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Resistance of local genotype pepper (*Capsicum annuum* L.) to natural attacks by begomovirus on plant growth

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Abstrak. Pepper production is greatly influenced by various factors such as pests and diseases attacks. Begomovirus attack is a very serious problem in pepper cultivation and can reduce yields. One way to cultivate virus-resistant chili plants is by using local germplasm varieties with high yields. The aim of this study was to determine the effect of begomovirus attacks on several local genotype pepper and their growth phases. This research was carried out at Universitas Syiah Kuala Farm. The research was designed using a non-factorial Randomized Block Design, with six local genotypes pepper, namely Akar, Indrapura, Kota Gugur, Joker, Perintis and Kencana. Plants are planted in 10 kg polybags; each polybag contains one plant. This study had 3 replications, so there were 18 experimental combinations. Each unit contains 10 plants. Data analysis was carried out using ANOVA and continued with the Least Significant Difference test at the 5% level. The parameters observed were plant height and stem diameter at 15, 30, 45, 60, and 75 days after transplanting (DAT); dichotomous height at 15, 30, 45, 60, and 75 DAT; the percentage of begomovirus infection in local genotypes pepper. The results showed that the local paper genotype of Kota Gugur tends to have better plant height and larger stem diameters. The genotype Joker have high dichotomous and larger stem diameters. The local genotype pepper Akar and Perintis had better resistance to begomovirus attacks. All of local genotypes pepper were 100% infected with begomovirus at 120 DAT.

1. Introduction

Peppers (*Capsicum annuum* L.) are a horticultural crop in the vegetable group with high economic value, making them widely cultivated in Indonesia. Peppers are widely used in cooking spices, industry and for export. In 2023, total pepper production in Indonesia reached 3.11 M tonnes which was used for export and domestic demand (Republic of Indonesia Ministry of Agriculture, 2025).

Pepper production is greatly influenced by various factors such as cultivation techniques, climate and weather, land area, chili varieties, pests and diseases attacks. In chili cultivation, attacks of pepper yellow leaf curl disease (PepYLCD) caused by Geminivirus from the Begomovirus genus are a very serious problem [1][2]. Begomovirus attacks cause leaves to shrink, the color of the leaves turns bright yellow, and the size of the plant becomes stunted, thus disrupting the process of photosynthesis and crop yields [3]. Our previous study found that there are other types of viruses that attack chili pepper plants, namely pepper yellow leaf curl Indonesia virus (PepYLCIV) and pepper yellow leaf curl Aceh virus (PepYLCAV) [4][5][6][7][8].



Pepper varieties that have virus resistance are still very limited in number, therefore efforts are needed to find varieties that are resistant to virus attacks. One way to control diseases caused by viruses is by planting crops that are tolerant to diseases. Local high-yielding varieties can be used as a source of germplasm in the assembly of peppers resistant to begomovirus [9]. The aim of this study was to determine the effect of begomovirus attacks on several local genotype pepper such as Akar, Indrapura, Kota Gugur, Joker, Perintis, Kencana and their growth phases.

2. Materials and methods

2.1. Research location

This research was conducted at the experimental farm of the Faculty of Agriculture, Syiah Kuala University (USK). Data on pepper harvests were processed in the Horticulture Laboratory, Department of Agrotechnology, USK, Banda Aceh.

2.2. Research methods and plants materials

This study used a Non-Factorial Randomized Block Design. The research materials used were five local genotypes pepper, namely Akar, Indrapura, Kota Gugur, Joker, Perintis; and one comparison variety, namely Kencana. This study has three replications, with 18 experimental units, each unit consisting of 10 plants.

2.3. Cultivation

The growing medium used is a mixture of soil, cow manure, and rice husk (2:1:1/v:v:v). The mixed medium is then filled into polybags with a capacity of 10 kg. Each polybag gets one pepper plant, and the distance between polybags 50 cm x 40 cm. The fertilizers used were NPK 250 kg ha⁻¹, Urea 150 kg ha⁻¹, SP36 as much as 250 kg ha⁻¹, KCl 150 kg ha⁻¹, MKP 300 kg ha⁻¹. Disease and pest control using insecticides containing the active ingredient abamectin (Score 250 EC) with a concentration of 2 cc L⁻¹ at the age of 15 to 105 DAT, with an interval of 10 days.

