STUDIES ON MAIZE DWARF MOSAIC VIRUS

BY

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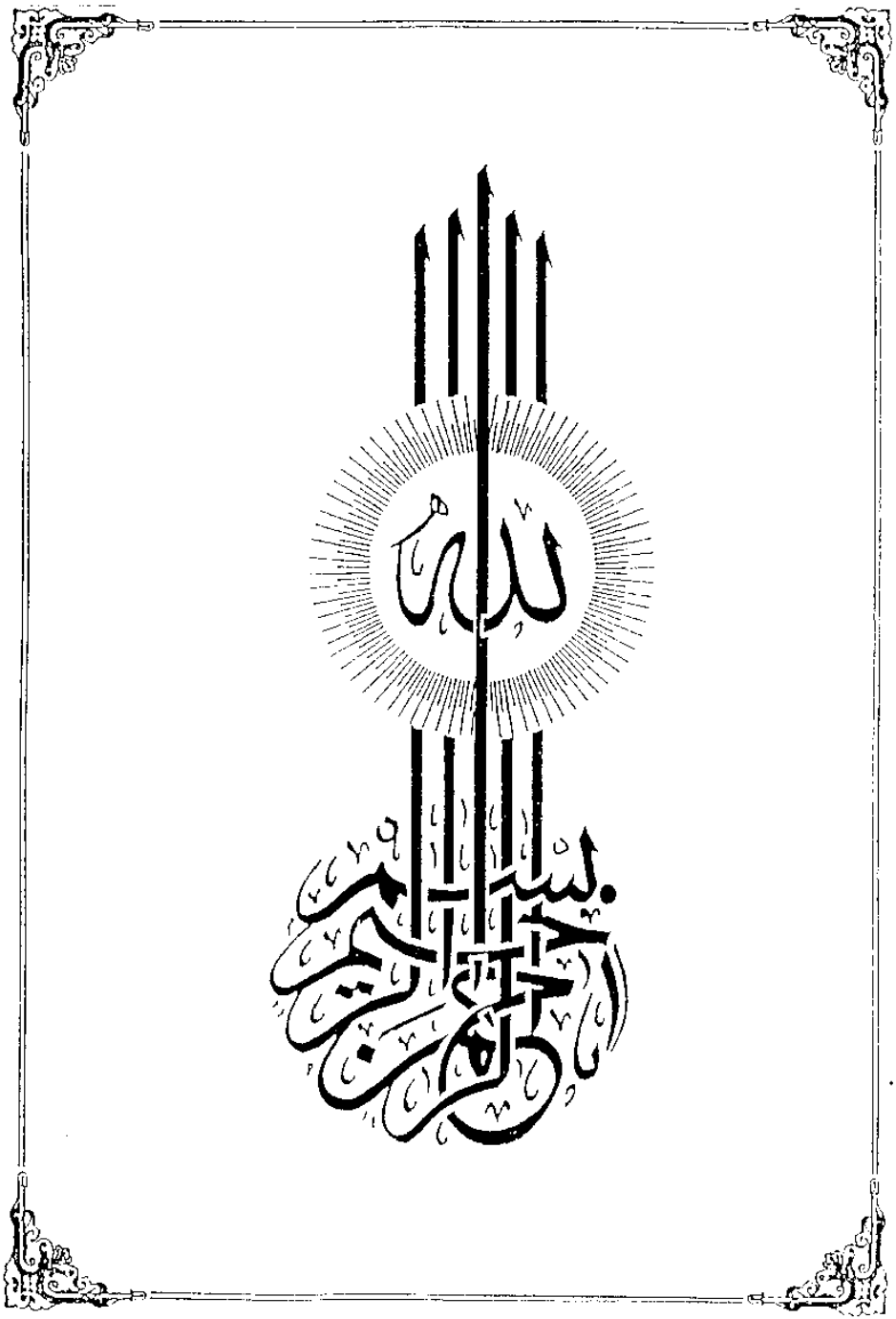
DEDICATION

This work is dedicated to my wife,son and daughter whose love,support and constant encouragement made it all possible.



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ABSTRACT

The Maize Dwarf Mosaic Virus (MDMV) is a member of the potyvirus group of plant viruses. The virus infects maize(*Zea mays* L.) and other members of the Gramineae plants.The virus isolate was strain A of MDMV (MDMV-A) isolated in Egypt from infected sorghum (*Sorghum bicolor* L.)plants.In this investigation, additional information about (MDMV-A) is presented.

