Journal Techno, Vol. 7, No. 2, 2021, pp. 105 - 112
ISSN. 2461-1484

RESISTANCE AND POTENTIAL YIELD TEST OF ACCESSION TOMATO DETERMINATE HYBRID (F1) TO *TOMATO YELLOW LEAF CURL VIRUS* (TYLCV)

Chitia Novita Sari, Lagiman, Endah Wahyurini*
Universitas Pembangunan Nasional Veteran Yogyakarta
e-mail : Chitia_n@yahoo.co.id
**Corresponding author e-mail* : Endahwahyurini@yahoo.com

ABSTRACT

This study aimed to determine the resistance and yield of accessionized determinate hybrid tomatoes (F1) against Tomato Yellow Leaf Curl Virus (TYLCV), and to obtain accessions of determinate tomatoes that are resistant to TYLCV and have high yields.This research method used Completely Randomized Design (CRD) to test the resistance of tomato accessions from TYLCV attack. The second stage of the experiment used a Completely Randomized Block Design (CRBD) to test the yield of tomato accession at the tolerance level forTYLCV resistance. The treatments consisted of 7 F1 tomato hybrids, namely T-26, T-41, T-121, T-122, T-165, T-175, T-187, and 3 control hybrid namely T-90, Liontin and Betavila. The data obtained were analyzed using analysis of variance (ANOVA) then followed by DMRT (Duncan's Multiple Range Test) at a significance level of 5%. The results showed that the control hybrid T-90 was resistant and the T-122 hybrid was moderately resistant to TYLCV (Experiments stages I and II). The seven hybrids tested (T-26, T-41, T-121, T-122, T-165, T-175, and T-187) had the same weight of fruits as the TYLCV resistant control hybrid (T-90). The superior hybrids on the parameters of weight of fruits, weight per fruits, number of fruit, and fruit diameter were T-122 and T-175. Hybrid (F1) which has resistance to TYLCV and high yield is T-122.
Keywords: *Tomato accession, resistance test, potential yield, TYLCV.*

INTRODUCTION

Tomato is one of the vegetable commodities that has the potential to be developed. This plant can be planted widely in the lowlands to the highlands (Setiawati *et al*., 2001). The main constraint to tomato cultivation is the presence of pathogens and one of them is the *tomato yellow leaf curl virus* (TYLCV) which belongs to the Gemini virus group. TYLCV which has been reported by Moriones and Castillo (2000) has a bad impact, both in the tropics and subtropics because it is one of the main causes of decreased crop production. TYLCV in various countries causes yield losses of around 50-80%, even up to 100% (Mohamed 2010). Symptoms of attack in the form of dwarf plants, upright branches and leaf stalks, the leaf are small, wrinking and concave, and the edges of the leaves with or without yellow. TYLCV is transmitted by a vector the whitefly (*Bemisia tabaci*). One virulence whitefly can transmit the TYLCV virus.

Diseases caused by viruses are relatively difficult to control. The use of resistant varieties is one way of controlling that has advantages over chemical control (Suryaningsih, 2008). The degree of resistance in a plant is determined by many factors that interact between the degree of virulence of the pathogen, age and condition of the plant, as well as the environment (Gunaeni *et al*., 2002). The genes for resistance to bacterial wilt and Gemini virus can be obtained from wild tomatoes which generally have agronomic characters that are less attractive to consumers. MABC (*marker-assisted backcrossing)* is the process of using molecular markers to select target locus, reducing the length of the donor segment containing the target locus and accelerating the recovery of recurrent parental genomes during backcrossing (Hasan et.al., 2014).

