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Control of curly chili virus infection transmitted by *Bemisia tabaci* and *Thrips* sp. using tobacco extract which has never been done and researched, thereby reducing the decline in curly chili production caused by a virus.

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## **The Effect of Tobacco Extract Dosage on the Development of Virus Disease in Curly Chili**

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### AUTHORS' CONTRIBUTIONS

HH considers and plans an experiment. HH and SP collected data on the area of plant damage caused by *Bemisia tabaci* and *Thrips* sp. SP performs analysis and interpretation of plant damage data. HH prepared the script. The authors provide feedback and comments on the research flow, data analysis and interpretation and form of the manuscript. All authors have read and approved the final manuscript.

**COMPETING INTEREST**

The authors declare that they have no conflicts of interest.

# The Effect of Tobacco Extract Dosage on the Development of Virus Disease in Curly Chili

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## ABSTRACT

Curly chili is a horticultural product that has high nutritional value and is in great demand as a complement or flavoring for dishes that cannot be combined with other ingredients because of its distinctive taste and aroma. The increase in demand for chilies was not followed by an increase in production due to the disruption of the virus infected by *Bemisia tabaci* and *Thrips* sp. The purpose of this study was to determine the effect of tobacco extract on the growth and development of viral diseases in curly chili. This research was conducted at Kwangsang Village, Jumapolo District, Karanganyar Regency. September to December 2021 was designed using a single complete randomized block design, with treatment doses of tobacco extract 0ml/l, 1ml/l, 2ml/l, 3ml/l, 4ml/l labeled B0, B1, B2, B3, B4. The results showed that the parameters of plant height, number of leaves, number of fruits, fruit weight per plant were significantly different. The effect of tobacco extract on the incidence of disease and the intensity of viral attack was significantly different. The highest disease incidence was 35.42% (J0) and attack intensity was 70.92% (J0), while the lowest disease incidence was 14.583% (J4) and attack intensity was 20.58% (J4).

Key words: curly-chili, tobacco- extract, virus

## INTRODUCTION

Chili (*Capsicum annum* L.) is a spice plant in the Solanaceae family originating from America brought by the Portuguese and planted in Indonesia. Chili is divided into three, big chili, curly chili, and cayenne pepper. Curly chilies have curly fruit (Herison et al., 2018), are one of the important plants and are suitable for cultivation in Indonesia (Nurjati, 2021), including strategic commodities that have high economic value, are used as cooking spices, food industry, medicine, and herbs, containing vitamins A, C, B6 and potassium (Kumar et al., 2020). Consumption of spicy foods increases brain activity (Zhou et al., 2019) because the spicy taste of chili contains biochemical ingredients, namely capsaicin and  $\alpha$ -glucosidase inhibitory antioxidant compounds which are useful for helping to overcome diabetes mellitus (Lu et al., 2020).

Based on BPS (2022a) the harvested area of curly chili in Indonesia has increased from 82,804 ha in 2021 to 95,564 ha in 2022, and BPS (2022b) while production in 2021 was 8,601,851 million tons to 10,173,818 million tons in 2022. This increase cannot yet be to meet domestic chili needs, the Center for Agricultural Data

and Information (2020) reports that the projected national chili consumption from 2022 to 2023 has increased from 1,297 thousand tons to 1,340 thousand tons. Indonesian chili imports from India, China, Malaysia, Spain, Australia and other countries in 2021 will reach 27,800.02 tons (Putri, 2021).

Until now, the increasing demand for chilies in Indonesia has not been fulfilled, one of the reasons is because the plants are experiencing pathogenic disorders caused by viruses, this attack is marked by the leaves turning pale and then the leaf blade turning yellow with the veins still green, followed by the leaves rolling and spreading. to healthy leaves, Viral infections are transmitted by *Bemisia tabaci* and *Thrips* sp. (Figure 1), so control of intermediary pests is carried out (Rodríguez-Verástegui et al., 2022). The use of tobacco extracts has been tested to reduce pests *Hypothenemus hampei* coffee (Haryuni et al., 2019), rice weevil *Sitophilus oryzae* (Kanmani et al., 2021), *Grapholita molesta* of apples (Sarker and Lim, 2018).