2.2. Observation

The observed parameters were plant height and stem diameter at ages 15, 30, 45, 60, 75 DAT. The dichotomous height at ages 15, 30, 45, 60, 75 DAT; and the percentage of begomovirus attacks on local genotypes of pepper.

3. Results and discussion

3.1. The plant height of some local genotype pepper as Begomovirus effect on plants growth

This research showed that genotype had a very significant effect on plant height at 15 DAT, a significant effect on plant height at 30 and 60 DAT, and no significant effect on plant height at 45 and 75 DAT (Table 1). The genotypes Kota Gugur, Joker, and Perintis have higher plant growth compared to the Akar and Kencana varieties, but they do not differ significantly from the Indrapura genotype at 15 DAT. At 30 DAT, the tallest plant was found in the Kota Gugur genotype, which was not significantly different from the Indrapura, Joker, and Perintis genotypes, but was significantly different from the Akar and Kencana genotypes. At 60 DAT, all pepper genotypes have the same plant height except for the Kencana variety.

Bahagia (2019)[10] research shows that local pepper plants generally have short plant growth, with normal and healthy plants reaching a height of 70-85 cm at 60 DAT. This study shows that plants infected with Begomovirus have low plant height because their growth is disturbed. Our previous research on the genotypes Karo, Lolay, Perintis, and the Kencana variety showed that the Karo genotype and Kencana variety have short plant height at 60 DAT [9]. Begomovirus infection also causes hormonal disorders in chili plants. One of the hormones that is important for plant growth is gibberellin, which plays a role in stimulating cell division and elongation, as well as influencing the

formation of flowers and fruit. *Begomovirus* can inhibit gibberellin synthesis in chili plants, thereby reducing plant height and hindering flowering and fruiting [11].

Table 1. The plant height at the age 15, 30, 45, 60, 75 DAT from some local genotype pepper as *Begomovirus* effect.

Genotype of pepper	Plant height (cm)				
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT
Akar	13.93 a	29.78 ab	49.06	54.72 b	59.17
Indrapura	16.10 bc	33.50 bc	49.17	54.78 b	58.06
Kota Gugur	16.83 c	37.24 c	56.06	64.00 b	66.50
Joker	17.23 c	35.16 bc	47.72	56.06 b	59.78
Perintis	16.50 c	32.26 bc	46.44	59.17 b	58.56
Kencana	14.52 ab	25.61 a	38.72	44.17 a	53.83
LSD 5%	1.64	5.94	-	9.28	-

Note: Least Significant Difference (LSD) test at the 5% level

3.2 The stem diameter of some local genotype pepper as *begomovirus* effect on plants growth

This study shows that genotype has a significant effect on stem diameter at 60 and 75 DAT, but has no effect at 15, 30, and 45 DAT (Table 2). The largest stem diameter was found in the Kota Gugur genotype, which was not significantly different from the Joker genotype, but was significantly different from the genotypes Akar, Indrapura, Perintis, and the Kencana variety at 60 and 75 DAT. The smallest stem diameter was found in Kencana variety at 60 and 75 DAT.

The stem's primary function is to transport water and nutrients from the roots to the leaves, and from the leaves to all parts of the plant. The results of photosynthesis, or photosynthates, are transported by the stem through the phloem tissue. Virus attacks disrupt the photosynthates transport process and affect the growth of pepper plant stems [12]. The stem is useful as a growth support and as a distribution of nutrients for plants [13]. Our previous research also showed that the Kencana variety had a smaller stem diameter compared to other local genotypes pepper [9].

Table 2. The stem diameter at the age 15, 30, 45, 60, 75 DAT from some local genotype pepper as *Begomovirus* effect.

Genotype of pepper	Stem Diameter (mm)				
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT
Akar	2.41	3.46	5.10	6.37 b	7.14 ab
Indrapura	2.46	3.37	5.14	6.18 ab	6.74 ab
Kota Gugur	2.68	3.92	5.81	7.52 c	8.78 c
Joker	2.89	3.99	5.61	6.57 bc	7.57 bc
Perintis	2.70	3.54	4.69	6.00 ab	7.04 ab
Kencana	2.50	3.27	4.24	5.30 a	6.24 a
LSD 5%	-	-	-	1.05	1.27

Note: LSD test at the 5% level

3.3 The dichotomous height of some local genotype pepper as *Begomovirus* effect on plants growth

This study shows that dichotomous height at 30, 45, 60, and 75 DAT significantly affects pepper plants due to *begomovirus* infection. The Joker genotype has the highest dichotomous height compared to other genotypes at the ages of 30, 45, 60 and 75 DAT (Table 3). The lowest dichotomous height was found in the Kencana variety, which was not significantly different from the Akar genotype.

