



**TANZANIA PLANT HEALTH AND PESTICIDES
AUTHORITY (TPHPA)**



**REPORT OF OCCURRENCE OF MAIZE LETHAL NECROSIS DISEASE
AND ITS ASSOCIATED VIRUSES IN THE FIELD AND IN THE MAIZE
GRAIN SEEDS IN TANZANIA**



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DIRECTOR GENERAL

EXECUTIVE SUMMARY

RT-PCR detection of viruses causing maize lethal necrosis disease (MLND) from maize grain seed samples collected from Kasumulo Border in December 2023 did not detect any virus. Surveys to establish the occurrence of maize lethal necrosis disease (MLND) were conducted in Tanzania from 2016 to 2021. MLND was not found in the major maize-producing regions of Tanzania. These findings suggest that maize grain seeds from Tanzania do not pose a risk of transmitting viruses causing MLND in the region.

1. Background

Maize lethal necrosis disease (MLND) of maize (*Zea mays* L.) is caused by a combination of Maize chlorotic mottle virus (MCMV) and any of the cereal viruses in the Potyviridae group.

The Potyviruses include *Sugarcane mosaic virus* (SCMV), *Maize dwarf mosaic virus* (MDMV), *Maize mosaic virus* (MMV) and *Wheat streak mosaic virus* (WSMV).

Maize chlorotic mottle virus genus *Machlomovirus* was first reported to infect *Z. mays* in Peru (Hebert and Castillo 1973). In 1976 the virus was reported in the United States of America in Kansas, and Nebraska states and Hawaii (Niblett and Claflin 1978).

Globally, the virus occurs in Argentina, Mexico, Peru and China. At least two genetically and geographically distinct strains of MCMV have been reported, MCMV-P (Peru) and MCMV-K (Kansas) (Nyvall 1999).

In Africa, the disease was first reported in Kenya in 2011 (Wangai et al. 2012) where it caused losses of between 50-80% Wangai et al.,2012.

From its first appearance in Kenya in 2011 (Wangai et al.,2012) is now found in other countries of East Africa where maize is grown.

The disease has recently spread to Tanzania, Uganda, and Sudan (Makumbi et al., 2013).

Virus Disease transmission

MCMV transmission occurs through insect vectors, mechanically, and by seed at very low rates (**0.04%**) (Jensen et al. 1991). Maize thrips (*Frankliniella williamsi*) are the primary vectors of MCMV.

The following insect species can also transmit MCMV (Nyvall 1999):

- Three species of maize rootworms (*Diabrotica*):

The southern maize rootworm (*D. undecimpunctata*),

The northern maize rootworm (*D. lonicornis*), and

The western maize rootworm (*D. virgifera*)

- The maize flea beetle (*Chaetocnema pulicaria*)
- The flea beetle (*Systema frontalis*)
- The cereal leaf beetle (*Oulema melanopa*)

DISEASE TRANSMISSION

- Several other insects implicated as vectors for MCMV in literature:
 - Corn rootworms (*Diabrotica undecimpunctata*, *D. lonicornis* and *D. virgifera*)
 - Corn flea beetle (*Chaetocnema pulicaria*)
 - Flea beetle (*Systema frontalis*)
 - Cereal leaf beetle (*Oulema melanopa*)

 - Mechanical transmission.
 - Also reported to be transmitted at very low rates via infected seed.
- SCMV also said to be seed transmissible at low rates



Diabrotica undecimpunctata



Diabrotica virgifera



Chaetocnema pulicaria



Oulema melanopa

Following the first report of the occurrence of MLND in Tanzania, the Ministry of Agriculture conducted monitoring survey (2016-2021) to establish the areas affected by the disease and identify the viruses causing the disease. A comprehensive survey of MLND was conducted between 2015 and 2016 in the following regions:

Lake Zone (Mwanza, Kagera, Shinyanga, Mara), Northern Zone (Kilimanjaro, Manyara, Arusha) Southern Highlands (Ruvuma, Njombe, Iringa, Rukwa and Katavi), Minor survey was also done along the Central (Dodoma, Singida), western (Tabora) and eastern (Tanga and Morogoro)



