Three-dimensional epicuticular wax on plant surface reduces attachment and survival rate of *Salmonella* during storage

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Abstract

Salmonella is the second most common foodborne pathogen for leafy vegetables, therefore understanding how to reduce *Salmonella* attachment onto produce surface is crucial to combat salmonellosis. Epicuticular wax is the outermost layer on the leaf surface that directly interact with food pathogen attachment. The hydrophobic nature of epicuticular wax was found to increase pathogen resistance, however, there is limited study on if three-dimensional epicuticular wax on the leaf can reduce *Salmonella* attachment. This study aims to test whether the presence of three-dimensional epicuticular wax crystals decreases the attachment of *Salmonella* on leafy green surfaces. Using gum arabic paste, three-dimensional epicuticular wax was removed from three waxy plants (USVL188-NG, USVL115-NG, and 'Top Bunch' collard). Leafy surfaces in disks were dip-inoculated with a mixture of *Salmonella* Typhimurium and Tennessee at day 0, followed by aerobic storage at 4.0 ± 0.2 °C for 14 d. After 30-minute inoculation, significantly lower ($P < 0.05$) *Salmonella* were attached to plants with three-dimensional epicuticular wax, resulting in 3.27, 2.76, and 4.51 $\log_{10}$ CFU $cm^{-2,}$ respectively when compared to three glossy plants (USVL188-GL, USVL115-GL, and 'Green Glaze' collard greens) on XLT-4 agar. Attached *Salmonella* on gum arabic-treated plants were significantly lower than the untreated plants, suggesting that three-dimensional epicuticular wax reduced the attachment efficiency of *Salmonella*. The survival rate of *Salmonella* populations on three waxy plants were usually significantly lower ($P < 0.05$) than glossy plants during storage. From day-9 to day-14, the *Salmonella* population on 'Top Bunch' collard greens decreased faster and resulted in lower ($P < 0.05$) numbers than 'Green Glaze' collard greens (2.88–3.47 vs 4.41–4.82 $\log_{10}$ CFU cm^{-2}). The results implied that plant cultivars with three-dimensional epicuticular wax may be a safer choice for producers in terms of minimizing foodborne outbreak risks.