The application of tobacco extract is expected to affect the activity of *Bemisia tabaci* and *Thrips* sp. which will interfere with chili plants, because tobacco extract are bioactive compounds with antioxidants, anti-inflammatory, antifungal properties (Banožić et al., 2020). A number of researchers have reported various groups of substances in tobacco, such as alkaloids (including nicotine) (Li et al., 2015), fatty alcohols, phytosterols (Liu et al., 2010), limonene, indole, pyridine (Gozan et al., 2014), aroma compounds (Popova et al., 2015), polyphenols, terpenoids and essential oils (Zou et al., 2021). The content of these compounds acts as a poison for virus-mediating pests that infect chili plants. The purpose of this study was to determine the effect of tobacco extract on the growth and development of virus disease on curly chili

## MATERIALS AND METHODS

**Preparation of Tobacco Extract.** Tobacco leaves extracted using the Extended Heat Reflux Extraction (EHRE) Sentosa et al, 2019 method, have been produced by the research group of the University of Indonesia and PT. Zekindo.

**Preparation of Planting.** Quality curly chili seeds were purchased from the Padas Tani Mulyo farmer group at Kwangsan village, Jumapolo, Karanganyar. Central Java. Land preparation was carried out two weeks before planting with two stages of processing. the first week is the first turning of the land and the second week is the

second plowing and leveling of the land. The sown seeds are transferred to the planting area after the soil has been processed to a depth of 20-40 cm. Beds are made with a height of 30-40 cm and a width of 120 cm. The distance between the beds is 60 cm and the length of the beds is 500 cm. The distance for planting chillies is (60x50) cm. After the land is available, it is given a cow pen and then left for 7 days, after 7 days it is given basic fertilizer Urea 60 g, TSP 60 g and KCl 30 g and left for 7 days. Seedlings are transferred to the field after 21 days after sowing, then watered and planting is done in the morning until 08.30 so that the seeds do not lay Hardiansyah et al., 2017 method and Tjokrosumarto & Soedjarwo 2017 method.

**Research Design.** The research was conducted at Kwangsang village, Jumapolo, Karanganyar, Central Java from Sept 2021 to Januari 2022. The soil type is Latosol, altitude of 511 m above sea level. This research was designed using a Completely Randomized Block Design consists of single factors, the factor was the concentration of tobacco extract 4 levels, namely 0 ml/l, 1 ml/l, 2 ml/l, 3 ml/l, 4 ml/l (J0, J1, J2, J3, and J4), each treatment combination was repeated 3 times. Data were analyzed by analysis of variance (Anova). If significantly different, between treatments were tested using Duncan Multiple Range Test (DMRT) at a level of 5% (Gomez and Gomez, 1995).

#### Incidence and Intensity of Virus Disease

The disease incidence (%) of Virus (P) was calculated using the formula from Mohamed et al. 1999 (1):

$$P = \frac{n}{v} \times 100\% \quad (1)$$

Where  $n$  is the number of affected plants and  $v$  is the number of observed trees.

The intensity of pest attack (I) was calculated using the formula from Wongpia & Lomthaisong (2010) (2):

$$I = \frac{\sum n.v}{Z.n} \times 100\% \quad (2)$$

Where  $n$  is the number of chillies attacked by Virus disease;  $v$  is the attack category scale;  $Z$  is the scale value of the highest attack category; and  $N$  is the total number of chillies observed. To estimate the diseases on chilli fruit

0-5 scale was followed as proposed by Ravinder Reddy (1982), The score is 0 when there is no attack; 1 if the attacks are between 0–24%; and 2 if the attack 25–49%; 3 if the attacks are between 50–74%, and 4 if the attacks are between 75– 100%.

## **RESULT AND DISCUSSION**

Analysis of the Effect of Tobacco Extract on Plant Height, Number of Leaves, Number of Fruits, and Fruit Weight of Chili Duncan's Multiple Range Test Analysis of 5% on Treatment and Control is presented in Table 1

Plant height was significantly different between treatments J0, J1, J2, J3, and J4 which also increased with the addition of tobacco extract doses (Table 1). Plant height, number of curly chili leaves, number of fruits, and fruit weight per plant increased with increasing tobacco extract. Plant height, number of leaves, and number of fruits are influenced by hormones produced by plants (Kumar et al., 2020), plant hormones play a role in cell growth and expansion, and are produced at the tips of plants or growing parts that actively synthesize the enzyme  $\alpha$ -amylase which stimulates starch hydrolysis and increases cell elongation (Iqbal et al., 2017), phloem, xylem differentiation, root formation, inhibition of leaf, flower and fruit fall, the levels will differ according to the site of auxin synthesis (Liu et al., 2022).