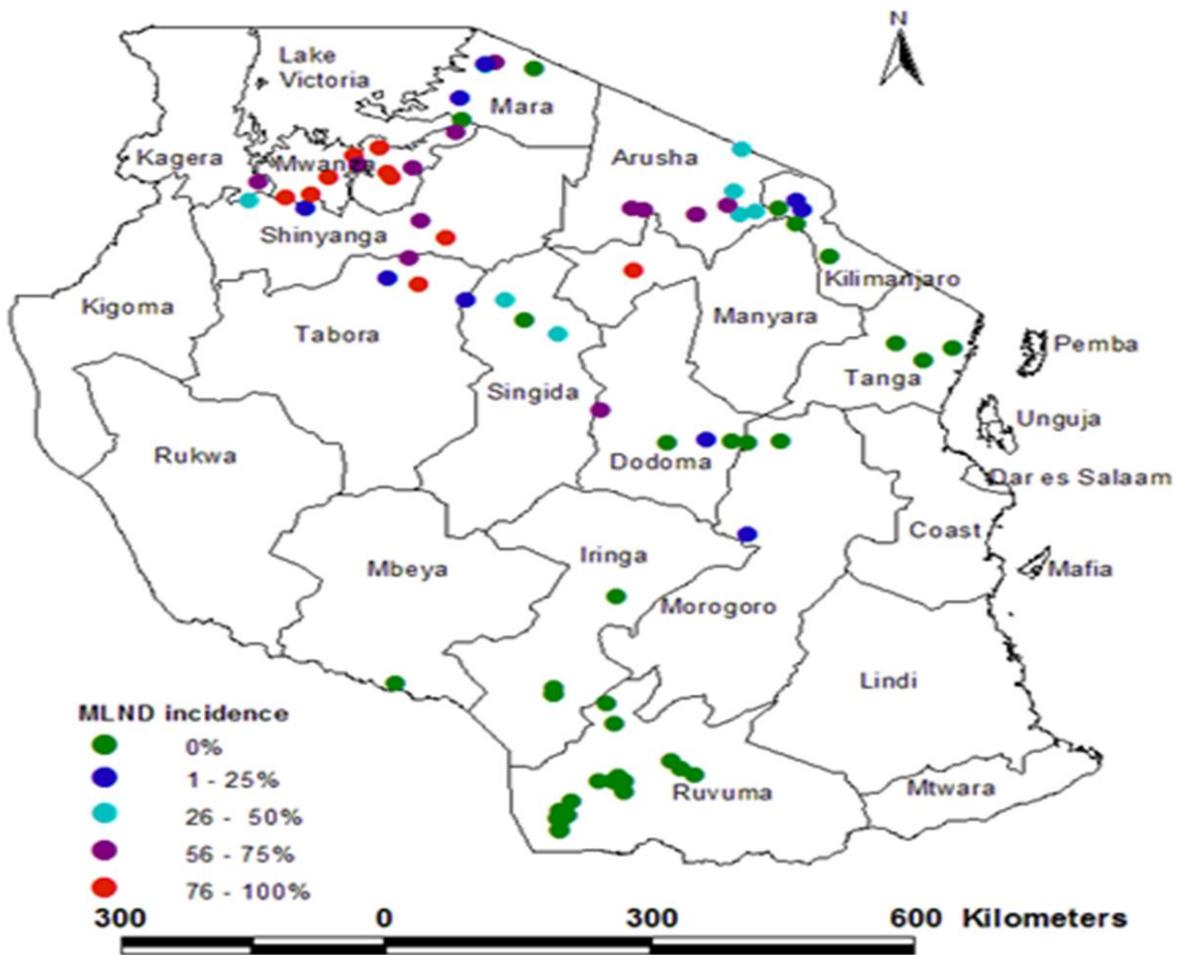
Field surveys of MLND in Tanzania



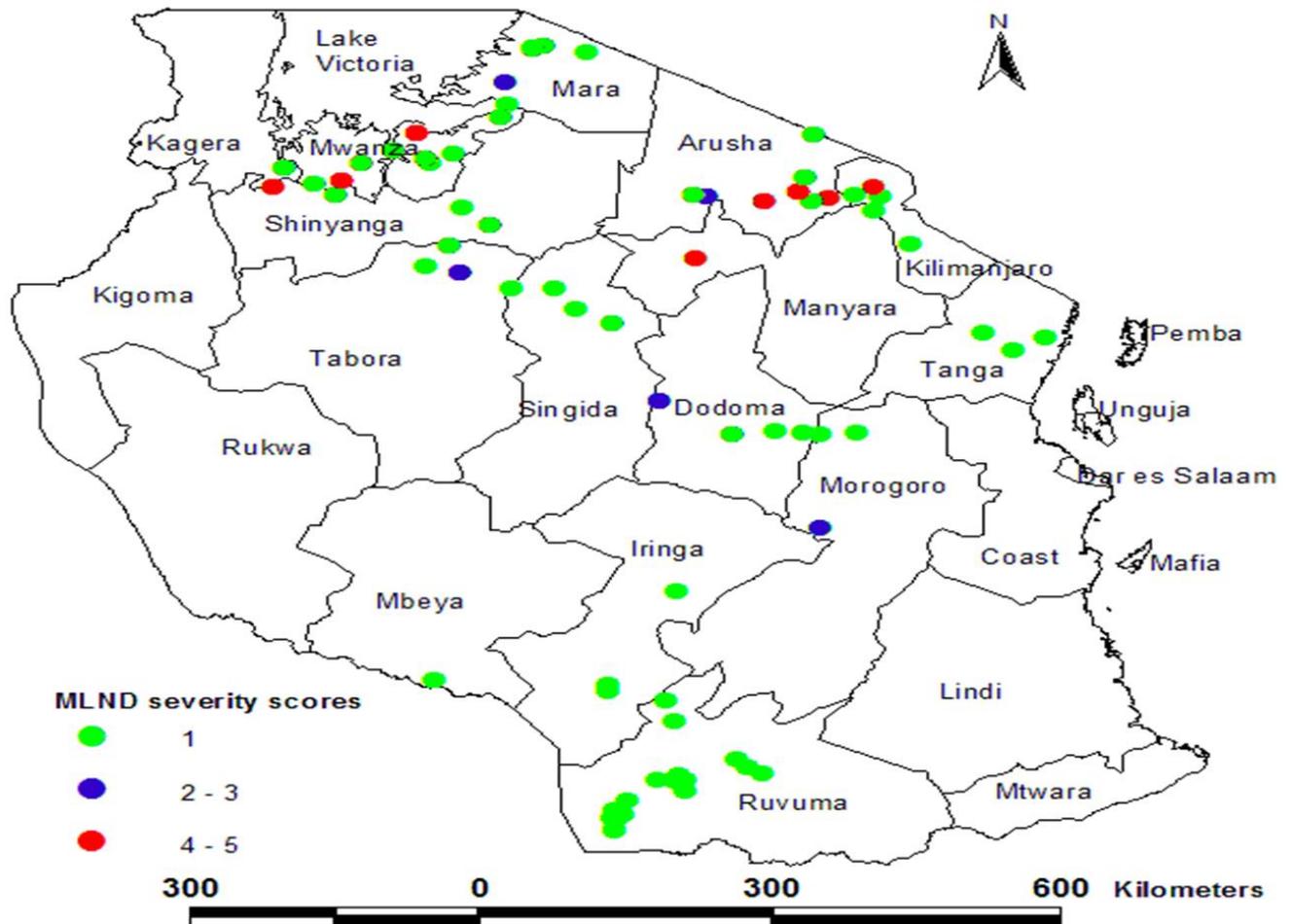
Field surveys of MLND in Tanzania

2. FIELD SURVEY RESULTS:

MLND was found in northern Tanzania with moderate incidence and in the Lake Zone. Moderate to low incidence was recorded in Shinyanga, Singida, Dodoma with low incidence in Morogoro. MLND was not found in the major maize-producing regions of Tanzania (Ruvuma, Iringa, Njombe, Mbeya, Songwe, Rukwa and Katavi).



Map a) Incidence of MLND in Tanzania



Map b) Severity of MLND in Tanzania

From the two Maps, it is clear that MLND was not found in the major maize-producing areas in Tanzania (Ruvuma, Njombe, Iringa, Rukwa, Mbeya, and Katavi regions) (green dotted).

3. DETECTION OF MLNDV FROM MAIZE GRAIN SEEDS

3.1 Sample collection

To establish whether viruses causing MLND were found in maize grain seeds, we sampled 6 trucks that were on transit at the Kasumulo Border post that is bordering Malawi at the end of December 2023. The samples were used for RT-PCR-based virus detection using primers specific to four viruses previously reported to be associated with MLND.