The pattern of UV absorption spectrum of the MDMV after purification was typical for nucleoprotein.The yield of purified virus was 20-25 µg/g fresh infected Leaf tissue.The crude juice,semipurified and purified preparations of MDMV were infectious in corn plants even when diluted at 1/1000,1 µg/ml and 0.1 µg/ml,respectively.The MDMV particles were flexuous filaments ranging in length from 723-750 nm and 13 nm in width and the Cylindrical inclution(CI) was

characterized morphologically by the electron microscope.The molecular weight (MW) of MDMV-capsid and MDMV-CI by SDS-PAGE were approximately 37.5 KDa and 70 KDa,respectively.The UV sepectrum of MDMV-protein and MDMV-RNA were typical for viral protein and nucleic acid.The MW of MDMV-RNA by agarose gel electrophoresis was about $3.1x10^6$ daltons.The dilution end point of MDMV-capsid antiserum by reapt-enzyme linked immunosorbent assay (R-ELISA),immuno-dot blot assay and western blotting was 1/9000,1/4500,1/5000,respectively.Sphere-linked immunodiagnostic assay (SLIDA) is a sensitive method for the detection of antibodies in serum,data herein indicated that it was found to specifically label the antigen-coated spheres.Data herein indicated that serological cross reactivity was found between MDMV,Tobacco etch virus (TEV),Potato virus Y (PVY),and Sweet potato feathery mottle virus (SPFMV) capsid proteins;and MDMV-CI,TEV-CI proteins and Tobacco mosaic virus TMV-126 KDa protein.Data indicated that the MDMV was assigned to subdivision III since it produced CI of scrolls,pinwheel and laminated aggregates.Also,cytoplasmic vesicles and virus particles were found associated with these inclusions.Immunogold labeling studies clearly showed the CI bodies;scrolls,pinwheel, and laminated aggregates,but not vesicles.This indicates that membranous structures might be seen without using osmium.The MDMV was labeld by immunogold, this indicates that we use this method as a serological test and a diagnostic tool to study the morphology of the virus.Data herein indicated that specific binding was between MDMV-CI bodies and MDMV-CI antiserum,as well as between virus particles and MDMV-capsid antiserum. The method recognized the location of various virus antigens such as the virus proteins and CI.In healthy and infected plants,ATPase activity was found in plasma membranes,chloroplast thylakoid membranes, nuclear membranes and in mitochonderia.In MDMV-infected cells,ATPase activity was found in cytoplasmic vesicles which were found in close proximity to the virus specific cytoplasmic CI at the end of the arms of the CI in the plasmodesmata.

In the glass-house, the MDMV was found to infect some cultivars of maize and sorghum plants.The symptoms were summarized as mosaic and severe mosaic.In the field,data herein indicated that MDMV affected: a)Appearance time of silks,male flowers(tassels) of maize ;and flowers(heads) of sorghum plants,since it caused delay in the appearance with a range of 2-5 days than healthy plants .b)Rate of vegetative growth of maize and sorghum plants,since MDMV caused significant reduction in the number ofleaves and plant height after 20,30,40 and 50 days from virus mechanical inoculation. c)Yield components of maize and sorghum plants,since the MDMV caused significant reduction in weight of grains per feddan

with percentage 21.6% and 17.7% for maize cultivars Giza 2 and DC 204,respectively; and 32% and 22.6% for sorghum cultivars Dorado and Giza 15,respectively.Data on the presence of MDMV in pollen of infected maize plants showed that the virus existed in pollen obtained from infected cultivars Giza 2 and DC 204 when their pollen was checked for presence of virus by infectivity assay through inoculating extracts of pollen to healthy plants.Data of the presence of MDMV (in infected plants which artificially pollinated with pollen from infected or healthy plants) in the different ears (frist and second ears) and in the different parts of ears showed that the virus existed in sheath,silks,cobs and kernel`s coat ,but it was not found in endosperm and embryo of kernels at milk and dough ripe stages and disappears completely in full ripe stages.IN addition,data herein indicated that the virus was not found in all parts of ear at the three different stages in healthy plants which were artificially pollinated with pollen from infected or healthy (as control) plants.This indicates that the MDMV was not transmitted through pollen to healthy plants .

Key Words

AS-SWK: Antiserum several weeks.
BiMV: Bidens Mottle Virus.
BSMV: Barley Stripe Mosaic Virus.
CI: Cylindrical inclusions.
CIP: Cylindrical inclusions protein.
CPMV: Cowpea Mosaic Virus.
JGMV-O: Johnsongrass Mosaic Virus (strain O).
K.Da.:Kilo dalton.
LiCl: Lithium Chloride.
MDMV-A: Maize Dwarf Mosaic Virus (strain A).
MW: Molecular weight.
PMV: Pepper Mottle Virus.
PTA: Phosphotungstic acid.
R-ELISA: Reapt-Enzyme linked immunosorbent assay.
PVY:Potato Virus Y.
SCMV-MDB: Sugarcane Mosaic Virus (Strain MDB).
SDS-PAGE: SDS-Polyacrylamide gel electrophoresis.
SLIDA: Sphere-linked immunodiagnostic assay.
SMV: Soybean Mosaic Virus.
SorMV: Sorghum Mosaic Virus.
SPFMV: Sweet Potato Feathery Mottle Virus.
TEV-HAT: Tobacco etch Virus (High Aphid Transmissible).
TMV-U1: Tobacco Mosaic Virus (U1 Strain).
TRSV: Tobacco Ringspot Virus.
TuMV: Turnip Mosaic Virus.
TVMV: Tobacco Vein Mottling Virus.
WSMV: Wheat Streak Mosaic Virus.
WSU: Wayne State University.

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Table of Contents

page

List of Tables

List of Figures