Honey bees can be found all around the world and fulfill key pollination roles within their natural ecosystems, as well as in agriculture. Most species are typically docile, and most interactions between humans and bees are unproblematic, despite their ability to inject a complex venom into their victims as a defensive mechanism. Nevertheless, incidences of bee stings have been on the rise since the accidental release of Africanized bees to Brazil in 1956 and their subsequent spread across the Americas. These bee hybrids are more aggressive and are prone to attack, presenting a significant healthcare burden to the countries they have colonized. To date, treatment of such stings typically focuses on controlling potential allergic reactions, as no specific antivenoms against bee venom currently exist. Researchers have investigated the possibility of developing bee antivenoms, but this has been complicated by the very low immunogenicity of the key bee toxins, which fail to induce a strong antibody response in the immunized animals. However, with current cutting-edge technologies, such as phage display, alongside the rise of monoclonal antibody therapeutics, the development of a recombinant bee antivenom is achievable, and promising results towards this goal have been reported in recent years. Here, current knowledge on the venom biology of Africanized bees and current treatment options against bee envenoming are reviewed. Additionally, recent developments within next-generation bee antivenoms are presented and discussed.