METHODS

This study used 2 experimental stages, namely experimental stage 1 and experimental stage 2. Experimental stage 1 was to test the resistance of tomato accessions from TYLCV attack. The first stage of the experiment was carried out at the Whitefly Greenhouse Block-16 PT. Tani Murni Indonesia. The tools and materials used in the first stage of the experiment included 72 seedling trays, cistern, pens, pencils, notebooks, whitefly Green House , seeds of 7 tomato F1 hybrids (T-26, T-41, T-121, T-122, T-165, T-175, and T-187), seeds of 3 control hybrids namely T-90 (TYLCV resistant control hybrid), Liontin and Betavila (TYLCV susceptible control hybrid), growing media (soil, cocopeat, roasted husk, and dung), dolomite, whitefly host plants, seedling labels, and NPK. The tools and materials used in the second stage of the experiment include hoes, rakes, mulch hole tools, pens, pencils, notebooks, tomato seedlings, dung, dolomite, silver black mulch, ZA fertilizer, urea, SP-36, KCL, insecticides made from active metomil 25%, and fungicides with active ingredients mankozeb 80%.

The experimental research method stage 1 used a completely randomized design (CRD) with a one-factor pattern. Stage 2 experiment to test the yield of tomato accession. The second stage of the experiment was carried out in the Block C area of PT. Tani Murni Indonesia. The experimental research method stage 2 used a Completely Randomized Block Design (CRBD) with a one-factor pattern. The factor consisted of three control hybrids (T-90 (resistant control), Betavila and Liontin (susceptible control)) and seven hybrids tested (T-26, T-41, T-121, T-122, T-165, T-175, T-187). Overall there were 10 treatments with 3 replications. Each treatment consisted of 10 plants. A total of 300 plants were planted.

RESULTS AND DISCUSSION

Incubation period and intensity of disease symptoms

Observation of incubation period and intensity of disease symptoms were analyzed using Analysis of Variance at 5% level. The treatment of several hybrids (F1) showed a significant effect. The average value can be seen in Table 1.

Tabel 1.Incubation period and intensity of TYLCV disease symptoms

Hybrids(F1)	Trial stage 1			Trial stage 2	
	Incubation period	Intensityof TYLCV disease symptoms	Resistance rating	Intensity of TYLCV disease symptoms	Resistancerating
	Average	Average		Average	
T-26	28,33 **d**	41,67 **a**	*Susceptible*	46,94 **cd**	*susceptible*
T-41	29,00 **cd**	24,17 **ab**	*Moderate*	75,00 **a**	*Highly susceptible*
T-121	34,33 **b**	26,67 **ab**	*Moderate*	60,00 **bc**	*Highly susceptible*
T-122	40,67 **a**	18,33 **b**	*Moderate*	20,00 **e**	*Moderate resistance*
T-165	29,67 **bcd**	28,33 **ab**	*Moderate*	4 1,67 **d**	*susceptible*
T-175	33,67 **c**	30,56 **ab**	*Susceptible*	53,33 **cd**	*Highly susceptible*
T-187	34,33 **b**	38,89 **ab**	*Susceptible*	54,44 **cd**	*Highly susceptible*
Betavila (R)	23,67 **e**	27,5 **ab**	*Moderate*	70,83 **ab**	*Highly susceptible*
Liontin (R)	22,00 **e**	34,17 **ab**	*Susceptible*	78,33 **a**	*Highly susceptible*
T-90 (T)	43,00 **a**	6,67 **c**	*Resistance*	10,00 **e**	*Resistance*

Descripion :The mean followed by the same letter in the same column indicates there is not a significant difference in DMRT (*Duncan's Multiple Range Test*) with a real level 5%. R = Susceptible, T = Resistance.

Results of variance Table 1 shows data on the incubation period and intensity of TYLCV disease symptoms. The hybrid (F1) with the shortest incubation period for tomato plants was a susceptible control hybrid of TYLCV (Betavila and Liontin) in the range of 21-23 DAS. Hybrid (F1) with the longest incubation period of tomato plants was T-122 and hybrid (F1) resistant control TYLCV (T-90) in the range of 41-43 DAS. The difference in incubation period in a homogeneous environment was caused by the resistance response of tomato plants to *Tomato yellow leaf curl virus* (TYLCV) disease, and the success of the virus in multiplying in plant tissues. According to Muis (2002) the difference in incubation period is due to the young plant tissue providing food for infection and virus replication, and make it easy for pathogens to enter and develop.