Tobacco extract contains nicotine, d-limonene, pyridine, and indole compounds, the highest nicotine content tested to repel mosquitoes (Gozan et al., 2014; Prommaban et al., 2022), used as a potential alternative to conventional insecticides (Sarker & Lim, 2018). Sugiyatna (2016) explained that the potassium content in tobacco extract is elastic and hard, rich in oil (Hu et al., 2019), plays a role in increasing cell elongation. Research conducted by Cheng et al., (2021) showed that increasing nicotine also increased soluble starch, soluble protein, vitamin C, cellulose, free amino acids, total phenol, choline, total flavonoids, and procyanidin but decreased sucrose from chickpea leaves. Tobacco nicotine allelopathy supports the growth of subsequent cereal crops such as corn because it increases the availability of essential nutrients such as total N, Ca, Fe, and Zn in the soil (Lisuma et al., 2019), research results by Haryuni et al., (2020), explain that the interaction of biopesticides with *Rhizoctonia binucleat* increases the content of N, P, K which play a role in increasing the resistance, health, and productivity of vanilla.



Table 2 shows that increasing the dose of tobacco extract showed a decrease in the incidence of the disease and the intensity of the virus attack. The highest attack without tobacco extract (J0) was significantly different from J1, J2, J3, and J4. This is thought to have something to do with the presence of insect vector populations and without the application of tobacco extract, where insect populations also increase in line with plant age, an increase in insect vector populations certainly provides more opportunities to transmit viruses to plants. The final observation J0 showed that all plants were infected with the virus, the affected plants showed symptoms (figure 2) of leaf parts such as mosaics, vein banding and vein clearing, chlorosis, mosaic, degradation of chlorophyll pigments, changes in chloroplast structure, decreased chlorophyll content, changes in the rate of electron transport, inhibition of photo and reduction of CO<sub>2</sub> fixation (Zanini et al., 2021; Zhao, Zhang, Hong, & Liu, 2016), affects carbohydrate and chlorophyll metabolism (Ananthu and Umamaheswaran, 2016), then causes a decrease in photosynthetic rate and efficiency (Lei et al., 2022).

Table 2 shows that the application of tobacco extract (J1, J2, J3) was not significantly different, but significantly different from J0 and J4. This shows that the parameter of disease incidence in tobacco extract at a dose of 4ml/l (J4), especially alkaloids, can inhibit the spread of *Bemisia tabaci* and *Thrips* sp. (Figure 1) that cause chlorosis and mosaic. The mechanism of viruses infecting plants is through mechanical injury by insect vectors or through pollen infection, infection occurs by closing blood vessels from cell to cell through plasmodesmata, then multiplying in cells. When it reaches the phloem, it continues towards the apical meristem or food storage cells (Mandadi & Scholthof, 2013). The intensity of the J4 virus attack was significantly different from J0, J1, J2, and J3, this was because the tobacco extract contained a large number of metabolites. supports the biological activity of plants (Jasbi et al., 2017; Zou et al., 2021), supported by previous studies that alkaloids derived from tobacco extracts have an insect-repellent effect (Fowsiya and Madhumitha, 2020; Barreto et al., 2014; Lombardo and Maskos, 2015). In addition, the content of phenolic acids, especially chlorogenic acid, contributes to the potential for antioxidant and antimicrobial activity. Overall, tobacco extracts show the presence of abundant bioactive molecules that can provide many benefits, especially the spread of viral diseases carried by *Bemisia tabaci* and *Thrips* sp. vectors (Al-Lahham, et al., 2020). Disease incidence and intensity of virus attack depend on plant age, variety, and virus strain (Hasan et al., 2022).

