

## BAB V

### KESIMPULAN DAN SARAN

#### 5.1 Kesimpulan

Berdasarkan hasil penelitian diperoleh kesimpulan bahwa :

1. Terdapat tujuh jenis cendawan endofit yang berhasil diisolasi dari daun, batang dan buah tanaman cabai sehat berasal dari genus *Trichoderma*, *Fusarium*, *Aspergillus* dan *Lasiodiplodia*.
2. Isolat cendawan *Trichoderma* sp. asal daun menghambat pertumbuhan patogen *Fusarium* dengan nilai Percentage Inhibition of Radial Growth ( PIGR) tertinggi sebesar 62,50 %
3. Aplikasi perlakuan *Trichoderma* sp, yang dikombinasikan dengan mulsa plastik dan kompos efektif menghambat perkembangan penyakit layu fusarium sebesar 7,4 % dan 13,5 % masing-masing pada daun dan buah cabai

#### 5.2 Saran

Perlu dilakukan penelitian lanjutan untuk melihat sinergitas antar isolat cendawan endofit sehingga dapat dikonsorsiumkan dalam mengendalikan penyakit layu fusarium pada tanaman cabai.

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## **LAMPIRAN-LAMPIRAN**

**Tabel Perhitungan Penghambatan Pertumbuhan Fusarium oxysporum oleh cendawan endofit**

**Tests of Between-Subjects Effects**

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	174.606 <sup>a</sup>	7	24.944	.997	.457
Intercept	599.705	1	599.705	23.974	.000
Jenis_Cendawan	174.606	7	24.944	.997	.457
Error	600.346	24	25.014		
Total	1374.656	32			
Corrected Total	774.951	31			

a. R Squared = .225 (Adjusted R Squared = -.001)

**Penghambatan**

Tukey HSD

JenisCendawan	N	Subset
		1
kontrol	4	.0000
buah 1	4	3.4175
buah 2	4	3.4175
daun 1	4	3.4175
batang 1	4	3.4525
daun 2	4	6.4475
daun 3	4	6.9125
batang 2	4	7.5675
Sig.		.420

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean

Square(Error) = 25.014.

PENGAMATAN 2

**Tests of Between-Subjects Effects**

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	249.208 <sup>a</sup>	7	35.601	1.169	.356
Intercept	1278.410	1	1278.410	41.991	.000
Jenis_Cendawan	249.208	7	35.601	1.169	.356
Error	730.684	24	30.445		
Total	2258.302	32			
Corrected Total	979.892	31			

a. R Squared = .254 (Adjusted R Squared = .037)

**Penghambatan**

Tukey HSD

JenisCendawan	N	Subset
		1
kontrol	4	.0000
buah 1	4	3.9975
batang 1	4	6.7375
daun 1	4	7.2200
daun 3	4	7.2425
daun 2	4	7.7875
buah 2	4	8.1675
batang 2	4	9.4125
Sig.		.280

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean

Square(Error) = 30.445.

**Tests of Between-Subjects Effects**

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3336.624 <sup>a</sup>	7	476.661	24.543	.000
Intercept	6791.369	1	6791.369	349.678	.000
Jenis_Cendawan	3336.624	7	476.661	24.543	.000
Error	466.123	24	19.422		
Total	10594.116	32			
Corrected Total	3802.747	31			

a. R Squared = .877 (Adjusted R Squared = .842)

**Penghambatan**

Tukey HSD

JenisCendawan	N	Subset				
		1	2	3	4	5
kontrol	4	.0000				
buah 1	4	6.5375	6.5375			
batang 1	4	8.4050	8.4050			
daun 3	4	8.9200	8.9200			
daun 2	4		13.9650	13.9650		
batang 2	4			19.6925	19.6925	
buah 2	4				26.8425	26.8425
daun 1	4					32.1825
Sig.		.126	.293	.602	.336	.679

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 19.422.

PENGAMATAN 4

**Tests of Between-Subjects Effects**

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5167.567 <sup>a</sup>	7	738.224	23.883	.000
Intercept	11251.875	1	11251.875	364.013	.000
Jenis_Cendawan	5167.567	7	738.224	23.883	.000
Error	741.855	24	30.911		
Total	17161.297	32			
Corrected Total	5909.422	31			

a. R Squared = .874 (Adjusted R Squared = .838)

**Penghambatan**

Tukey HSD

JenisCendawan	N	Subset			
		1	2	3	4
kontrol	4	.0000			
batang 1	4	9.4625	9.4625		
buah 1	4	10.2000	10.2000		
daun 3	4	11.6975	11.6975		
daun 2	4		20.1075	20.1075	
batang 2	4			25.3575	
buah 2	4			31.6475	31.6475
daun 1	4				41.5400
Sig.		.101	.168	.109	.236

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 30.911.

