

**The Lone Star Tick, an Actant in the Actor-Network of the US Army
A STS Research Paper Submitted to the**

Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements of the Degree

Bachelor of Science, School of Engineering


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Spring 2021

On my honor as a University Student, I have neither given nor received
unauthorized aid on this assignment as defined by the Honor Guidelines
for Thesis-Related Assignments

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Introduction

In 2009, at the University of Virginia, Dr. Scott Commins and Dr. Thomas Platts-Mills along with many others established a link between tick bites and the formation of IgE antibodies to galactose-alpha-1,3-galactose, or alpha-gal. (Commins et al, 2011) This means people with the bite from a certain tick develop the chance to have an allergic reaction to a carbohydrate found in mammalian meat. They found specifically this was expanding in the Southeastern United States, which is where the range of the lone-star tick, *Amblyomma Americanum*, was expanding into at the same time, finding evidence of link between the two.

The STS research paper aims to develop a link between the lone-star tick and the actor network of the US Army. The US Army is a huge actor-network within the US. The US Army is the primary land force of the US military, meaning soldiers spend time in the field. Due to this mission, the Army has identified readiness as a primary focus. The soldier's exposure ticks are why the tick is an actant within the Army's actor-network system. Tick bites can cause a number of health issues by introducing illnesses to the hosts, impacting the readiness of the force.

Literature Review

In August of 2020 I spent a week at Fort Pickett in Virginia, in the subsequent months I noticed that I would have a mild allergic reaction every time I consumed beef. After not eating red meat for a few weeks, I got tested and found out that I had trace amounts of IgE titers towards the sugar galactose-alphas-1,3-galactose which is found in mammalian meat, such as pork, lamb, and beef. This limited my diet and knowing I would be joining the Army following graduation I began to think about this condition. I began researching the specific allergy, commonly known as the alpha-gal allergy and colloquially known as the red meat allergy. I then

began researching the way it spreads since this allergy is a tick-borne illness, spread by the lone star tick. At the same time, I researched the Army's menus and base locations in order to see how many posts are located within the expanding range of the lone star tick. I researched what the Army studied about pests, how to fight these pests, and how these strategies affected the health of the soldiers.

Methodology

The research for this paper was conducted online using a variety of sources. The sources include academic peer reviewed journals. These journals are primarily used to establish a baseline of knowledge of what the allergy is, how it is transmitted, how it is fought, and how those methods impact soldiers' bodies. This allergy was discovered very recently so there is not a plethora of information detailing its spread, effects, and combat. The other sources used were Department of Defense sources that detail information on the combat rations, Meals-Ready-to-Eat (MRE), options and the location of Army bases. These sources allow me to build a connection between the effects of the location of the base and the expansion of the tick's range. This connection proves the importance of mitigating soldiers' exposure to ticks, developing ways to combat the spread, and dealing with the effects of the tick bites. The research also let me formulate second order effects of how the Army is dealing with not only this pest but the wide variety of pests soldiers encounter in the field.

Body of the Paper

The Army has identified readiness as one of its primary focuses, which requires keeping soldiers healthy and trained, requiring the Army to account for health in the field. Ticks are a small arthropod that spread disease through their bites. The lone-star tick, *Amblyomma*

Americanum, is a tick that originated in western Texas and now spans to Maine. It is reported that 10 soldiers had over 100 of these ticks in a two-week period during a training event at Little Rock AFB in Arkansas (Goddard & Varela-Stokes, 2008). This expansion of range and exposure to tick borne illnesses is why the lone-star tick is an actant in the actor-network of the Army.

The lone-star tick has symbiotic relations with two common genera of pathogens. The first is the Rickettsia genus of bacteria, which are responsible for Rocky Mountain Spotted Fever (RMSF) and American Boutoneusse Fever, both of which have been confirmed by transmission studies. The second type is the Ehrlichia genus, which are responsible for Human Ehrlichiosis and Human Monocytic Ehrlichiosis, these have also been verified by transmission studies (Goddard & Varela-Stokes, 2008). This existing relationship between the tick and these pathogens can be used to theorize new relationships. As previously theorized in Australia, ticks could be responsible for spreading a red meat allergy (Commins & Platts-Mills, 2014). In this 2014 study, the relationship between RMSF and the tick was used to link the red meat allergy and the lone-star tick, which has been further developed through the rise in allergy cases and lone-star tick bites.

