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**BIOLOGICAL CHARACTERISTICS AND VIRULENCY
OF Cucumber Mosaic Virus (CMV) ISOLATES
BALIHORTICULTURE PLANT**

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ABSTRACT

Information regarding the biological character and virulence of CMV isolates from some horticultural plants from Bali is still limited. The results of research on this information are very much needed in further research and development of science and technology, because it is known that CMV infects several horticulture plants and can cause various symptoms of infection or specific symptoms in certain plants. Based on these problems, this research was carried out through CMV biological testing and the virulence of CMV isolates found in a number of horticultural plants in Bali. So that the biological characteristics and virulence level of each isolate is known. The biological test results of CMV isolates from several Bali horticultural plants namely, cucumbers (CMV-MB isolates), eggplants (CMV-TRB isolates), watermelon (CMV-SB isolates), chilies (CMV-CB isolates), pumpkin (CMV-LB isolates), and tomatoes (CMV-TB isolates), showed mosaic symptoms occurred in the indicator plants *Nicotianaglutinosa*, *Capsicum annuum* (big chili), *Cucumis sativus* (cucumber), *Lycopersicon esculentum* (tomato), and *Cucurbita moschata* (pumpkin). Severe mosaic symptoms only occurred in *Cucumis sativus* (cucumber) plants. In *Vigna sinensis* (long bean) infection CMV-Bali isolates only

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**BIOLOGICAL CHARACTERISTICS AND VIRULENCY
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ABSTRACT

Information regarding the biological character and virulence of CMV isolates from some horticultural plants from Bali is still limited. The results of research on this information are very much needed in further research and development of science and technology, because it is known that CMV infects several horticulture plants and can cause various symptoms of infection or specific symptoms in certain plants. Based on these problems, this research was carried out through CMV biological testing and the virulence of CMV isolates found in a number of horticultural plants in Bali. So that the biological characteristics and virulence level of each isolate is known. The biological test results of CMV isolates from several Bali horticultural plants namely, cucumbers (CMV-MB isolates), eggplants (CMV-TRB isolates) watermelon (CMV-SB isolates), chilies (CMV-CB isolates), pumpkin (CMV-LB isolates), and tomatoes (CMV-TB isolates), showed mosaic symptoms occurred in the indicator plants *Nicotianaglutinosa*, *Capsicum annuum* (big chili), *Cucumissativus* (cucumber), *Lycopersumesculentum* (tomato), and *Cucurbita moschata* (pumpkin). Severe mosaic symptoms only occurred in *Cucumissativus* (cucumber) plants. In *Vignasinensis* (long bean) infection CMV-Bali isolates only

cause symptoms of malformation and even cause no symptoms. Virulence test of these isolates in chilli plants showed results, the incubation period varied from 8.67 days in Pumpkin isolates (CMV-LB isolates) to 12.40 days in watermelon isolates (CMV-SB isolates). The highest percentage and intensity of disease occurred in Pumpkin isolates (CMV-LB isolates), with disease percentage reaching 80% and disease intensity 65%. Likewise in cucumber isolates (CMV-MB isolates), the percentage of disease reached 80% and the intensity of disease 62%. Pumpkin isolates (CMV-LB isolates) and cucumber isolates (CMV-MB isolates) are more virulent isolates compared to eggplant isolates (CMV-TRB isolates), watermelons (CMV-SB isolates), chilies (CMV-CB isolates), and tomatoes (CMV-TB isolates).

Keywords: Cucumber mosaic virus; Cucumissativus; Cucurbita moschata;

Lycopersumesculentum; Vignasinensis

Background

⁴ *Cucumber Mosaic Virus* (CMV) is a virus species from the genus *Cucumovirus*, family *Bromoviridae* (Mochizuki and Ohki, 2012). ⁵ *Cucumber Mosaic Virus* (CMV) is also one of the ⁶ *viruses* that cause mosaic disease which is commonly found in *Cucurbitaceae* plants. ⁷ Symptoms of the disease due to the *Cucumber Mosaic Virus* (CMV) infection ⁸ vary depending on the host species or CMV strain, which include: mosaic, chlorosis, dwarf, malformed leaves and necrosis. Differences in host species or CMV strains cause different symptoms and this happens is certainly a reaction from the host to a viral infection, so it appears the character of the host reaction to CMV infection that can be pointed out by the molecular character of CMV isolates and CMV isolates can isolated from various host plants.

