

OCCURRENCE OF ROCKY MOUNTAIN SPOTTED FEVER IN RELATION TO CLIMATIC, GEOPHYSICAL, AND ECOLOGIC VARIABLES

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Abstract. To study the time of onset of cases of Rocky Mountain spotted fever (RMSF) in relation to mean winter temperature, average daily solar radiation, elevation, and potential climax vegetation, we analyzed cases of RMSF from a 19-state area in the southeastern United States during the years 1970–1980 according to the counties in which patients resided. A bimodal incidence of RMSF, with peak onset of cases in mid-May and in mid-July, was noted in the oak-hickory-pine, oak-hickory, and Appalachian oak zones of potential climax vegetation during the years 1970–1974. In 1975–1980, however, coincident with an increase in incidence of RMSF, a single peak of illness in mid-June was observed in the oak-hickory-pine zone, where the number of cases of RMSF was highest; bimodality persisted in the oak-hickory and in the Appalachian oak zones. Analysis of cases in the zones in which bimodality persisted indicated that the first peak of illness may predominate in northern, cooler areas, and the second peak, in southern, warmer areas.

Epidemiologic information collected for cases of Rocky Mountain spotted fever (RMSF) in the United States during the years 1970–1974 indicated a bimodal occurrence of the disease, with peak onsets of illness in mid-May and in mid-July each year.¹ This observation could not be explained, but was thought to be related to the tick vectors of the disease. We analyzed cases of RMSF reported in the following 6-year period (1975–1980) and found that, in addition to the increase in cases reported previously,^{2,3} bimodality was not as apparent (Fig. 1).

To explore the reasons for this apparent change from a bimodal to a single peak of illness, we analyzed cases of RMSF in 1970–1980 in 19 eastern and southeastern states (from which 94% of the cases were reported) by various climatic, geophysical, and ecologic variables that might affect the incidence of the disease—potential climax vegetation,^{4,5} mean winter temperature,⁶ average daily solar radiation,⁶ and elevation⁶—according to the counties in which patients resided.

The most significant findings pertained to the three zones of potential climax vegetation from which the greatest numbers of cases (75% of the total) were reported during the study period. While bimodality was apparent in all three of these zones in 1970–1974 (data not shown), a single peak of illness was observed in the oak-

hickory-pine zone in 1975–1980, while bimodality appeared to persist in the oak-hickory and in the Appalachian oak zones (Fig. 2). Analysis of cases in the oak-hickory-pine zone by 2- and 3-year periods (1970–1972, 1973–1974, 1975–1976, 1977–1978, 1979–1980) revealed a gradual shift from a bimodal incidence of disease to a single peak of illness, with the greatest change occurring between 1973–1974 and 1975–1976 (data not shown). In the oak-hickory and in the Appalachian oak zones, we compared cases occurring in the first peak of illness with those in the second peak during the years 1970–1980 and found that the first peak tended to be associated with cooler northern areas with smaller amounts of solar radiation, while the second peak tended to be associated with warmer southern areas with greater amounts of solar radiation. However, only a few of these associations were statistically significant (data not shown).

Analysis of only those cases of RMSF in 1970–1980 that were laboratory confirmed (53% of the total) did not change any of the observations noted above.

Potential problems inherent in this analysis are incomplete reporting of RMSF, the assignment of cases to the county of residence (not necessarily the county in which infection was acquired), and inability to consider patterns of land use and microenvironments within counties. Nevertheless, the findings suggest that, in addition to the greater number of cases of RMSF

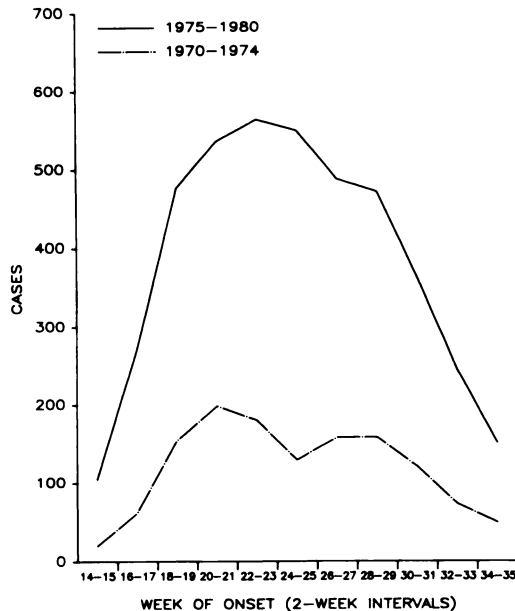


FIGURE 1. Cases of Rocky Mountain spotted fever by week of onset, United States, 1970-1980.

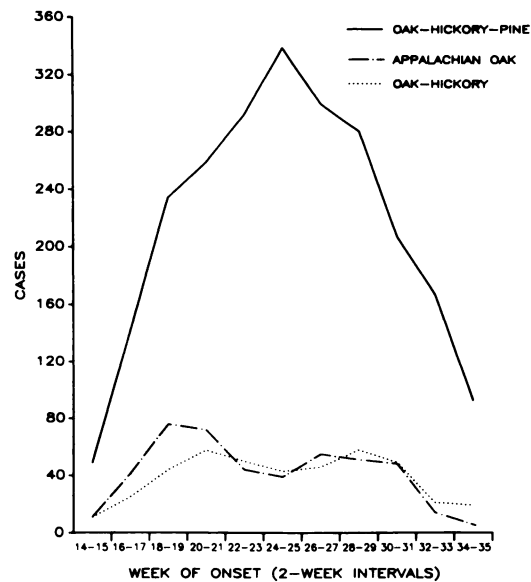


FIGURE 2. Cases of Rocky Mountain spotted fever by week of onset and potential climax vegetation zones, United States, 1975-1980.

reported in the United States in 1975-1980 when compared with the previous 5-year period, there was a qualitative change in the occurrence of illness between these two periods, namely, the loss of a bimodal incidence of the disease in the oak-hickory-pine zone in 1975-1980, when compared with 1970-1974.

A bimodality in the adult population of *Dermacentor variabilis*, the primary tick vector of RMSF in the eastern United States, has been reported in southeastern Massachusetts and in Virginia—the first peak representing overwintering adults, and the second peak, immature ticks that become adults later in the season.^{7,8} The question of whether seasonality and/or any other phenomena related to tick populations can explain bimodality or the changes observed in the oak-hickory-pine zone between 1970-1974 and 1975-1980 cannot be answered by our data.

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