

The Global Distribution of Lyme Disease

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Following the original description of erythema chronicum migrans (ECM) in Sweden in 1909, ECM became widely recognized in Europe. The first reported case of ECM acquired in the United States occurred in 1969, and in 1975 the full symptom complex now known as Lyme disease was recognized. In 1981, cases of Lyme disease were recognized in yet a third continent, Australia and, to date, cases acquired in at least 19 countries have been reported. Beginning with the original case reported in Sweden, clinical observations suggested that *Ixodes ricinus* ticks were a vector for ECM in Europe and the distribution of cases in Europe corresponds to the distribution of this tick, although one case outside this range has been reported following mosquito bites. Through similar observations, *I. dammini* and *I. pacificus* ticks have been established as vectors in the United States. In Australia, a vector has not been established, and none of the recognized vectors of Lyme disease occur there. The reporting of cases of Lyme disease from widely separated parts of the world involving multiple vectors suggests the disease may, in the future, be recognized in additional areas.

Erythema chronicum migrans (ECM), the skin lesion characteristic of Lyme disease, was originally described by Afzelius in Sweden in 1909 [1]. Subsequently, ECM has been recognized in at least 18 additional countries on three continents. Before the recognition of ECM in the United States in 1969 [2] and in Australia in 1981 [3], however, ECM was well described, and the vector identified, in the European literature.

Afzelius, in his original description, noted that the disease had occurred after a tick bite. A tick vector was also recognized by subsequent European investigators and this tick was identified as *Ixodes ricinus*, widely distributed in Europe from the coastal areas of Scandinavia to northern Spain and northern Italy in the south [4]. At least one case of ECM, however, acquired in northern Sweden outside the recognized distribution of *I. ricinus*, has been ascribed to a mosquito vector [5]. In the United States, the recognized vectors are *I. dammini* and *I. pacificus* [6], ticks closely related to *I. ricinus*. In Australia, however, ticks have not been implicated, as cases were acquired after the bites of unknown insects. Interestingly, in Australia, no ticks reported to bite humans belong to the *I. ricinus* tick complex [7]. Thus, although only three closely related ticks are presently recognized as documented vectors of ECM, the occurrence of a case in Sweden ascribed to the bite(s) of mosquitoes and the cases occurring in Australia suggest that other vectors may eventually be described.

In Europe, shortly after Afzelius' report, Lipschütz in 1913 described ECM occurring in Austria [8]. Subsequently, ECM has been reported from all the Scandinavian countries, England and Scotland in Great Britain, and all the countries of western Europe, with the exception of Greece. In eastern Europe, cases have been reported from Czechoslovakia, Romania, and Russia.

The first case of ECM reported from the United States was acquired in Wisconsin in 1969 [2]. It was not until 1975, however, that researchers from Yale University School of Medicine, investigating an unusual cluster of cases of arthritis in Connecticut, again recognized ECM acquired in the United States and shortly thereafter described the full clinical spectrum of Lyme disease [9]. Subsequently, Lyme disease has been recognized in three broad geographical areas: the coastal areas of the Northeast (Massachusetts to Virginia), the Midwest (Minnesota and Wisconsin), and California, Nevada, and Oregon in the West [6,10]. These areas roughly correspond to the recognized distribution of *I. dammini* (in the Northeast and Midwest) and *I. pacificus* (in the West). Individual cases have also been reported from Georgia [10] and Arkansas [11], and two cases were reported from North Carolina [12]. Similarly, unpublished individual cases meeting a clinically defined case definition were reported in 1982 from Utah and western Pennsylvania, additional areas far removed from recognized endemic areas [13]. For the moment, it may be prudent not to consider these areas as endemic until additional cases are recognized in the areas or the clinical diagnosis can be confirmed by serologic or culture evidence.

In Australia, in 1982, cases were reported from the Hunter Valley, north of Sydney [3]. No cases from other areas are known to Australian health authorities [Editor, Communicable Diseases Intelligence—Australia: personal communication].

Whether the long time interval (more than half a century) between the first descriptions of ECM in Europe and its recognition in North America and Australia is due to simple lack of recognition or to spread of the organism causing Lyme disease [14] in some unknown manner is unclear. In either event, it is likely that we may see Lyme disease diagnosed in additional areas not currently thought to be endemic.

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