The alpha-gal allergy, commonly red meat allergy, is spread by the lone-star tick. This tick-borne illness causes the host to develop immunoglobulin E (IgE) titers towards the sugar structure galactose- α -1,3-galactose which is found in beef, lamb, and pork (Khoury, Khoury, Schaefer, Chitnis, & Hassen, 2017). This 2017 study notes the allergy is typically self-diagnosable although there are laboratory tests, which characterize the allergy as IgE antibody levels higher than 0.35 kU/L. The patients in the study reports the IgE levels in follow on tests and related complications disappear when they stop consuming red meat.

The Army uses meals-ready-to-eat (MRE) as its current field ration. These are precooked meals that come in vacuum sealed bags and contain an entree, snacks, and dessert item. In the 2019 menus, the Army has 24 varieties of MRE menus and 14 of those have a form of red meat whether it is meatballs or a beef patty (Defense Logistics Agency, 2019). This source details the available menus going back to 2015; with 2018 having 15 out of 24 containing red meat; 2015, 2016, and 2017 each have 14 red meat main meals. Additionally, in the 24 total halal and kosher menu offerings, eight contain a red meat main meal (Defense Logistics Agency, no date). This means the majority of MRE offerings contain red meat, meaning affected soldiers have much fewer MRE choices available.

The lone-star ticks' range is from Texas to Maine, which covers the southern US as well as the East coast. In the early 2000s, it was found that 20% of patients and controls had IgE titers towards alpha-gal in southern states of Virginia, Tennessee, North Carolina, Arkansas, and southern Missouri (Commins & Platts-Mills, 2014). This is significant because of the amount of US Army bases located in this area. Virginia and North Carolina stand out because Virginia and Georgia have the most Army bases, with seven bases (US Army, 2016). North Carolina stands out because it is home to Fort Bragg, where approximately 57,000 soldiers call home and is one of the largest military bases in the world (US Army, 2018). The high number of soldiers living and training in the tick's range cause the illnesses and bites to be significant.

A survey of troops conducted from 1984 to 1988 found that 70% of those surveyed had problems with arthropods in field environments, including problems from bites to disrupting movement (Mehr, Echano, Rutledge, & Gupta, 1997). The survey found 28% of participants ranked ticks and chiggers to be the most troublesome pests and found 21% had gone to sick call due to these pests (Mehr, Echano, Rutledge, & Gupta, 1997).

In order to combat tick exposure, the Army started to impregnate field uniforms with permethrin which combats the lone-star tick at its recommended doses. Laundering the uniforms removes the permethrin over time so to mitigate this, a study was conducted in 2006 by Faulde and Uedelhoven to find the best impregnation method. The findings of this study indicated fabrics that were polymer coated with permethrin showed the same residuals after 100 launderings as the US Army IDA-kit did after six launderings (Faulde & Uedelhoven, 2006). This means that polymer coated uniforms are active in fighting ticks during the life of the uniform.

The Army mandated permethrin treated uniforms in 2013, with exceptions for allergies to the chemical and maternity uniforms. Since the uniform is in contact with skin, permethrin is absorbed and metabolized by the body into 3-phenoxybenzoic acid, 3-PBA, and urinated out (Maule, Scarpaci, & Proctor, 2019). This study used data from two US Army cohorts by collecting urine samples and comparing the 3-PBA levels to the average levels of Americans found in the National Center for Health Statistics. Comparing these two data sets, shows the Army cohorts had much higher concentrations of 3-PBA with the soldier's median concentration being three to four times higher than the 95th percentile of average US citizen. The effect of long-term exposure still requires tracking to be accurately determined (Maule, Scarpaci, & Proctor, 2019).

In 2017 was reported 71% of Americans between the ages of 17 and 24 are unfit for military service. (Strong, 2019) This means the pool the military can pull from has been drastically reduced from the general population. Pairing this statistic, with the issue of retention of soldiers, having more disqualifiers makes keeping military strength and manning more difficult. Having fewer soldiers and being less likely to recruit new ones makes it hard for the

Army to complete its mission. As demonstrated, the tick effects on the Army's readiness in multiple ways.

Conclusion

In conclusion, the lone-star tick, while a small and insignificant animal, is a threat to the Army's readiness and therefore a threat to the national security. The tick degrades mission readiness by limiting the food soldiers can consume and increasing their exposure to harmful chemicals. Not only does the lone-star tick introduce new allergic reactions to soldiers, it can also introduce numerous other dangerous tick-borne illnesses such as Rocky Mountain Spotted Fever. Coupling these consequences with the low percentage of eligibility found in America's youth, presents a serious challenge to Army leaders. The effects the tick has shows that it is an actant in the actor-network of the United States Army. These effects cause the Army to develop methods of limiting exposure as well as forcing leaders to develop ways of coping with past exposures

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