Babesia peircei sp. nov. from the jackass penguin

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An avian piroplasm, *Babesia peircei* sp. nov. is described from the jackass penguin *Spheniscus demersus.* Morphological differences between *Babesia peircei* sp. nov. and the other valid *Babesia* spp. are discussed together with the possible vectors.

'n Voël-piroplasma, *Babesia peircei* sp. nov. afkomstig van die brilpikkewyn *Spheniscus demersus,* word beskryf. Morfologiese verskille tussen *Babesia peircei* sp. nov. en die ander geldige *Babesia* spesies word bespreek tesame met die moontlike vektore.

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Peirce (1975) revised the nomenclature of the avian piroplasms after the discovery that the generic name *Nuttallia* França, 1909 for species of the Babesiidae was preoccupied by *Nuttallia* Dall, 1898 for the bivalves of the family Psammobiidae. All the species which were considered valid were transferred to the genus *Babesia* Starcovici, 1893 by Peirce (1975) since Levine (1971) considered *Nuttallia* to be a synonym of *Babesia.* Although Levine (1971) followed Laird & Lari (1957) in considering avian piroplasms as belonging to the genus *Babesia,* he was not justified in considering all the described piroplasms to be one species (Peirce 1973). Peirce (1975) listed 10 avian *Babesia* parasites considered to be valid. Subsequently, Peirce & Feare (1978) reported on an avian piroplasm discovered in masked boobies *Sula dactylatra* from Desnoeufs Island, Amirantes, Indian Ocean, but did not describe this species.

Coles (1941) considered a piroplasm found in jackass penguins *Spheniscus demersus* on Dassen Island, Cape west coast to be an *Aegyptianella* sp. These parasites were re-identified as *Babesia* sp. by Bennett, Earlé, du Toit & Huchzermeyer (1992) but not described. Bloodsmears from jackass penguins taken from various localities along the South African coast showed infections with a *Babesia* sp., which is the subject of the present study.

Materials and methods

Blood smears used for this study were taken from oiled jackass penguins which were rescued and rehabilitated for release at the Rescue Station of the South African National Foundation for the Conservation of Coastal Birds (SANCCOB) in Milnerton, Cape Town. Smears were made from blood collected after pricking the webs on the penguins' feet with a sterile lancet. The four smears used for the descriptions were air dried and then stained either with Wright's stain or a modified Romanowsky before examination. All were deposited in the collection of the International Reference Centre for Avian Haematozoa.

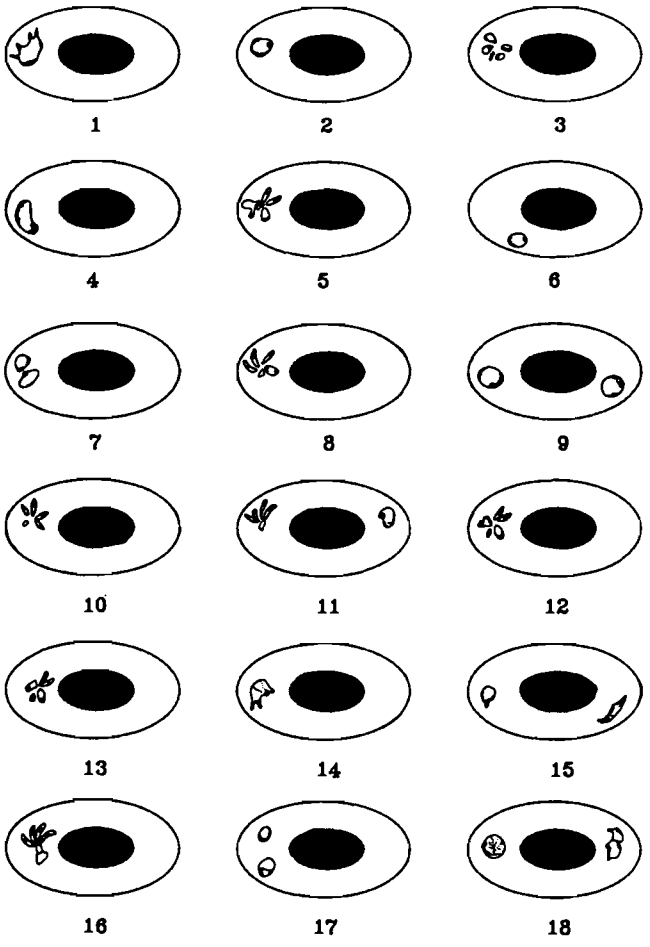
The morphological characteristics were obtained by drawing the appropriate cells and parasites with the aid of a drawing tube. Measurements were taken from these drawings together with drawing-tube projections of a micrometer slide.

Babesia peircei sp. nov.