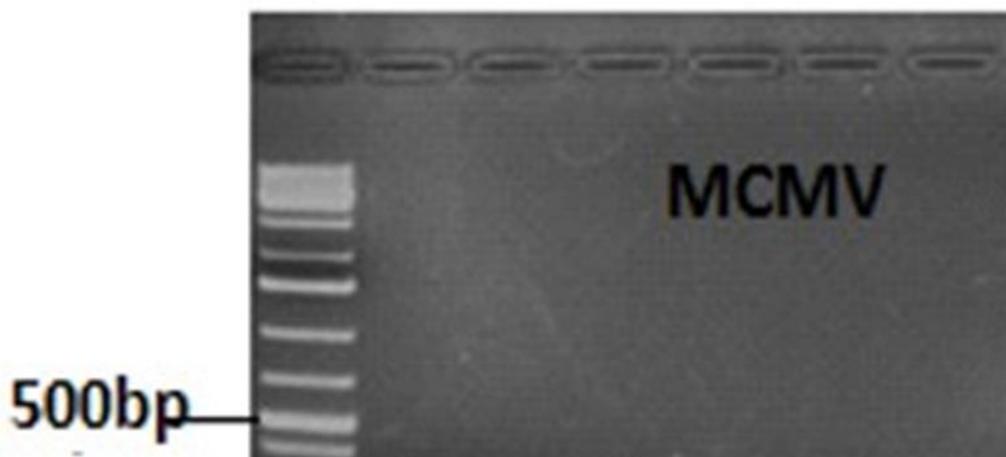
Maize samples collected from Kasumulo for virus detection