PENGAMATAN 5

**Tests of Between-Subjects Effects**

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6109.196 <sup>a</sup>	7	872.742	33.476	.000
Intercept	18207.567	1	18207.567	698.396	.000
Jenis_Cendawan	6109.196	7	872.742	33.476	.000
Error	625.693	24	26.071		
Total	24942.457	32			
Corrected Total	6734.890	31			

a. R Squared = .907 (Adjusted R Squared = .880)

**Penghambatan**

Tukey HSD

JenisCendawan	N	Subset				
		1	2	3	4	5
kontrol	4	.0000				
batang 1	4		12.8375			
buah 1	4		15.3375	15.3375		
daun 3	4		20.1300	20.1300		
daun 2	4			25.1125	25.1125	
batang 2	4				35.0975	35.0975
buah 2	4					37.7075
daun 1	4					44.6050
Sig.		1.000	.490	.168	.151	.192

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 26.071.

PENGAMATAN 6

**Tests of Between-Subjects Effects**

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7757.027 <sup>a</sup>	7	1108.147	27.827	.000
Intercept	26949.133	1	26949.133	676.718	.000
Jenis_Cendawan	7757.027	7	1108.147	27.827	.000
Error	955.758	24	39.823		
Total	35661.918	32			
Corrected Total	8712.786	31			

a. R Squared = .890 (Adjusted R Squared = .858)

**Penghambatan**

Tukey HSD

JenisCendawan	N	Subset				
		1	2	3	4	5
kontrol	4	.0000				
buah 1	4		18.8750			
batang 1	4		20.1250			
daun 3	4		25.7225	25.7225		
daun 2	4		31.3525	31.3525	31.3525	
batang 2	4			39.1075	39.1075	39.1075
buah 2	4				44.0775	44.0775
daun 1	4					52.9000
Sig.		1.000	.143	.096	.128	.080

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 39.823.



## PENGAMATAN 7

### Tests of Between-Subjects Effects

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9550.598 <sup>a</sup>	7	1364.371	15.853	.000
Intercept	39418.002	1	39418.002	458.010	.000
Jenis_Cendawan	9550.598	7	1364.371	15.853	.000
Error	2065.529	24	86.064		
Total	51034.129	32			
Corrected Total	11616.126	31			

a. R Squared = .822 (Adjusted R Squared = .770)

### Penghambatan

Tukey HSD

JenisCendawan	N	Subset			
		1	2	3	4
kontrol	4	.0000			
batang 1	4		24.8000		
buah 1	4		27.6450		
daun 3	4		34.4575	34.4575	
daun 2	4		38.5900	38.5900	38.5900
batang 2	4		43.0400	43.0400	43.0400
buah 2	4			51.9725	51.9725
daun 1	4				60.2725
Sig.		1.000	.147	.180	.051

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 86.064.

## PENGAMATAN 8

### Tests of Between-Subjects Effects

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9404.107 <sup>a</sup>	7	1343.444	21.468	.000
Intercept	39055.234	1	39055.234	624.097	.000
Jenis_Cendawan	9404.107	7	1343.444	21.468	.000
Error	1501.891	24	62.579		
Total	49961.232	32			
Corrected Total	10905.999	31			

a. R Squared = .862 (Adjusted R Squared = .822)

### Penghambatan

Tukey HSD

JenisCendawan	N	Subset			
		1	2	3	4
kontrol	4	.0000			
batang 1	4		25.8300		
buah 1	4		28.6975		
batang 2	4		36.2500	36.2500	
daun 3	4		36.4225	36.4225	
daun 2	4		38.7525	38.7525	
buah 2	4			52.4550	52.4550
daun 1	4				61.0750
Sig.		1.000	.328	.118	.778

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 62.579.

PENGAMATAN 9

**Tests of Between-Subjects Effects**

Dependent Variable: Penghambatan

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9828.974 <sup>a</sup>	7	1404.139	43.371	.000
Intercept	40532.027	1	40532.027	1.252E3	.000
Jenis_Cendawan	9828.974	7	1404.139	43.371	.000
Error	777.004	24	32.375		
Total	51138.005	32			
Corrected Total	10605.978	31			

a. R Squared = .927 (Adjusted R Squared = .905)

**Penghambatan**

Tukey HSD

JenisCendawan	N	Subset		
		1	2	3
kontrol	4	.0000		
batang 1	4		26.9450	
buah 1	4		29.4450	
batang 2	4		34.7200	
daun 3	4		38.3325	
daun 2	4		38.8875	
buah 2	4			53.8875
daun 1	4			62.5000
Sig.		1.000	.102	.419

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 32.375.

