

**CHARACTERIZATION AND CONTROL OF FIG  
MOSAIC DISEASE**

**By**

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**THESIS**

**Submitted in Partial Fulfillment of the  
Requirements for the Degree of**

**DOCTOR OF PHILOSOPHY**

**In**

**Agricultural Sciences  
(Plant Pathology)**

**Department of Plant Pathology  
Faculty of Agriculture  
Cairo University  
EGYPT**

**2022**

**Format Reviewer**

**Vice Dean of Graduate Studies**

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**Title of thesis:** Characterization and Control of Fig Mosaic Disease.  
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**Department:** Plant Pathology      **Date:** 1 / 8 / 2022

### ABSTRACT

Fig mosaic is a viral disease (FMD) that poses a significant threat to the economy of the fig production in Egypt. During the two growing seasons 2017 and 2018, fig leaves and fruits showing different symptoms associated with fig mosaic disease (FMD) were collected and differentiated from the most famous fig-growing governorates in Egypt, Marsa Matrouh, Ismailia and Giza. Pathogenicity tests of FMD viruses to some herbaceous and fig hosts through mechanical and graft transmission was carried out. Symptomatic samples were tested by RT-PCR using specific primers to assess the presence of FMV, FLMaV-1, FLMaV-2, FMaV, FLV-1, FFkaV and FCV. Three viruses were detected in mixed infections and showed positive results. FMV was detected with infection rate 49% followed by FLMaV-2 with infection rate 21.8% and FLMaV-1 with infection rate 10.9%, whereas all tested samples were negative for the other viruses.

The nucleotide sequence and phylogenetic analysis indicated that the Egyptian FMV isolate was closely related to other FMV isolates, especially the Argentina ones with 99% identity. While FLMaV-1 isolate showed more than 98% identity with Saudi Arabia FLMaV-1 isolate, on the other hand, the isolate of FLMaV-2 showed 100% identity with Italy FLMaV-2 isolate based on phylogenetic analysis. Transmission electron microscope (TEM) observations of thin-sectioned tissues from symptomatic leaves and fruits showed double membrane bodies (DMBs) characteristic for FMV particles.

Biochemical studies were made among three fig varieties *Ficus carica*, cv. sultany, *Ficus carica*, cv. kommathri and *Ficus carica*, cv. Kahramany that were infected with FLMaV-1, FLMaV-2 and FMV by mechanically and grafting transmitted. The phenolic contents increased in each of the three fig varieties comparing with healthy one. However, sugars, amino acids, indoles, chlorophyll a, chlorophyll b and carotenoids were reduced in each of the three fig varieties comparing with healthy one. For producing virus-free plant material, Two Egyptian fig accessions of local varieties (*Ficus carica* cv. Sultany and *Ficus carica* cv. kommathri) infected by FLMaV-1, FLMaV-2 and FMV were subjected to thermotherapy technique with hot water which was reliable for elimination from zero to 50% of fig viruses. However, elimination of the three viruses was possible though with cryotherapy technique with rates of removal from zero to 40% while cryotherapy coupled with thermotherapy was the most effective for elimination from 10 to 60% of fig viruses.

**Key words:** FMD, Fig viruses, RT-PCR, nucleotide sequence, grafting, DMBs, Biochemical studies, thermotherapy and cryotherapy.

## LIST OF ABBREVIATIONS AND SYMBOLS

bp	Base pair(s)
Cv.	Cultivar
Cvs.	Cultivars
DMBS	Double membrane bodies
DMSO	Dimethyl sulfoxide
E	Extinction coefficient
<i>et al.</i>	Et alii
FMD	Fig mosaic disease
FMV	Fig mosaic virus
FLMaV-1	Fig leaf mottle associated virus-1
FLMaV-2	Fig leaf mottle associated virus-2
FLV-1	Fig latent virus-1
FMMaV	Fig milde mottle associated virus
FCV	Fig cryptic virus
FFKaV	Fig fleck associated virus
FBV-1	Fig badnavirus-1
g/gm	Gram
ha	Hectare
hrs	Hours
HSP70	Heat shock protein 70
LS	Loading solution
M	Molar
mg	Milligram
ml	Mille
mm	Millemeter
nm	Nanometer
No.	Number
PDAB	$\beta$ -dimethylaminobenzaldehyde
pH	Potential of hydrogen
PVS 2	Plant vitrification solution
RdRp	RNA-dependent RNA polymerase
RNA	Ribonucleic acid
rpm	revolutions per minute
RT-PCR	Reverse transcription-polymerase chain reaction
s	second
TEM	Transmission electron microscope

UV.	Ultra violet
V	Volt
μl	Microlitre
β	Beta
%	Percentage
° C	Degree celsius
™	Trade mark

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