

Pushing past the limits: Application of electropenetrography to unmask the temporal details of tick feeding behaviors

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Ticks are significant pests and pathogen vectors for humans and animals. Billions of dollars are spent annually trying to control ticks and tickborne diseases. A significant knowledge gap exists regarding the details of tick feeding behavior and associated host interactions because mouthpart movements and salivation are masked by host tissue, restricting development and rigorous evaluation of tick and tick-borne pathogen control products. Electropenetrography (EPG) offers a profound solution to investigate on-host tick feeding behavior in real time. AC-DC EPG was used to monitor the on-host feeding behaviors of adult *Dermacentor variabilis* and *Amblyomma americanum*, two medically important tick species. Initial EPG recordings were performed during early stages of slow-phase tick feeding using an awake calf host. Applied voltage was 350 mV with R_i of 108 Ω . Both tick species exhibited discernable and stereotypical waveforms of low-, medium-, and high-frequencies. Similar waveform families and types were observed for both species; however, species-specific differences in waveform fine-structure were also observed. Tick waveforms were hierarchically categorized into three families containing seven types. Some waveform types were conserved by both species (e.g., Types 1b, 1c, 2b, 2c) while others were variably performed among species and individuals (e.g. Types 1a, 2a). R dominance suggested waveforms represent salivation. This study provides a proof-of-principle demonstration of the feasibility for using EPG to monitor, evaluate, and compare tick feeding behaviors, providing a foundation for future studies aimed at correlating specific feeding behaviors with waveforms, and ultimately the influence of control measures on tick feeding behaviors.