

CHAPTER V

GENERAL DISCUSSION AND CONCLUSION

5.1 General discussion and conclusion

This thesis investigated two interconnected aspects of cassava–whitefly–virus interactions: (i) the role of trichome density across cassava cultivars in influencing *B. tabaci* infestations, and (ii) the transmission characteristics of SLCMV by *B. tabaci*. Together, these findings provide an integrated perspective on how plant morphological defenses and vector–virus biology shape cassava health and the epidemiology of CMD.

Whitefly infestation levels differed significantly among cassava cultivars and were strongly associated with trichome density. Cultivars such as Huaybong 60 and Rayong 72, which exhibited higher trichome densities, supported fewer whiteflies, while cultivars with lower trichome densities (e.g., CMR 89, Kasetsart 50, Rayong 4, Pirun 2) were more susceptible. Trichomes act as physical barriers, restricting whitefly landing, feeding, and oviposition, thereby reducing colonization and reproduction. This pattern is consistent with previous research on other crops, in which dense trichomes suppress whitefly survival and oviposition (Simmons et al., 2003; Lambert and Shah, 1999; Andrade et al., 2017). Although trichome size showed variable effects, density consistently emerged as the dominant resistance factor. The non-glandular trichomes observed in all cultivars further reinforce this physical barrier, underscoring the importance of structural traits as a first line of plant defense.

The investigation of SLCMV transmission dynamics revealed that successful virus acquisition by *B. tabaci* required at least 24 hours of feeding, with efficiency increasing markedly after 48 hours. Inoculation followed a similar trend: infections were detectable after 24 hours of exposure, although these plants often remained symptomless, indicating pre-symptomatic or low-titer infections. Such “silent carriers” pose a significant epidemiological risk, as they may act as hidden reservoirs for virus spread. By contrast, plants exposed to a 48-hour IAP developed visible CMD symptoms

viruses. These findings align with earlier reports on Indian and African cassava mosaic viruses, which also require extended feeding durations for efficient transmission (Antony et al., 2006; Kumar et al., 2014; Legg, 2008).

Integrating these results highlights the dual importance of host plant traits and vector–virus interactions in cassava disease dynamics. On the one hand, high trichome density reduces whitefly colonization and, indirectly, limits opportunities for virus transmission. On the other hand, the efficiency of SLCMV acquisition and inoculation underscores that even moderate whitefly infestations may contribute significantly to CMD spread when feeding durations are sufficiently long. Environmental factors, including temperature and photoperiod, further modulate whitefly population growth in the field, with warmer and longer-day conditions favoring outbreaks and amplifying the risk of virus transmission.

From a management perspective, these findings offer valuable implications for breeding and integrated pest management. Incorporating high trichome density into elite cassava cultivars presents a promising avenue for developing durable resistance to whiteflies and reducing transmission pressure. At the same time, the time-dependent nature of SLCMV acquisition and inoculation emphasizes the need for early intervention to minimize feeding opportunities, particularly during peak vector population periods. Monitoring asymptomatic infections is also critical, as reliance on visible symptoms alone may underestimate disease incidence.

In conclusion, this thesis demonstrates that trichome density is a key morphological defense trait conferring resistance to *B. tabaci*, while extended feeding periods are essential for efficient SLCMV transmission and systemic infection. The integration of plant resistance traits with insights into vector–virus transmission biology underscores the necessity of a multifaceted approach to CMD management. Future research should prioritize breeding for high-trichome cultivars, refining diagnostic tools to detect asymptomatic infections, and implementing integrated pest management strategies that account for seasonal vector dynamics. Collectively, these approaches will enhance cassava resilience, safeguard productivity, and reduce the burden of CMD in cassava-growing regions.

5.2 Reference

- Andrade, M.C., da Silva, A.A., Neiva, I.P. Oliveira, I.R.C. De Castro, EM., Francis, D.M., & Maluf, W.R. (2017). Inheritance of type IV glandular trichome density and its association with whitefly resistance from *Solanum galapagense* accession LA1401. *Euphytica*, 52, 213. doi:10.1007/s10681-016-1792-1
- Antony, B., Melzer, M. J., Uchida, J. Y., & Hunter, W. B. (2006). Transmission of Indian cassava mosaic virus by *Bemisia tabaci*. *Journal of Phytopathology*, 154(2), 93–97. doi:10.1111/j.1439-0434.2006.01064.x
- Kumar, J., Rabindran, R., Singh, H., & Kumar, P. (2014). Molecular studies on the transmission of Srilankan cassava mosaic virus (SLCMV) in cassava and cassava based crops. *Journal of Cell and Tissue Research*, 14, 4559-4564.
- Lambert, A.M., & Shah, P.J. (1999). Influence of glandular and non-glandular trichomes on oviposition and feeding behavior of the whitefly *Bemisia argentifolii*. *Environmental Entomology*, 28(4), 709–718.
- Legg, J. P. (2008). Epidemiology of a whitefly-transmitted cassava mosaic geminivirus pandemic in Africa. *Plant Virus Epidemiology*, 71, 233–257. https://doi.org/10.1007/978-1-4020-9210-9_13
- Simmons, A.T., Gurr, G.M., McGrath, D., & Nicol, H.I. (2003). Trichomes of *Lycopersicon* species and their effect on *Myzus persicae* (Sulzer) colonization. *Entomologia Experimentalis et Applicata*, 107(3), 221–230. doi:10.1046/j.1440-6055.2003.00376.x.