**Tabel Perhitungan Uji Endofitik  
Colonization M1**

**ANOVA**

Nilai

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39146.667	5	7829.333	46.976	.000
Within Groups	4000.000	24	166.667		
Total	43146.667	29			

**Nilai**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
4.00	5	.0000		
5.00	5	4.0000		
6.00	5	4.0000		
2.00	5		48.0000	
3.00	5		52.0000	
1.00	5			100.0000
Sig.		.996	.996	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 5.000.

## Colonization M3

### ANOVA

Nilai

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	43466.667	5	8693.333	48.296	.000
Within Groups	4320.000	24	180.000		
Total	47786.667	29			

### Nilai

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05	
		1	2
4.00	5	.0000	
5.00	5	.0000	
6.00	5	.0000	
2.00	5		60.0000
3.00	5		80.0000
1.00	5		84.0000
Sig.		1.000	.087

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 5.000.

**Tabel Perhitungan Insidensi Penyakit *Fusarium oxysporum* pada daun Pengamatan 35 HST**

**ANOVA**

Hasil

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19.870	5	3.974	.831	.531
Within Groups	430.542	90	4.784		
Total	450.412	95			

**Hasil**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05
		1
2.00	16	0.0000
5.00	16	0.0000
6.00	16	0.0000
1.00	16	.7813
3.00	16	.7872
4.00	16	1.0913
Sig.		.720

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Pengamatan 42 HST**

**ANOVA**

Hasil

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	376.371	5	75.274	5.372	.000
Within Groups	1261.224	90	14.014		
Total	1637.595	95			

**Hasil**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05	
		1	2
5.00	16	0.0000	
6.00	16	0.0000	
2.00	16	.3689	
4.00	16	2.0197	2.0197
3.00	16	2.1103	2.1103
1.00	16		5.6625
Sig.		.604	.075

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Pengamatan 49 HST**

**ANOVA**

log10

	Sum of Squares	df	Mean Square	F
Between Groups	1.236	5	.247	9.934
Within Groups	2.240	90	.025	
Total	3.477	95		

**log10**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
5.00	16	.7281		
6.00	16	.7649		
2.00	16	.8573	.8573	
3.00	16		.9361	.9361
4.00	16		.9752	.9752
1.00	16			1.0484
Sig.		.198	.290	.343

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Pengamatan 56 HST**

**ANOVA**

Hasil

	Sum of Squares	df	Mean Square	F
Between Groups	1026.849	5	205.370	14.251
Within Groups	1296.959	90	14.411	
Total	2323.807	95		

**Hasil**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
5.00	16	5.9606		
6.00	16	6.3563	6.3563	
3.00	16	8.8900	8.8900	
2.00	16	9.1837	9.1837	
4.00	16		10.2586	
1.00	16			15.8841
Sig.		.167	.051	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Pengamatan 63 HST**

**ANOVA**

Hasil

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1800.098	5	360.020	23.483	.000
Within Groups	1379.807	90	15.331		
Total	3179.905	95			



**Hasil**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
5.00	16	6.4579		
6.00	16	6.5496		
3.00	16	10.0192	10.0192	
2.00	16	10.2511	10.2511	
4.00	16		10.6454	
1.00	16			19.4595
Sig.		.077	.998	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Pengamatan 70 HST**

**ANOVA**

Hasil

	Sum of Squares	df	Mean Square	F
Between Groups	2860.713	5	572.143	34.832
Within Groups	1478.315	90	16.426	
Total	4339.027	95		

**Hasil**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
5.00	16	7.0875		
6.00	16	7.1716		
2.00	16	10.9895	10.9895	
4.00	16	11.0212	11.0212	
3.00	16		11.5968	
1.00	16			23.3711
Sig.		.076	.998	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Pengamatan 77 HST**

**ANOVA**

Hasil

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4373.682	5	874.736	45.194	.000
Within Groups	1741.982	90	19.355		
Total	6115.663	95			