Dichotomous height is the first branching that forms a "V" shape. Dichotomous height is positively correlated with plant height, so the taller the plant, the higher the dichotomous height [14]. Plants with a high dichotomous height have good growth potential because they have more space for their canopy. Begomovirus attacks can inhibit the photosynthesis process, dichotomous height, and reduce the leaf canopy.

Table 3. The dichotomous height at the age 15, 30, 45, 60, 75 DAT from some local genotype pepper as begomovirus effect.

Genotype of pepper	Dichotomous Height (cm)			
	30 DAT	45 DAT	60 DAT	75 DAT
Akar	22.12 ab	24.50 ab	24.70 ab	24.76 ab
Indrapura	25.74 bc	27.37 bc	27.39 bc	27.39 bc
Kota Gugur	27.97 c	29.89 c	29.89 c	29.94 c
Joker	31.94 d	34.39 d	34.78 d	33.78 d
Perintis	24.58 bc	25.01 b	25.03 b	25.03 b
Kencana	20.50 a	21.11 a	21.11 a	21.11 a
LSD 5%	3.97	3.68	3.76	3.40

Note: LSD test at the 5% level.

3.4 Percentage of resistance of some genotypes of local pepper plants to begomovirus attack

Begomovirus attacks are influenced by many factors, including the presence of *Bemisia tabaci* which transmits the virus, environmental conditions (temperature and humidity), the presence of host plants, and cultivation methods. Table 4 shows that the pepper genotypes Akar and Perintis started to be attacked at the age of 15 DAT. The percentage of begomovirus attacks occurred rapidly in all local genotypes pepper with varying levels of attack at 30 DAT. There is a decrease in attack activity for genotype Akar, Indrapura, Perintis Kencana at the age of 60, 75 and 90 DAT; but on the other hand, begomovirus attacks increased rapidly reaching 100 % in genotype Kota Gugur at the age 60, 75 and 90 DAT and Indrapura at 75 and 90 DAT. In this study, the fluctuations in the percentage of begomovirus attacks were observed. This may be related to environmental conditions where it rains so that the temperature becomes lower so that the movement of whiteflies is slower. Moreover, application of an insecticide containing the active ingredient abamectin at a dose of 2 cc per liter of water and an application interval of 10 days reduced the infestation.

Table 4. The percentage of Begomovirus attacks at the age 15, 30, 45, 60, 75, 90, 105 dan 120 DAT from some local genotype pepper plants.

Genotype of pepper	The number of affected plants (%)							
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	105 DAT	120 DAT
Akar	11.1	55.6	66.7	22.2	11.1	11.1	66.7	100
Indrapura	0.0	55.6	66.7	11.1	33.3	33.3	55.6	100
Kota Gugur	0.0	11.1	66.7	100	100	100	88.9	100
Joker	0.0	11.1	55.6	88.9	100	100	88.9	100
Perintis	11.1	66.7	33.3	11.1	33.3	33.3	44.4	100
Kencana	0.0	100	44.4	11.1	11.1	11.1	22.2	100

In this study, although the percentage of begomovirus attack on the Kencana variety was small, the attack level was very severe (level 6, data not shown). The local genotype pepper Akar and Perintis had

better resistance to begomovirus attacks. the attack levels were limited to leaf curl (level 1) and leaf base curl (level 2) out of the six observation levels we conducted (data not shown). Akar genotype, a local pepper genotype originating from the lowlands, is thought to be tolerant to the thrips pest. The Perintis genotype, also originating from the lowlands, has been studied for its *pepper yellow leaf curl disease virus resistance 1 (pepy-1)*, a gene for resistance to curly pepper disease [8][15].

4. Conclusions

The local paper genotype of Kota Gugur tends to have better plant height and larger stem diameters. The genotypes Joker have high dichotomous and larger stem diameters. The local genotype pepper Akar and Perintis had better resistance to begomovirus attacks. The results of this study can be used as information for disease control and begomovirus-resistant cultivar breeding programs in the future.

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