Parameters intensity of TYLCV disease symptoms in experimental stage 1 showed that hybrids (F1) T-26, T-41, T-121, T-165, T-175 and T-187 were not significantly different from susceptible control hybrids (Betavila and Liontin).). Parameters intensity of TYLCV disease symptoms in experimental stage 2 showed that hybrid (F1) T-41 was not significantly different from TYLCV susceptible control hybrids (Betavila and Liontin). The T-122 (F1) hybrid was not significantly different from the TYLCV (T-90) resistant control hybrid. The more vectors that are active during the incubation period, the higher the incidence of disease in a crop (Rashid *et al*., 2008).

Figure 1.Ratio intensity of TYLCV disease symptoms of several hybrids (F1)

Weight of Fruit Per Plant, Weight Per Fruit, Fruit Diameter, and Number of Fruit Per Plant

Observations the weight of per plant fruit, weight per fruit, fruit diameter, and number of per plant fruits were analyzed using Analysis of Variance at the 5% level. The treatment of several hybrids (F1) showed a significant effect on the weight of per plant fruit, weight per fruit, fruit diameter, and number of per plant fruits. The average value can be seen in Table 2.

Table 2. Weight of fruit per plant, weight per fruit, fruit diameter, and number of fruit per plant

Hybrid (F1)	Weight of fruit per plant (g)	weight per fruit (g)	fruit diameter (mm)	number of fruit per plant
T-26	2078,89 **ab**	47,27 **a**	45,31 **abc**	44,00 **b**
T-41	1599,33 **b**	37,85 **bcd**	42,95 **bcd**	42,33 **b**
T-121	1642,33 **b**	35,06 **cd**	44,51 **abcd**	46,33 **ab**
T-122	2713,45 **a**	45,35 **ab**	47,19 **abc**	60,33 **ab**
T-165	2090,78 **ab**	34,09 **cd**	44,42 **abcd**	62,33 **ab**
T-175	1941,44 **ab**	42,81 **abc**	47,82 **a**	45,67 **ab**
T-187	1897,22 **ab**	38,12 **bcd**	47,47 **ab**	50,00 **ab**
Betavila (R)	1494,22 **b**	37,77 **bcd**	46,27 **abc**	39,67 **b**
Liontin (R)	491,89 **c**	30,87 **d**	40,07 **d**	15,33 **c**
T-90 (T)	2223,56 **ab**	33,34 **cd**	42,55 **cd**	68,33 **a**

Descripion :The mean followed by the same letter in the same column indicates there is not a significant difference in DMRT (*Duncan's Multiple Range Test*) with a real level 5%. R = Susceptible, T = Resistance.

Results of variance Table 2 shows the data on the weight of fruit per plant,weight per fruit, fruit diameter, and number of fruit per plant. The seven hybrids tested (T-26, T-41, T-121, T-122, T-165, T-175, and T-187) had not significant difference in weight of fruit per plant with the TYLCV resistant control hybrid (T-90). The highest weight per fruit was a hybrid (F1) T-26. The difference in weight per fruit and weight of fruit per plant was due to each hybrid having different yield potentials according to plant genetics. As stated by Ruchjaningsih *et al*. (2000) that a plant genotype will give a different response in each of the same or different environments.

Characters of fruit diameter have various sizes with a size range of 40.07-47.82 mm. The fruit diameter of the hybrid (F1) T-175 was better than the susceptible control varieties TYLCV (Liontin) and T-90 (control resistant to TYLCV), but not different from the variety Betavila (control susceptible to TYLCV). The number of per plant fruits characters varies in number with an average range of 15.33-68.33 pieces. The number of fruits per cluster, the number of fruits per plant, and fruit diameter are purely derived from genetic traits (Rick & Holle, 1990 in Soedomo (2012)).

