frequently encountered on domestic pigs in Zimbabwe (Shone & Philip, 1960). In South Africa they were obtained from clinically affected animals (Naudé, 1962).

The immature stages of *R. simus* feed on rodents (Norval & Mason, 1981) while the adult stages seem to prefer monogastric animals such as Burchell's zebra, carnivores, warhogs and bushpigs rather than ruminants (Horak *et al.*, 1988; Boomker *et al.*, 1991).

B. trautmanni infections in pigs in South Africa are not of major importance since commercial farmers house pigs under intensive conditions and they are rarely allowed to roam outside. However, in some places pigs are allowed to roam around in search of food, as they do in rural areas in Africa. Under such conditions the incidence of babesiosis may be higher because the domestic pigs may become infested with infected ticks from bushpigs or warhogs frequenting the same area.

The mildness of the infection, even in splenectomized pigs, is in accordance with observations by other workers (Nardi, 1954; Lawrence & Shone, 1955; Naudé, 1962; Dipeolu, Majaro & Akinboade, 1982; Dipeolu, Otesile, Adetunji & Fagbemi, 1983). Apparently disease outbreaks usually occur when the animals are stressed by other conditions such as concurrent *Eperythrozoon suis* infection (Dipeolu, Otesile, Fabemi & Adetunji, 1983), helminth infestations (Dipeolu & Sellers, 1977), poor nutrition (Naudé, 1962) or *Trypanosoma simiae* infection (Ocholi, Ezeugwu & Nawathe, 1988).

REFERENCES

- BOOMKER, J., HORAK, I. G., BOOYSE, D. G. & MEYER, SANTA, 1991. Parasites of South African wildlife. VIII. Helminth and arthropod parasites of warhogs, *Phacochoerus aethiopicus*, in

- the eastern Transvaal. *Onderstepoort Journal of Veterinary Research*, 58, 195–202.
- BURGDORFER, W., 1970. Hemolymph test. A technique for detection of Rickettsiae in ticks. *American Journal of Tropical Medicine and Hygiene*, 19, 1 010–1 014.
- DE WAAL, D. T. & POTGIETER, F. T., 1987. The transstadial transmission of *Babesia caballi* by *Rhipicephalus evertsii evertsii*. *Onderstepoort Journal of Veterinary Research*, 54, 655–656.
- DIPEOLU, O. O. & SELLERS, K. C., 1977. An investigation of the endoparasites of indigenous pigs in a rural area of South-western Nigeria. *Bulletin of Animal Health and Production in Africa*, 25, 77–81.
- DIPEOLU, O. O., MAJARO, O. M. & AKINBOADE, A., 1982. Studies on the blood parasites of pigs in Ibadan, Nigeria. *Veterinary Parasitology*, 10, 87–90.
- DIPEOLU, O. O., OTESILE, E. B., ADETUNJI, A. & FAGBEMI, B. O., 1983. Studies on blood parasites of pigs in Nigeria. Pathogenicity of *Babesia trautmanni* in experimentally infected pigs. *Zentralblatt für Veterinärmedizin, Reihe B*, 30, 97–102.
- DIPEOLU, O. O., OTESILE, E. B., FAGBEMI, B. O. & ADETUNJI, A., 1983. Pathogenicity of *Eperythrozoon suis* alone and when mixed with *Babesia trautmanni* in experimentally infected pigs. *Veterinary Parasitology*, 13, 127–134.
- HENNING, M. W., 1956. Animal diseases in South Africa. 3rd edn. South Africa: Central News Agency Ltd.
- HEYNE, HELOISE, ELLIOTT, E. G. R. & BEZUIDENHOUT, J. D., 1987. Rearing and infection techniques for *Amblyomma* species to be used in heartwater transmission experiments. *Onderstepoort Journal of Veterinary Research*, 54, 461–471.
- HORAK, I. G., BIGGS, H. C., HANSSSEN, TAMMY, S. & HANSSSEN, ROSE, E., 1983. The prevalence of helminth and arthropod parasites of warthog, *Phacochoerus aethiopicus*, in South West Africa/Namibia. *Onderstepoort Journal of Veterinary Research*, 50, 145–148.
- HORAK, I. G., BOOMKER, J., DE VOS, V. & POTGIETER, F. T., 1988. Parasites of domestic and wild animals in South Africa. XXIII. Helminth and arthropod parasites of warthogs, *Phacochoerus aethiopicus*, in the eastern Transvaal Lowveld. *Onderstepoort Journal of Veterinary Research*, 55, 145–152.
- HORAK, I. G., BOOMKER, J. & FLAMAND, J. R. B., 1991. Ixodid ticks and lice infesting red duikers and bushpigs in north-eastern Natal. *Onderstepoort Journal of Veterinary Research*, 58, 281–284.
- KNUTH, P. & DU TOIT, P. J., 1921. Die Piroplasmosis des Schweines. 409–411 In: *Tropen-Krankheiten der Haustiere*. Leipzig: Barth.
- LAWRENCE, D. A. & SHONE, D. K., 1955. Porcine piroplasmosis. *Babesia trautmanni* infection in Southern Rhodesia. *Journal of the South African Veterinary Medical Association*, 26, 89–93.
- NARDI, E., 1954. Ulteriori osservazioni sulla piroplasmosi suina. *Veterinaria Italiana*, 5, 803–811.
- NAUDÉ, T. W. 1962. An outbreak of porcine babesiosis in the northern Transvaal. *Journal of the South African Veterinary Medical Association*, 33, 209–211.
- NEITZ, W. O., 1956. Classification, transmission and biology of piroplasms of domestic animals. *Annals of the New York Academy of Science*, 64, 56–111.
- NORVAL, R. A. I. & MASON, C. A., 1981. The ticks of Zimbabwe. II. The life cycle, distribution and hosts of *Rhipicephalus simus* Koch, 1844. *Zimbabwe Veterinary Journal*, 12, 2–9.
- OCHOLI, R. A., EZEUGWU, R. U. & NAWATHE, D. R., 1988. Mixed outbreak of trypanosomiasis and babesiosis in pigs in Nigeria. *Tropical Animal Health and Production*, 20, p. 140.
- POTGIETER, F. T. & VAN RENSBURG, L., 1987. Tick transmission of *Anaplasma centrale*. *Onderstepoort Journal of Veterinary Research*, 54, 5–7.
- SHONE, D. K. & PHILIP, J. R., 1960. The susceptibility of the African bushpig, *Potamochoerus porcus maschona*, Lönnberg, to infection with *Babesia trautmanni*. *Journal of the South African Veterinary Medical Association*, 31, 451–453.
- SMITHERS, R. H. N., 1983. The mammals of the southern African subregion. 1st edn. Pretoria: University of Pretoria.
- STEWART, C. G., KEFFEN, R. H., MCCRINDLE, C., DUNCAN, A. N. & DE WAAL, D. T., 1992. *Babesia trautmanni* infection in a warthog (*Phacochoerus aethiopicus*). *Journal of the South African Veterinary Medical Association*, 63, p. 98.