## CONCLUSION

The decrease in the yield of curly chili was caused by a virus through infection with *Bemisia tabaci* and Thrips sp. showed chlorosis and mosaic symptoms on the leaves. Affected plants do not die but experience a decrease in yield. The application of tobacco extract was significantly different and reduced the percentage of incidence and intensity of virus attacks on curly chili.

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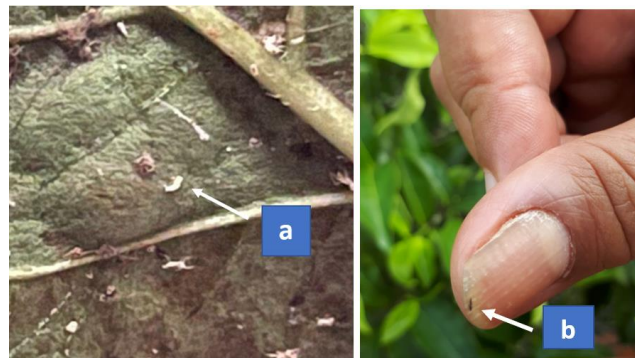


Figure 1. Viral infections are transmitted. (a) *Bemisia tabaci*; (b) Thrips sp.



Figure 2. Symptoms of yellow leaf curl disease on Curly Red Chili. (A) Mottle; (B) Yellowing

Table 1. Effect of tobacco extract on plant of height, number of laves, number of fruits, Weight of fruits per plant.

Treatment	Observation			
	Plant of height	Number of laves	Number of fruits	Weight of fruits per plant
J0	32.667 e	97.000 d	21.167 e	371.237 e
J1	44.667 d	109.917 c	32.750 d	489.217 d
J2	54.667 c	126.750 b	36.667 c	559.360 c
J3	63.500 d	136.250 a	47.333 b	575.217 b
J4	71.667 a	140.167 a	50.833 a	599.847 a

Note: The number followed by different letter in similar column significantly different at the Duncan test at 5%.  
 J0: tobacco extract 0 ml/l, J1: tobacco extract 1ml/l, J2: tobacco extract 3 ml/l, J3: tobacco extract 3 ml/l,  
 J4: tobacco extract 4 ml/l.

Table 2. Effect of tobacco extract on disease incidence (%) and intensity of virus disease

Treatment	Virus disease of chili	
	Disease incidence (%)	Intensity of attack (%)
J0	35.42 a	70.92 a
J1	22.92 b	63.58 a
J2	20.83 b	36.92 b
J3	18.750 bc	28.57 c
J4	14.583 c	20.58 d

Note: The number followed by different letter in similar column significantly different at the Duncan test at 5%.  
 J0: tobacco extract 0 ml/L, J1: tobacco extract 1ml/l, J2: tobacco extract 3 ml/l, J3: tobacco extract 3 ml/l,  
 J4: tobacco extract 4 ml/l.

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**[JHPTT:JTTPD] Revisioin From Editor**

2 pesan

**jhpt tropika** <jhpt.tropika@fp.unila.ac.id>  
Kepada: haryuni@lecture.utp.ac.id

29 Oktober 2023 pukul 16.22

Dear Ms. Haryuni

Thank you very much for your submission. Before being further proceed, there are several revisions that need to be made on your manuscript.


We do hope that we can receive your revised manuscript as well as names of three potential reviewers maximum one week after you receive this email.

Thank you very much

Best wishes and sincere regards,  
Editor in chief  
Prof. Rosma Hasibuan

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**2 lampiran**

 **Ms.650 cekpustaka - Copy\_checked.docx**  
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413K

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**Haryuni Haryuni** <haryuni@lecture.utp.ac.id>  
Kepada: jhpt tropika <jhpt.tropika@fp.unila.ac.id>

4 November 2023 pukul 18.14

Dear  
Editor in chief Prof. Rosma Hasibuan

Thank you very much for the review

We hope that our manuscript will be accepted and have included three potential reviewers


Thank you very much  
Haryuni  
Faculty of Agriculture Tunas Pembangunan Univer  
Jalan Balekambang Lor no. 1 Surakarta

Pada Min, 29 Okt 2023 pukul 16.23 jhpt tropika  
<jhpt.tropika@fp.unila.ac.id> menulis:  
[Kutipan teks disembunyikan]