**Hasil**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05			
		1	2	3	4
5.00	16	7.4156			
6.00	16	7.6633	7.6633		
2.00	16		12.1383	12.1383	
4.00	16			12.3561	
3.00	16			12.6210	
1.00	16				27.5918
Sig.		1.000	.055	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Tabel Perhitungan Insidensi Penyakit *Fusarium oxysporum* pada buah**

**ANOVA**

Nilai

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13682.745	5	2736.549	47.328	.000
Within Groups	5203.865	90	57.821		
Total	18886.610	95			

**Nilai**

TukeyHSD<sup>a</sup>

Perlakuan	N	Subset for alpha = 0.05			
		1	2	3	4
5.00	16	13.5813			
6.00	16	20.8902	20.8902		
3.00	16		25.4953	25.4953	
2.00	16		26.9013	26.9013	
4.00	16			28.9194	
1.00	16				52.2569
Sig.		.081	.232	.798	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 16.000.

**Tabel Perhitungan Bobot buah cabai besar**

**ANOVA**

log10

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	6.095	5	1.219	43.884	.000
Within Groups	2.445	88	.028		
Total	8.540	93			

**Log10**

TukeyHSD<sup>a,b</sup>

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
1.00	16	1.1145		
4.00	15		1.5603	
2.00	16		1.6853	
6.00	16		1.6867	
3.00	16		1.7056	
5.00	15			1.9566
Sig.		1.000	.154	1.000

Means for groups in homogeneous subsets are displayed.

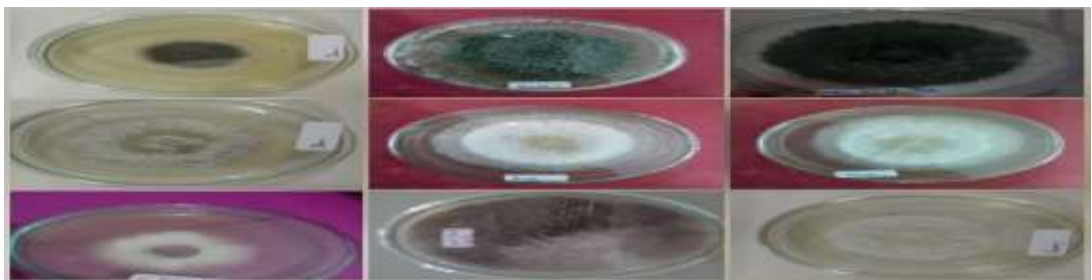
a. Uses Harmonic Mean Sample Size = 15.652.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

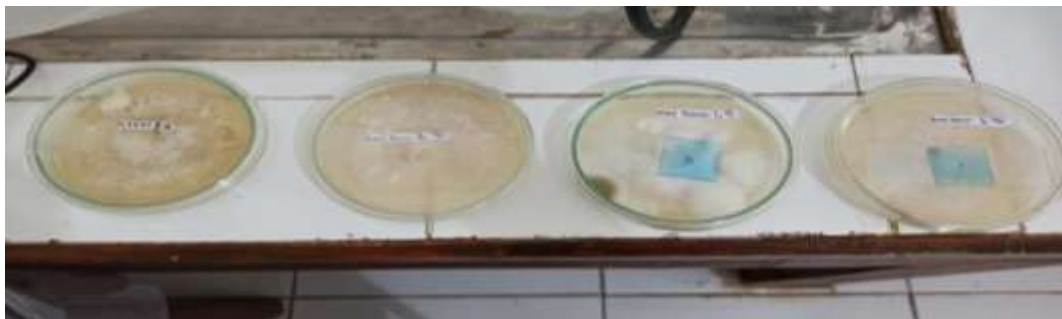
## Dokumentasi Penelitian



Gambar 1. Tempat Pengambilan sampel tanaman cabai sehat dan bergejala di Teaching Farm Universitas Hasanuddin



Gambar 2. Cendawan endofit dari tanaman cabai



Gambar 3. Cendawan Patogen dari tanaman cabai



Gambar 4. Identifikasi cendawan endofit dan cendawan patogen



Gambar 5. Uji Patogenisitas



Gambar 6. Uji Biakan Ganda



Gambar 7. Uji Endofitik



Gambar 8. Pencampuran cendawan endofit *Trichoderma* dengan kompos bahan tanaman



Gambar 9 . Lahan pertanaman cabai pada enam perlakuan



Gambar 10 . Pengamatan insidensi penyakit pada tanaman cabai





Gambar 11 . Gejala Penyakit layu pada tanaman cabai



Gambar 12 . Gejala Penyakit layu pada tanaman cabai



Gambar 13. Penimbangan Bobot segar tanaman