3.2 LAB RESULTS

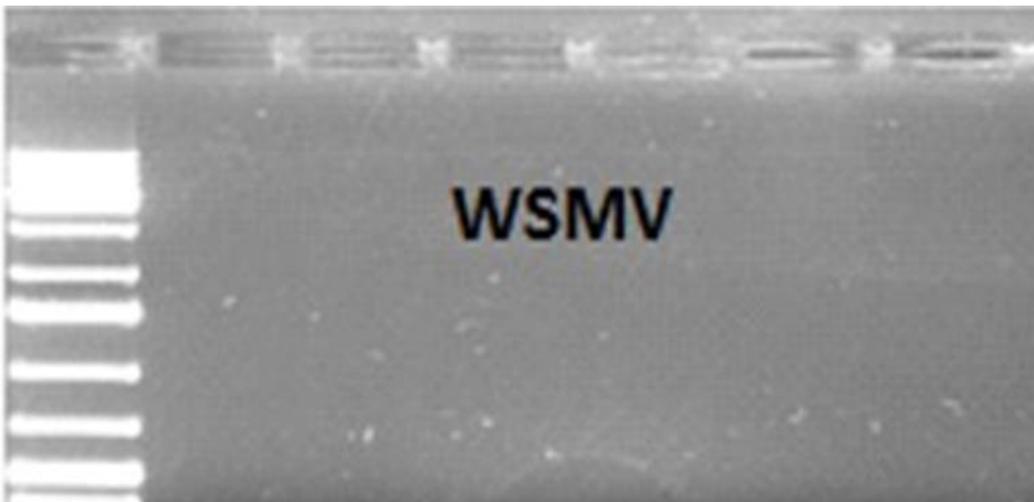
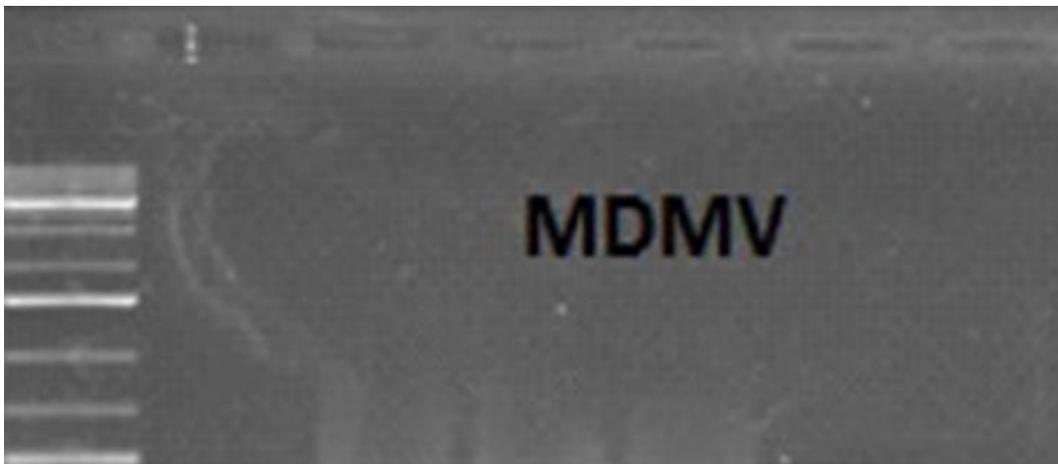
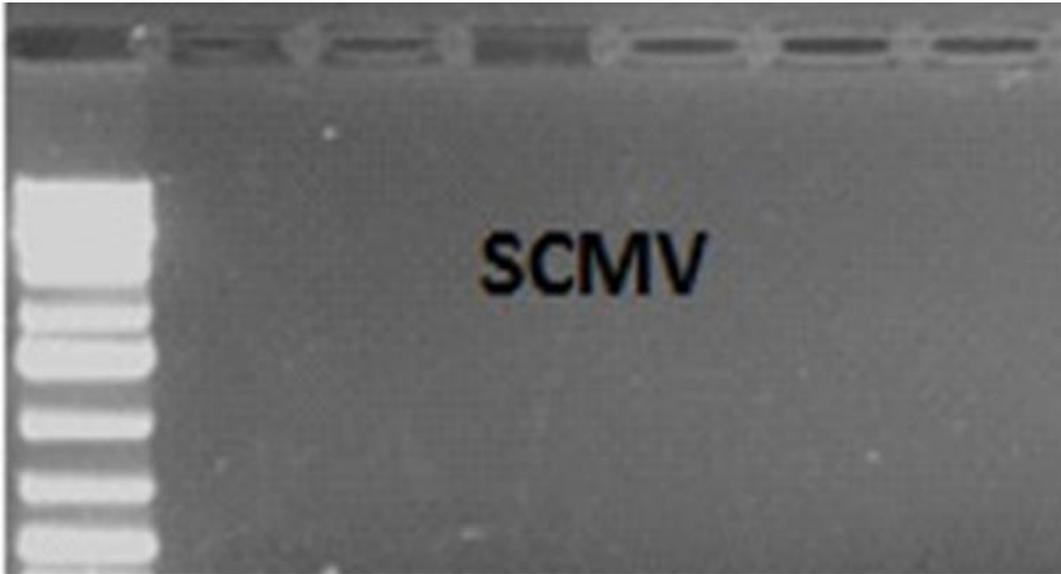
RT PCR analysis of the RNA samples extracted from the six maize seed samples did not show detection of any of the four viruses causing MLND confirming that the maize grain seeds samples did not carry the viruses (Table 1).

Table 1: PRC based detection of Four viruses associated with Maize lethal necrosis disease (MLND) from 6 samples collected at Kasumulo Boarder using primers specific to maize chlorotic mottle virus (MCMV), Sugarcane mosaic virus (SCMV), Maize dwarf mosaic virus (MDMV) and wheat streak mosaic virus (WSMV)

S/N	Sample No.	MCMV	SCMV	MDMV	WSMV
1	T.234D2H/T.149CRF	-	-	-	-
2	T.636EEF/T.636EEF	-	-	-	-
3	T.952ECS/T869DVJ	-	-	-	-
4	T.812EBX/T523ECL	-	-	-	-
5	T.727ECA/T.726ECA	-	-	-	-
6	T209DZA/T.521 BAL	-	-	-	-



Electrophoresis gel pictures showing the detection of MLND-associated viruses from maize seed samples



Gel pictures for the detection of MLV showed no detection of any of the four viruses associated with MLND

4: CONCLUSION

MLND was not found in the major maize-producing regions of Tanzania. RT-PCR detection of viruses causing MLND from maize grain seed samples collected from Kasumulo Border did not detect any virus confirming that maize grain seeds from Tanzania do not pose a risk of transmitting viruses causing MLND in the region.