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**[JHPTT:JTTPD] Revisioin From Editor**

2 pesan

**jhpt tropika** <jhpt.tropika@fp.unila.ac.id>  
Kepada: haryuni@lecture.utp.ac.id

6 November 2023 pukul 16.09


Kepada  
Yth. Ibu Dr. Haryuni  
di Tempat

Dengan hormat,  
Sebelum proses artikel dilanjutkan, kami informasikan bahwa terdapat revisi yang harus dilakukan pada naskah tersebut, mohon kiranya untuk diperiksa kembali. Atas perhatian dan kerjasamanya, kami sampaikan terimakasih.

Demikian informasi ini kami sampaikan.

Ttd  
Redaksi JHPT Tropika

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**Haryuni Haryuni** <haryuni@lecture.utp.ac.id>  
Kepada: jhpt tropika <jhpt.tropika@fp.unila.ac.id>

7 November 2023 pukul 22.35

Kepada  
Redaksi JHPT Tropika

Dengan hormat,  
terimakasih atas koreksi naskah a.n Haryuni & Priyadi, bersama ini ter kirim naskah perbaikan dan hasil Cek-Turnitin.  
Demikian , harapan kami semoga sesuai standar yang ditentukan.


Salam hormat,  
Haryuni  
Fakultas Pertanian Universitas Tunas Pembangunan Surakarta  
Jalan Balekambang Lor No.1 Surakarta  
Jawa Tengah, Indonesia

Pada Sen, 6 Nov 2023 pukul 16.09 jhpt tropika  
<jhpt.tropika@fp.unila.ac.id> menulis:  
[Kutipan teks disembunyikan]

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**2 lampiran**

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**[JHPTT:JTTPD] Revision From Editor**

5 pesan

**jhpt tropika** <jhpt.tropika@fp.unila.ac.id>

20 Februari 2024 pukul 10.25

Kepada: Haryuni Haryuni &lt;haryuni@lecture.utp.ac.id&gt;

Kepada

Yth. Ibu Dr. Haryuni  
di Tempat

Dengan hormat,

Sebelum dilanjutkan artikel tersebut, ada beberapa revisi yang harus dilakukan pada naskah artikel tersebut :

Catatan

1. figure 1 minta tolong kirimkan gambar yang lebih jelas ke objek nya jika memungkinkan dibawah mikroskop.
2. fig 2 adakah gambar yg lebih jelas tidak buram
3. fig 4 apakah hasil foto sendiri atau rujukan dr sumber lain (kl dr sumber lain disertakan rujukannya).
6. (Ananthu & Umamaheswaran, 2016), tidak ada di pustaka, adanya Ananthu & Umamaheswaran, 2019
7. Soedjarwo & Tjokrosumarto, 2017). tidak ada di pustaka, adanya Soedjarwo & Tjokrosumarto, 2018
8. Reang et al. 2018 tidak ada di pustaka

Mohon komen/koreksian dilakukan pada file PDF tersebut. perbaikan dapat kami terima kembali paling lambat 3 hari setelah email ini diterima, atas perhatian dan kerjasama yang baik, kami ucapkan terimakasih.

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Redaksi JHPT Tropika

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**Haryuni Haryuni** <haryuni@lecture.utp.ac.id>

26 Februari 2024 pukul 13.11

Kepada: jhpt tropika &lt;jhpt.tropika@fp.unila.ac.id&gt;

Kepada

Ysh. Redaksi JHPT Tropika

Dengan hormat,

Berdasarkan revisi untuk gambar (point 1 dan 2) ter kirim melalui email, penulis telah melakukan perbaikan baik pada naskah maupun foto, Terlampir perbaikan naskah dan rekap revisi.

Salam Hormat,

Haryuni

Fakultas Pertanian Universitas Tunas Pembangunan Surakarta  
Jalan Balekambang Lor No. 1 Surakarta.  
57139.