The severity of symptoms that arise due to viral infection depends on the resistance of each host plant so that there will be a different virulence from each molecular character of CMV isolates.

Information regarding the biological characteristics and virulence of CMV isolates from some horticultural plants from Bali is still limited. The results of research on this information are needed in further research and development of science and technology, because it is known that CMV infects several horticulture plants and can cause various symptoms of infection or specific symptoms in certain plants. Based on these problems, this research was carried out through CMV biological testing and virulence of CMV isolates found in a number of horticultural plants in Bali. So that the biological characteristics and virulence level of each isolate is known.

Materials and Methods

CMV isolates collection through the biological test on indicator plants

Indicator plants used to study the symptoms of infection by all isolates obtained were plants: *C. annuum* (big chili), *Cucumis sativus* (cucumber), *L. esculentum* (tomato), *Solanum melongena* (green eggplant), *Vigna sinensis* (longbeans), and *Cucurbita moschata* (pumpkin). All CMV positive isolates were inoculated on several indicator plants. The differences in isolates are expected to be identified based on differences in symptoms in indicator plants so that CMV isolates collection from several hosts was obtained.

Virulence test of CMV isolates in chilli plants

The virulence test of CMV isolates used chili as an indicator. Inoculation was carried out mechanically with sap plant sources of CMV inoculums when the chili plants were 2 weeks after planting. Test chili plants were maintained and observed parameters for incubation period, type of symptoms that appeared, intensity of disease and percentage of disease events in chilli plants as a result of inoculation of each CMV isolate. Test chili plants that showed symptoms and showed no symptoms after inoculation in the study were detected by ELISA test using CMV antiserum to confirm the presence of CMV in the chili indicator plants.

Results

In indicator plants, *Nicotianaglutinosaisolates* CMV-MB, CMV-SB, CMV-CB, and CMV-TB cause mosaic symptoms, whereas other isolates cause symptoms of malformation. In *Capsicumannuum* (bigchili) isolates CMV-MB,CMV-TRB,CMV-CB andCMV-LB cause symptomatic mosaics, whereas CMV-S Band CMV-TB isolate cause symptoms of malformation. In *Cucumissativus* (cucumber) plants,CMV-MB isolates and CMV-SB showed severe mosaic symptoms, CMV-TRB, CMV-LB, and CMV-TB isolates caused mosaic symptoms while CMV-CB isolates showed no symptoms. In *Lycopersumesculentum* plants (tomato), CMV-S Band CMV-C Bisolate because of mosaic symptoms while CMV-MB, CMV-TRB, CMV-LB, and CMV-TB isolates cause symptoms of malformation. In indicator plants of *Vignasinensis* (longbean) isolates CMV-M Band CMV-TB cause symptoms of malformation while CMV-TRB isolates, CMV-SB, CMV-CB, and CMV-LB do not cause symptoms. In

the *Cucurbita moschata* plant (pumpkin), CMV-MB, CMV-CB, and CMV-LB isolate caused mosaic symptoms, CMV-S Band CMV-TB isolates caused symptoms of malformation while CMV-TR Isolates showed no symptoms. In *Chenopodium amaranticolor* plants all isolates cause local necrotic symptoms.

Table 1. Symptoms of indicator plants infected with CMV isolates from Bali

Indicator plant	CMV-Bali isolates					
	Symptoms					
	CMV-MB	CMV-TRB	CMV-SB	CMV-CB	CMV-LB	CMV-TB
<i>Nicotianaglutinosa</i>	mosaic	malformation	mosaic	mosaic	malformation	mosaic
<i>Capsicum annuum</i>	mosaic	mosaic	malformation	mosaic	mosaic	malformation
<i>Cucumis sativus</i>	weight mosaic	mosaic	weight mosaic	asymptomatic	mosaic	mosaic

<i>Lycopersu m. esculentum</i>	malfo r matio n	malfor matio n	mosai c	mosaic	malfor matio n	malfor mation
<i>Vignasin en sis</i>	malfo r matio n	asym ptomati c	asym ptomati c	asympt omatic	asym ptomati c	malfor mation
<i>Cucurbitam oschata</i>	mosai c	asym ptomati c	malfo rmati on	mosaic	mosai c	malfor mation
<i>Chenopodi um amarantico lor</i>	necro tic	nckro tic	necro tic	necro tic	necro tic	necro tic

