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Spring's Warmth and Humidity: A Perfect Storm for Hard Tick Activity

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ABSTRACT

While spring is a time for rebirth, ticks are also back. The likelihood of tick-borne infections increases when temperatures rise because these tiny parasites become more active. But what impact do meteorological factors like humidity, temperature, wind, and precipitation have on tick activity, and what does the spring forecast for this year mean? This review aims to discuss how the climate and seasonal changes affect the tick activities. Concerns regarding the effects of environmental conditions on tick abundance and dispersion, as well as the prevalence and spread of tick-borne infections, are raised by recent advancements in climate research, as well as by deeper understanding of tick-pathogen relationships, tick distribution, and tick-borne pathogen detection. It is usually challenging to separate the effects of human behavior from those influencing tick host abundance, even while climate surely affects tick distribution and seasonal abundance. Disease spread by ticks can be challenging to determine whether changes are caused by global warming or other factors since systems are complicated.

Keywords: Climate change, Hard tick, Tick activity, Tickborne disease, Pathogens

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Introduction

Hard ticks are obligate external parasite of animals and humans. They are found in the Arctic and tropical regions of the planet and belong to the category Acari, order Parasitiformes, and suborder Ixodida. Despite efforts to manage tick infestations, ticks and the diseases they spread remain a major global health concern for both humans and animals (1).

Hard tick-borne diseases appear to be on the rise globally, based on a number of events that took place in the last decades of the 20th century and the early years of the 21st. Rocky Mountain spotted fever in Arizona, the United States, and Baja California, Mexico; Crimean-Congo hemorrhagic fever in the north of Turkey and the southwestern regions of the Russian Federation; Kyasanur forest disease in Karnataka state, India; and tick-borne encephalitis in Central and Eastern Europe are among the recent national and regional outbreaks of well-known illnesses (2, 3, 4). The number of unique and epidemiologically significant diseases spread by ticks has significantly expanded during the past 30 years on a global scale. For instance, since 1984, around ten novel spotted fever rickettsioses have been discovered (5, 6).

Effect of climate on the activity of Tick

Estimating the location and time at which a population is susceptible to infection by a pathogen is one of the main public health concerns in the field of infectious diseases. Such forecasts, in the case of vector-borne illnesses, frequently call for a thorough ecological understanding of the vector life cycle and the environmental factors that either facilitate or hinder its formation and maintenance (7). The etiological agents of zoonotic illnesses are primarily spread by ticks. Worldwide, the importance of tick-borne illnesses to public health is growing (8, 9). The frequency of human-infected vector-borne agent interaction, which is impacted by both biotic and abiotic variables, determines the risk of infection (9).

Every organism that interacts with the outside world is a part of its own climate envelope, which establishes the range of temperatures in which its populations can thrive. Because some ticks have a limited climate envelope and require particular climate conditions, their geographic distribution is likely to be fairly limited, making it more likely that changes in climate will affect their population size and range compared to ticks with wider distributions (10, 11).

The ability of ticks to survive and mature into life stages that can spread diseases to people is impacted by temperature and moisture levels throughout crucial stages of tick growth and activity (12). While nymph host-seeking peaks in late spring and early summer, nymph development is most crucial in late winter and early spring (12). During these two times, nymph survival and host-seeking activities may both be enhanced by warm, humid weather. Nymph activity is reduced by hot, dry summer weather (13). Humidity and temperature have an impact on people's outdoor leisure behavior. People are generally more active outside during the warmer months. During times of intense heat or high humidity (i.e., when the heat index is high), people also tend to be less active. It has been difficult to measure the respective contributions of the two factors, but it is believed that the late spring/summer peak in human incidence of tick-borne diseases is caused by the small size of nymphs and the temporal synchronization of nymph activity with the peak of human outdoor activity (14, 15).

In addition to tick growth and mortality, climate can also impact on the tick activity rates, which has a significant impact on human infestation risks and the severity of tick-related illnesses in the reservoir hosts. Ticks use a process called questing to locate a host, climb on it, and feed. Ticks search the plants at different heights, depending on variables like relative humidity and temperature (16, 17, 18).

Conclusion

In order to forecast tick distribution, both present and future, or even specific phenological patterns, a number of reliable programs use environmental factors as drivers. A number of climatic characteristics and conditions, which are obviously complex, control tick vector populations. Nevertheless, the "risk," which is defined as the likelihood that humans will contract diseases spread by ticks, depends on a wide range of genetic factors (at the infectious agent, tick, and host levels), social variables, and the dynamics of competent reservoir hosts, which adds even more complexity.

References

[1] de la Fuente J, Almazán C, Blouin EF, Naranjo V, Kocan KM. Reduction of tick infections with Anaplasma marginale and A. phagocytophilum by targeting the tick protective antigen subolesin. Parasitol Res. 2006 Dec;100(1):85-91. doi: 10.1007/s00436-006-0244-6. Epub 2006 Jul 1. PMID: 16816958.

[2] Randolph SE. Tick-borne encephalitis incidence in Central and Eastern Europe: consequences of political transition. Microbes Infect. 2008 Mar;10(3):209-16. doi: 10.1016/j.micinf.2007.12.005. Epub 2007 Dec 23. PMID: 18316221.

