ABSTRACT

Banana production in East and Central Africa (ECA) is severely impacted by banana *Xanthomonas* wilt (BXW) disease caused by *Xanthomonas vasicola* pv. *musacearum* (*Xvm*). Currently, none of the banana cultivars grown in ECA is known to be resistant to BXW except for the wild inedible genotype, *Musa balbisiana*. Interestingly, incomplete systemic movement (ISM) of *Xvm* affects colonization of plant organs and the lateral shoots. Additionally, several studies have reported up to 70% recovery of BXW diseased plants. During pathogen infection, increased callose (a polysaccharide of β-1,3-glucan) deposition in the cell wall, plasmodesmata and site of infection presents one of the most effective first line of defense by forming a permeability barrier to slow down microbial colonization and transmission. Whether callose is involved in the reported ISM of *Xvm*, recovery of BXW diseased plants and the resistance of *M. balbisiana* to BXW, is not known. There is also need to develop a more efficient method of callose quantification since the conventional methods are labor-intensive, non-specific to callose and mostly qualitative. In this study, the role of callose in the reported i) ISM of *Xvm*, ii) low incidence of BXW in lateral shoots, iii) cases of recovery from BXW disease, and iv) resistance of *M. balbisiana* to BXW was investigated. Additionally, a new ELISA-based method for callose quantification was also developed. The experimental plants were inoculated with *Xvm* or sterile distilled water (control) and samples of leaves, pseudostems, corms and roots were collected at 0, 1, 2, 7, 14 and 28 days post inoculation. This study reported differential callose production in banana organs with the corm producing the highest ($P < 0.0001$). Therefore, differential callose production could be partly responsible for the reported i) ISM of *Xvm*, ii) low incidence of BXW in lateral shoots, iii) cases of recovery from BXW disease. Additionally, the ELISA-based method for callose quantification was specific, sensitive, reproducible and suitable for high-throughput studies. Contrary to the expectation of this study, there was no significant variation in callose production between the three banana genotypes ($P = 0.079$). Thus, the findings of the current study could inform the breeding of BXW resistant cultivars through enhanced callose production in the aerial organs of banana leading to enhanced ISM of *Xvm* and subsequent BXW recovery. The use of callose-based resistant cultivars and the BXW cultural management practices will ultimately eradicate BXW, increase banana production and subsequently contribute to the Sustainable Development Goals (SDGs) 2020/21 – 2024/25 which include SDG 1 (no poverty), SDG 2 (zero hunger) and SDG 3 (Good health and well-being).