Severe mosaic symptoms only occur in *Cucumissativus* (cucumber) plants due to infection with CMV-MB isolates and CMV-SB. Mosaic symptoms occur in indicator plants *Nicotianaglutinosa* (due to infection with CMV- MB,CMV-SB, CMV-CB, and CMV-TB isolates), in *Capsicumannuum* plants (bigchili) (due to infection with CMV-MB isolates, CMV-TRB), CMV-CB and CMV-LB, in *Cucumissativus* (cucumber) plants, (due to CMV- TRB, CMV-LB and CMV-T Bisolates), in *Lycopersumesculentum* (tomato) plants (due to CMV-SB and CMV isolates)-CB), in *Cucurbitamoschata* (pumpkin) plants (due to infection with CMV-MB,CMV-CB and CMV-LB isolates) In *Vignasinensis* (longbean) infection

CMV-Bali isolates did not cause mosaic symptoms, only caused symptoms of malformations (due to infection with CMV-MB and CMV-TB isolates) and even CMV isolates from Bali, namely CMV-TRB isolates, CMV-SB,CMV-CB, and CMV-LB did not cause symptoms.



A. Pumpkin Isolate B.Tomato Isolate C.Egg plant Isolate



D. Cucumber Isolate E.Watermelon Isolate F.Chili Isolate

Figure 1.CMV-Bali isolates

Table 2.Virulence of CMV Isolates from Bali

No.	Name isolate	Source of isolate	Incubation period (dai)	Percentage of disease (%)	Disease intensity (%)	Positive ELISA
1	CMV-MB	Cucumber	9,13	80	62,00	70 %
2	CMV-TRB	Eggplant	12,20	50	37,00	50 %
3	CMV-SB	Watermelon	12,40	50	33,00	40 %
4	CMV-CB	Chili	10,83	60	47,00	60 %
5	CMV-LB	Pumpkin	8,67	80	65,00	70 %
6	CMV-TB	Tomato	10,50	60	48,50	60 %

Discussions

The symptoms result from infection with six CMV isolates from Bali on several important indicator plants are highly varied and some are asymptomatic. It appears varying from 8 days after inoculation to 12 days after inoculation with severe mosaic, mosaic, local malformations, and necrotic symptoms. The incubation period of the six isolates in the virulence test with chilli plants showed mixed results, with an incubation period ranging from 8.67 days after inoculation in Pumpkin isolates (CMV-LB isolates) to 12.40 days after inoculation in watermelon isolates (CMV

isolates) -SB). Percentage and intensity of disease in virulence tests with chili plants showed various results, which were also highest in Pumpkin isolate (CMV-LB isolates) with disease percentage reaching 80% and disease intensity 65%. Furthermore, also in cucumber isolates (CMV-MB isolates) the percentage of disease reaches 80% and the intensity of disease 62%. ELISA from chilli plants in virulence test from Pumpkin isolate (CMV-LB isolate) and cucumber isolate (CMV-MB isolate) obtained that 70% positive CMV. The higher the intensity and percentage of disease caused by inoculation of one of the CMV isolates, the higher the virulence of the isolate can be estimated, while paying attention to the incubation period.

Conclusions

1. From this study found CMV isolates namely isolates derived from cucumber plants (CMV-MB isolates), eggplant (CMV-TRB isolates) watermelon (CMV-SB isolate), chili (CMV-CB isolate), pumpkin (CMV-LB isolate) and tomatoes (CMV-TB isolates).
2. Biological test of CMV isolates from Bali, mosaic symptoms occur in the indicator plant *Nicotianaglutinosa* included *Capsicumannuum* (bigchili), *Cucumissativus* (cucumber), *Lycopersumesculentum* (tomato), and *Cucurbitamoschata* (punpkin). Heavy mosaic symptoms only occur on *Cucumissativus* (cucumber) plant. In *Vignasinensis* (longbean) plant

infection, CMV-Bali isolates only cause symptoms of malformation and do not even cause symptoms.

3. Pumpkin isolates (CMV-LB isolates) and cucumber isolates (CMV-MB isolates) are quite virulent isolates compared to eggplant isolates (CMV-TRB isolates), watermelons (CMV-SB isolates), chillies (CMV-CB isolates) , and tomatoes (CMV-TB isolates).

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