EVOLUTIONARY ASPECTS OF FIRST EVER KNOWN HORIZONTAL GENE TRANSFER BETWEEN PLANT AND *WHITEFLY Bemisia tabaci* TO DEVELOP PEST CONTROL STRATEGIES

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ABSTRACT

Plants produce toxic secondary metabolites as defense against insect pests. Yet most of the plants are the major food source for insects. *Phyllanthus* is a plant which belongs to the family Phyllanthaceae and is known for producing secondary metabolites of medicinal importance. We observed that Whitefly, *Bemisia tabaci*, can infect *Phyllanthus* plants inspite of presence of phenolic glucosides, a class of secondary metabolites toxic to most insects. As per recent publications, Whitefly has been shown to have acquired a gene coding for malonyl transferase from plants through horizontal gene transfer which can detoxify phenolic glucoside. This has enabled whitefly to infect a large number of plants including important crop plants. Studies suggests that Whitefly is a carrier of several plant viruses. Here we propose a model to expain how the evolution of whitefly may have occurred by acquisition of the plant gene through viruses which use both *Phyllanthus* and whitefly as hosts. This evolution of whitefly through acquisition of the gene has enabled it to infect a large number of plants. We suggest a RNAi technology to combat whitefly infestation of crop plants.

INTRODUCTION

Phyllanthus is a traditionally important plant ; rich in secondary metabolites yet infected with various pests one of which is whitefly. Following is the data collected by Cubists from all over India.We observed agricultural crops getting infected too.

Fig 1 :- *Phyllanthus urinaria*

Fig 2 :- Whitefly infestation study in CUBE HomeLabs

Whitefly

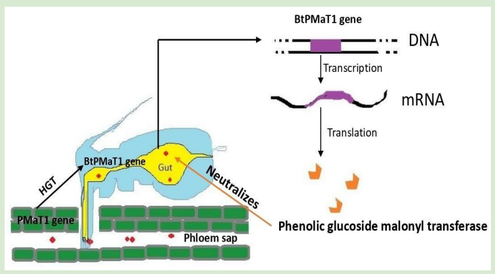
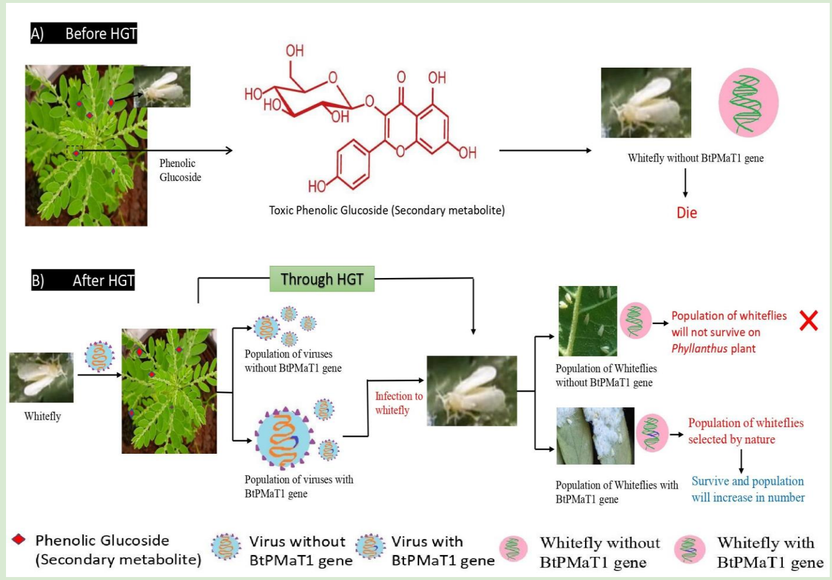


Fig 3 :- Mechanism of detoxification of phenolic glucoside in the gut of the whitefly

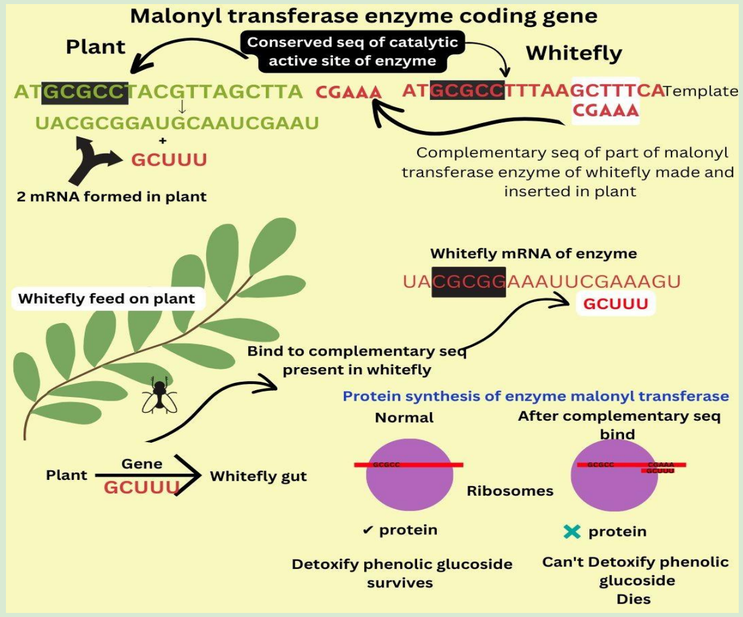
The disruption of the cellular structure that occurs when whiteflies feed on the phloem sap of *Phyllanthus* leaves causes molecules of phenolic glucoside (red) to escape the vacuole and enter the gut of the whitefly. White fly has acquired a gene, BtPMaT1, through HGT from plants (Xia et al., 2021) which produces the enzyme, phenolic glucoside malonyl transferase (orange), which can detoxify phenolic glucoside.

HYPOTHESIS

ROLE OF HORIZONTAL GENE TRANSFER IN EVOLUTION



RNAi as PEST CONTROL MECHANISM



CONCLUSION AND FUTURE WORK

Whitefly, *Bemisia tabaci*, has evolved to resist phenolic glucosides produced by *Phyllanthus sp.* plants through acquisition of a detoxifying gene, BtPMaT1, from plants. However, RNAi technology can be used to combat whitefly infestation of plants.

We plan to search for plants which exhibit natural resistance to whitefly infection and study the mechanism/s operating in these plants to resist whitefly infection.

***Phyllanthus* plants infested with whitefly**

Healthy Tomato plant infected with whitefly

REFERENCES

Czosnek, H., Hariton-Shalev, A., Sobol, I., Gorovits, R., & Ghanim, M. (2017). The incredible journey of begomoviruses in their whitefly vector. *Viruses*, *9*(10), 273.

Gilbert, C., & Maumus, F. (2022). Multiple horizontal acquisitions of plant genes in the whitefly Bemisia tabaci. *Genome Biology and Evolution*, *14*(10), evac141.

Leke, W. N., Mignouna, D. B., Brown, J. K., & Kvarnheden, A. (2015). Begomovirus disease complex: emerging threat to vegetable production systems of West and Central Africa. *Agriculture & Food Security*, *4*(1), 1-14.

Xia, J., Guo, Z., Yang, Z., Han, H., Wang, S., Xu, H., ... & Zhang, Y. (2021). Whitefly hijacks a plant detoxification gene that neutralizes plant toxins. *Cell*, *184*(7), 1693-1705.

Zhao, J. Q., Wang, Y. M., Lv, J. J., Zhu, H. T., Wang, D., Yang, C. R., & Zhang, Y. J. (2014). New phenolic glycosides from Phyllanthus cochinchinensis. Journal of the Brazilian Chemical Society, 25, 1446-1454.