The Historical Background of Heartwater

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Abstract
Heartwater is a disease of cattle, sheep, goats and some wild ruminants that is caused by a rickettsia, previously known as *Cowdria ruminantium* but recently reclassified as *Ehrlichia ruminantium*, which is transmitted by the bont tick (*Amblyomma*). Typically the disease, which usually results in death, is characterized by high fever, nervous signs, and the accumulation of fluid in the lungs, brain, thoracic cavity and sac around the heart. It is one of the major causes of stock losses in sub-Saharan Africa.

Introduction
The first reference to what probably could have been heartwater was made in South Africa by the Voortrekker pioneer, Louis Trichardt in 1838. On the 9th of March he mentions a fatal disease, "nintas", amongst his sheep, following on a massive tick infestation approximately 3 weeks previously and which is described in his diary on the 17th of February 1838. Almost 50 years later a farmer, John Webb, reported to the Cattle and Sheep Disease Commission in Grahamstown, on a disease, which apparently, by then, was generally known as heartwater. He was of the opinion that the disease was introduced into the Eastern Cape at about the same time that William Bowker found a bont tick on a cow which was imported from Zululand in approximately 1837. The disease was subsequently reported from various parts of South Africa, but due to confusion with other conditions, such as verminosis and pasture deficiencies, all the earlier information regarding the incidence of heartwater cannot be fully relied upon. It will, no doubt, be interesting to study other historical documents of the previous century in order to fill the gaps in our knowledge regarding the possible introductions and spread of the disease in South Africa, or for that matter, in Africa. Confusion with other prevalent diseases with unknown aetiologies at that time will, however, make this a very difficult task.

There is, therefore, still no definite answer to the question whether heartwater is a disease indigenous to the African continent or whether it is an imported one. The resistance to heartwater exhibited by Persian sheep which were introduced into South Africa during 1872 suggested that a possible reason for their resistance could have been previous contact with the disease in their countries of origin. However, heartwater was known in South Africa long before the first importation of Persian sheep and although certain *Amblyomma* species occur on the Asian continent, there is no evidence that the disease exists in that part of the world. To date the occurrence of heartwater has only been confirmed in parts of Africa and on certain Caribbean islands, where it has probably been introduced during the slave trade. Apart from the distribution of 2 American *Amblyomma* species (*A. maculatum* and *A. cajennense*) which were found to be capable of transmitting the disease in the laboratory, the distribution of heartwater, in general, corresponds closely to that of its recognized vectors. All the existing information has been consolidated in the form of a global distribution map by Provost and Bezuidenhout and, although not conclusive, suggests that heartwater is an indigenous disease of Africa.

The history of heartwater research is a story of great dedication and perseverance of many workers in this field. Progress has, however, been relatively slow and there have been few significant breakthroughs. The mere fact that research over more than a century has still not provided a satisfactory method of control is a clear indication of the great difficulties that researchers have had to deal with.

The first major breakthrough came when it was proved by the end of the 19th century that the disease could be produced artificially by the intravenous inoculation of blood from sick to susceptible animals. Despite the fact that no organisms could be demonstrated in the blood or other tissues of diseased...
animals, it was concluded that heartwater is caused by a living micro-organism, at that time believed to be a filterable or ultraviolet virus. At about the same time the long-standing suspicion that the bont tick (A. hebraeum) is the vector of heartwater in South Africa was confirmed. These discoveries made it possible to reproduce heartwater in the laboratory and from then on much attention was given to defining the disease in order to develop some form of control.

One of the most important discoveries was made at Onderstepoort by Cowdry, a visiting rickettsiologist from the Rockefeller Institute for Medical Research in New York. He confirmed the suspicion of Sir Arnold Theiler that heartwater is caused by a rickettsia, by successfully demonstrating the organisms in the tissues of affected animals and in infected ticks. He also named the aetiological agent of heartwater Rickettsia ruminantium. The name was later changed to Cowdria ruminantium. This discovery also led to the development of an easy and practical method for the diagnosis of the disease, the so-called brain squash technique which is still widely used for the diagnosis of heartwater today.

Over the years the susceptibility of wild and laboratory animals received much attention, and proof was obtained that the blesbok (Damaliscus albifrons), the black wildebeest (Connochaetes gnou) and the springbok (Antidorcas marsupialis) are susceptible to heartwater, or that they can act as asymptomatic carriers of the disease. Since the earliest days it was realized that animals which recovered from the disease were subsequently immune. Extensive studies on the immunity of heartwater by Neitz and co-workers merit special reference. These studies still form the basis of our knowledge of immunity to heartwater, especially with reference to its duration in sheep. They also provided evidence that circulating organisms are detectable in the peripheral circulation of immune sheep following reinfection, irrespective of whether a demonstrable reaction is produced or not.

A major breakthrough with regard to the control of heartwater was the discovery by Neitz of an effective chemotherapeutic agent, the sulphonamide drug ‘Uleron’, against the disease.

The successful in vitro cultivation of C. ruminantium by Bezuidenhout and co-workers was another milestone in heartwater research. It opened many new avenues which led to improved diagnostic and serological methods and hopefully will one day lead to the development of a practical and safe method of immunization. Since this breakthrough a wealth of information on many aspects of the disease and its causative organism has recently become available and was reviewed by Allsopp, Bezuidenhout and Prozesky. The most recent revision of the order Rickettsiales abolishes the genus Cowdria in favour of Ehrlichia and the causative agent of heartwater is now called Ehrlichia ruminantium.

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References