Type host: jackass penguin *Spheniscus demersus*

Type locality: Muizenberg, Cape coast, Republic of South Africa

Both spherical and elongated forms were common. The smallest spherical forms measured 1,5 µm across but ranged between 1,5–3,0 µm (mean 2,3 µm). The elongated forms ranged between 1,7–4,0 µm (mean 3,0 µm). The spherical parasites had most of the chromatin concentrated in a ball on one side of the parasite (Figures 6 & 7) but this was often also spread out along the membrane (Figures 2, 4 & 9) or divided in two parts (Figure 18). The chromatin spreading along the membrane of the spherical parasite probably leads



Figures 1–18 Erythrocytes containing different forms of *Babesia peircei* sp. nov.

to the division of the chromatin and budding out into the 'cow's udder' formation (Figures 1 & 14). This 'cow's udder' formation probably leads to the formation of four elongated forms of the parasite in the shape of a fan (Figures 11 & 16). Characteristic of these divisions into elongated merozoites were the presence of the remains of the cytoplasm, without any chromatin, at the base of the group of elongated parasites (Figures 8, 11, 13 & 16). The chromatin in the elongated merozoites was seen mostly towards the middle or distal part of the elongated parasite (Figures 11, 12 & 16) and only once near the proximal ends (Figure 3). Linear division of the chromatin (Figures 17 & 18) as described by Peirce (1973) was also seen but was uncommon. Irregular forms were uncommon (Figures 4, 15 & 18).

Most of the parasites occupied a polar position within the host erythrocyte and in the heavy infection of the type specimen two parasites per host cell were common (Figures 11, 15, 17 & 18).

Basis of description. Hapantotype: Blood smear No. 118192 from the jackass penguin *Spheniscus demersus* collected by J.J. Brossy in September 1990, from a bird originating from Muizenberg, Cape coast, Republic of South Africa. **Parahapantotypes:** Bloodsmears Nos 118193, 118194 and 118195 from jackass penguins originating from Plettenberg Bay, Fish Hoek and Muizenberg, Cape coast, Republic of South Africa.

Comments. Morphologically, *B. peircei* and *B. krylovi* differ from all the other avian *Babesia* spp. in that the merozoites have their chromatin placed in the distal half of the parasite and not proximally, i.e. near to the area where they were attached to each other, as was illustrated for *B. balearicae* by Peirce (1973) or for *B. emberizica, B. mujunkumica, B. kazachstanica, B. rustica* and *B. frugilegica* by Jakunin & Krivkova (1971). Jakunin & Krivkova (1971, Figure 25) found *B. krylovi* to be positioned mostly alongside the erythrocyte nucleus and less often polarly whereas in *B. peircei* parasites alongside the erythrocyte nucleus were rare. The 'cow udder' form, however, clearly identifies *B. peircei*.

The development of *Babesia peircei* has not been followed in the circulating blood. However, a possible developmental sequence might consider that Figures 2 & 6 represent the youngest stages of the parasite in the blood, which develop into parasites as seen in Figures 7 & 17, with a further development of chromatin laterally as in Figure 9. From Figure 9 the parasite develops into the 'cow's udder' form seen in Figures 1 & 14, which develops into the four attached merozoite stage seen in Figure 11 & 16 and finally maturing into the four discrete merozoites seen in Figures 8, 10 & 12.

It seems most likely that ticks act as vectors of avian *Babesia* spp. (Mohammed 1958; Schurenkova 1938) although *Hyalomma excavatum* is the only tick species which has been found to be definitely associated with avian piroplasmosis (Hoogstraal 1956). The most common tick on the off-shore islands along the Cape coast is the argasid *Ornithodoros capensis* (Brooke & Crowe 1982). However, argasid ticks have as yet not been implicated as vectors of *Babesia*. Furthermore the abundance of this tick against the relative scarcity of *Babesia peircei* will probably rule out this tick as the vector. It seems more likely that the less common *Ixodes uriae*, which is widespread along the South African coast and feeds on marine birds (Walker 1991) is the vector for *Babesia peircei*, as ixodid ticks are the natural vectors for many other *Babesia* species (Walker 1974). It is possibly of some significance that although *Ixodes uriae* is the only tick feeding on alcids and gulls in the densely populated colonies off the coast of Newfoundland, none of the over 500 assorted alcids examined have been parasitized with this haematozoan. Peirce & Feare (1978) suggested that another ixodid tick *Amblyomma loculosum* might have been the vector of the piroplasm found in the masked boobies.

On the basis of both the morphology discussed as well as the indications that the hosts and probable vectors are ecologically separated from any other of the valid avian *Babesia* spp., we conclude that *Babesia peircei* is a distinct species. We further conclude that although the jackass penguin is the only known host at this stage, other seabirds might be hosts as the vectors probably feed on many different bird species in the seabird colonies where they occur.

We name this parasite *Babesia peircei* in honour of Dr Michael A. Peirce in recognition of his contribution to our knowledge of avian haematozoa in general but especially of the avian *Babesia* spp.

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