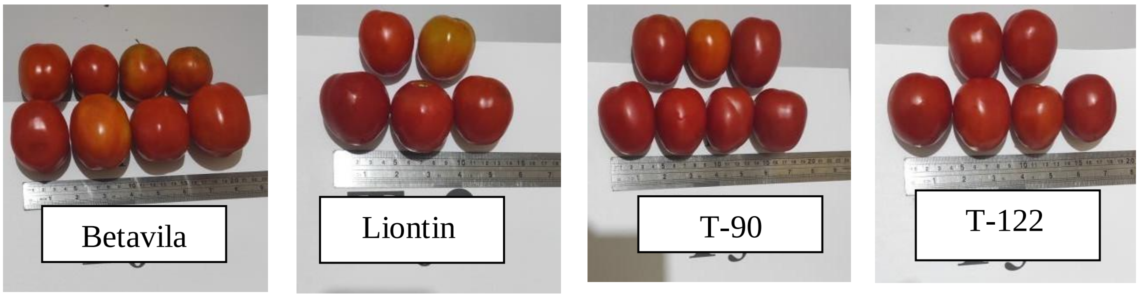

Figure 2. Ratio of the T-90 hybrid with TYLCV resistant and susceptible controls.

CONCLUSION

Based on the results of the study, it can be concluded as follows:

1. Experimental stage 1 and 2 hybrid (F1) T-122 was moderately resistant to TYLCV attack. The hybrids (F1) that were highly susceptible to TYLCV in phase 2 trials were T-121, T-175, and T-187.
2. Experimental phase 2 in the field shows the variability in yield of several hybrids (F1). The superior hybrids on the parameters of plant fruit weight, weight per fruit, number of fruit, and fruit diameter were T-122 and T-175. The parameters of the number of fruit cavities and the level of sweetness (brix) of all hybrids (F1) were not significantly different. TYLCV disease attack did not affect the number of cavities and levels of sweetness (brix).
3. Hybrid (F1) which has resistance to TYLCV attack and high potential yield is T-122, with yield above hybrid (F1) resistant and susceptible control.

ACKNOWLEDGMENTS

We would like to thank all those who have helped in carrying out this research.

REFERENCE

Damayanti, N, R. H. Murti, dan Toekidjo. 2006. Keragaman Galur-Galur Tomat (*Lycopersicon esculentum*) M4 Hasil Iradiasi Sinar Gamma 60Co. *Ilmu Pertanian* 14:34-45.

Grierson, D, and A. A. Kader. 1986. *Fruit Ripening and Quality*. In. Atherton, J.G and J. Rudich (eds). The Tomato Crop. Chapman and Hall. New York.

Hasan, M.M., M.Y. Rafii, M.R. Ismail, M. Mahmood, H.A. Rahim, M.A. Alam, S. Ashkani, M.A. Malek, and Ma. Latif. 2014. Marker-assisted Backcrossing:a Useful Method for Rice Improvement. *Biotechnology & Biotechnological Equipment*. 29(2):237-254.

Hayati, D. 2014. *Karakterisasi Morfologi dan Fisiologi 15 Genotipe Tomat (Solanum lycopersicum* L.*)*. Skripsi. Universitas Bengkulu, Bengkulu.

Mohamed, E.F. 2010. Interaction Between Some Which Attack Tomato (*Lycopersicon esculentum* Mill) Plant and Their Effect on Grouth Yield of tomato plants. *J. Am. Sci*.6(8): 311-320

Moriones E, Navas, and J. Catillo. 2000. Tomato Yellow Leaf Curl Virus, An Emerging Virus Complex Causing Epidemics Worldwide. *Virus Res* 71: 123-134

Muis, A. 2002. Sugarcane Mosaic Virus (SCMV) Penyebab Penyakit Mosaik pada Tanaman Jagung di Sulawesi. *J. Litbang Pertanian.* 21(2):64-68.

Murti, R.H., Ambarwati, dan Supriyanta. 2000. Genetika Sifat Komponen Hasil Tanaman Tomat. *Jurnal Mediagama*. II (2): 58-64.

Nazirwan, A. Wahyudi dan Dulbari. 2014. Karakterisasi Koleksi Plasma Nutfah Tomat Lokal dan Introduksi. *Jurnal Penelitian Pertanian Terapan* 14(1):70-75

Pardosi. S, K., Rustikawati., and D. Suryati. 2016. The Growth and Yield of Sixteen Tomato (*Solanum lycopersicum* L.) Genotypes Grown in Lowlands. *Akta Agrosia*. 19 (2): 118 – 128.