[3] Maltezou HC, Andonova L, Andraghetti R, Bouloy M, Ergonul O, Jongejan F, Kalvatchev N, Nichol S, Niedrig M, Platonov A, Thomson G, Leitmeyer K, Zeller H. Crimean-Congo hemorrhagic fever in Europe: current situation calls for preparedness. Euro Surveill. 2010 Mar 11;15(10):19504. PMID: 20403306.

[4] Ismael SS, 2023. Rocky mountain spotted fever. In: Aguilar-Marcelino L, Younus M, Khan A, Saeed NM and Abbas RZ (eds), One Health Triad, Unique Scientific Publishers, Faisalabad, Pakistan, Vol. 3, pp: 53-59. https://doi.org/10.47278/book.oht/2023.77

[5] Parola P, Paddock CD, Raoult D. Tick-borne rickettsioses around the world: emerging diseases challenging old concepts. Clin Microbiol Rev. 2005 Oct;18(4):719-56. doi: 10.1128/CMR.18.4.719-756.2005. PMID: 16223955; PMCID: PMC1265907.

[6] Paddock CD, Finley RW, Wright CS, Robinson HN, Schrodt BJ, Lane CC, Ekenna O, Blass MA, Tamminga CL, Ohl CA, McLellan SL, Goddard J, Holman RC, Openshaw JJ, Sumner JW, Zaki SR, Eremeeva ME. Rickettsia parkeri rickettsiosis and its clinical distinction from Rocky Mountain spotted fever. Clin Infect Dis. 2008 Nov 1;47(9):1188-96. doi: 10.1086/592254. PMID: 18808353.

[7] Hauser G, Rais O, Morán Cadenas F, Gonseth Y, Bouzelboudjen M, Gern L. Influence of climatic factors on Ixodes ricinus nymph abundance and phenology over a long-term monthly observation in Switzerland (2000-2014). Parasit Vectors. 2018 May 8;11(1):289. doi: 10.1186/s13071-018-2876-7. PMID: 29739424; PMCID: PMC5941567.

[8] Lommano E, Bertaiola L, Dupasquier C, Gern L. Infections and coinfections of questing Ixodes ricinus ticks by emerging zoonotic pathogens in Western Switzerland. Appl Environ Microbiol. 2012 Jul;78(13):4606-12. doi: 10.1128/AEM.07961-11. Epub 2012 Apr 20. PMID: 22522688; PMCID: PMC3370488.

[9] Randolph SE. The shifting landscape of tick-borne zoonoses: tick-borne encephalitis and Lyme borreliosis in Europe. Philos Trans R Soc Lond B Biol Sci. 2001 Jul 29;356(1411):1045-56. doi: 10.1098/rstb.2001.0893. PMID: 11516382; PMCID: PMC1088499.

[10] Gilbert L. The Impacts of Climate Change on Ticks and Tick-Borne Disease Risk. Annu Rev Entomol. 2021 Jan 7; 66:373-388. doi: 10.1146/annurev-ento-052720-094533. PMID: 33417823.

[11] Ismael SSB. Hyalomma asiaticum asiaticum. Biological Times Magazine. 2023; 2(9): 2

[12] Levi T, Keesing F, Oggenfuss K, Ostfeld RS. Accelerated phenology of blacklegged ticks under climate warming. Phil. Trans. R. Soc., 2015; B 370: 20130556. http://dx.doi.org/10.1098/rstb.2013.0556

[13] Burtis JC, Sullivan, P, Levi T. et al. The impact of temperature and precipitation on blacklegged tick activity and Lyme disease incidence in endemic and emerging regions. Parasites Vectors 9, 606 (2016). https://doi.org/10.1186/s13071-016-1894-6

[14] Heaney CD, Moon KA, Ostfeld RS, Pollak J, Poulsen MN, Hirsch AG, DeWalle J, Aucott JN, Schwartz BS. Relations of peri-residential temperature and humidity in tick-life-cycle-relevant time periods with human Lyme disease risk in Pennsylvania, USA. Sci Total Environ. 2021 Nov 15; 795:148697. doi: 10.1016/j.scitotenv.2021.148697. Epub 2021 Jul 1. PMID: 34252768.

[15] Lin S, Shrestha S, Prusinski MA, White JL, Lukacik G, Smith M, Lu J, Backenson B. The effects of multiyear and seasonal weather factors on incidence of Lyme disease and its vector in New York State. Sci Total Environ. 2019 May 15; 665:1182-1188. doi: 10.1016/j.scitotenv.2019.02.123. Epub 2019 Feb 8. PMID: 30893749.

[16] Vail SC, Smith G. Vertical movement and posture of blacklegged tick (Acari: Ixodidae) nymphs as a function of temperature and relative humidity in laboratory experiments. J Med Entomol. 2002 Nov;39(6):842-6. doi: 10.1603/0022-2585-39.6.842. PMID: 12495181.

[17] Busby AT, Ayllón N, Kocan KM, Blouin EF, de la Fuente G, Galindo RC, Villar M, de la Fuente J. Expression of heat shock proteins and subolesin affects stress responses, Anaplasma phagocytophilum infection and questing behaviour in the tick, Ixodes scapularis. Med Vet Entomol. 2012 Mar;26(1):92-102. doi: 10.1111/j.1365-2915.2011.00973. x. Epub 2011 Jul 22. PMID: 21781141.

[18] Ismael, S. S., and L. T. Omer. "Molecular identification of new circulating Hyalomma asiaticum asiaticum from sheep and goats in Duhok Governorate, Iraq." (2021): 79-83.