[Kutipan teks disembunyikan]

**4 lampiran****Bemisia tabaci..jfif**

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Haryuni Haryuni <haryuni@lecture.utp.ac.id>  
Kepada: jhpt tropika <jhpt.tropika@fp.unila.ac.id>

26 Februari 2024 pukul 13.17

Kepada  
Ysh. Redaksi JHPT Tropika

Dengan hormat,  
Berdasarkan revisi untuk gambar (point 1 dan 2) terkirim melalui email, penulis telah melakukan perbaikan baik pada naskah maupun foto, Terlampir perbaikan naskah dan rekap revisi.

Salam Hormat,  
Haryuni  
Fakultas Pertanian Universitas Tunas Pembangunan Surakarta  
Jalan Balekambang Lor No. 1 Surakarta.  
57139.

[Kutipan teks disembunyikan]

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**5 lampiran**


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Haryuni Haryuni <haryuni@lecture.utp.ac.id>  
Kepada: jhpt tropika <jhpt.tropika@fp.unila.ac.id>

26 Februari 2024 pukul 14.18

Kepada  
Ysh. Redaksi JHPT Tropika

Dengan hormat,  
Berdasarkan revisi untuk gambar (point 1 dan 2) terkirim melalui email, penulis telah melakukan perbaikan baik pada naskah maupun foto, Terlampir perbaikan naskah dan rekap revisi.

Salam Hormat,  
Haryuni  
Fakultas Pertanian Universitas Tunas Pembangunan Surakarta  
Jalan Balekambang Lor No. 1 Surakarta.  
57139.

[Kutipan teks disembunyikan]

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**9 lampiran**



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**Yellowing 1.jpeg**  
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**Haryuni Haryuni** <haryuni@lecture.utp.ac.id>  
Kepada: jhpt tropika <jhpt.tropika@fp.unila.ac.id>

3 Maret 2024 pukul 12.46

Microscope examination  
Kepada  
Ysh. Redaksi JHPT Tropika

Dengan hormat,  
Berdasarkan revisi untuk gambar 1 pengamatan mikroskopi terlampir

Salam Hormat,  
Haryuni  
Fakultas Pertanian Universitas Tunas Pembangunan Surakarta  
Jalan Balekambang Lor No. 1 Surakarta.  
57139.  
[Kutipan teks disembunyikan]

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**2 lampiran**



**Bemisia tabaci\_rev.jpg**  
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**Trips.jpg**  
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Haryuni Haryuni <haryuni@lecture.utp.ac.id>

**[JTTPD:JHPTT] Invoice**

2 pesan

**jhpt tropika** <jhpt.tropika@fp.unila.ac.id>

14 Maret 2024 pukul 19.14

Kepada: Haryuni Haryuni <haryuni@lecture.utp.ac.id>


Dear Dr. Haryuni

Please kindly find the attachment containing invoice regarding to your ongoing published manuscript entitled “ The Effect of Tobacco Extract Dosage on the Development of Virus Disease in Curly Chil ”

Thank you very much.

Editor in Chief

Prof. Rosma Hasibuan

 **Inv. Haryuni (JTTPD\_24.1).pdf**  
937K

**Haryuni Haryuni** <haryuni@lecture.utp.ac.id>

15 Maret 2024 pukul 08.40

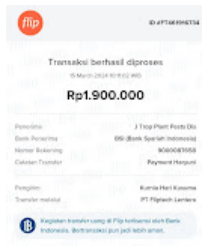
Kepada: jhpt tropika <jhpt.tropika@fp.unila.ac.id>

Dear  
Editor in Chief  
Prof. Rosman Hasibuan

Proof of payment was sent by Mrs. Haryuni's manuscript entitled "The Effect of Tobacco Leaf Extract Dosage on the Development of Disease Viruses in Curly Chilies"

Best Regards  
Haryuni  
Faculty of Agriculture  
Tunas Pembangunan University  
Balekambang lor street no. 1 Surakarta 57139. Central Java. Indonesia

[Kutipan teks disembunyikan]



**Payment manuscript Mrs. Haryuni .jpeg**  
61K



Haryuni Haryuni <haryuni@lecture.utp.ac.id>

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**[JHPTT:JTTPD] Publish**

1 pesan

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**jhpt tropika** <jhpt.tropika@fp.unila.ac.id>

15 Maret 2024 pukul 20.21

Kepada: Haryuni Haryuni <haryuni@lecture.utp.ac.id>

**Dear Dr. Haryuni**

Your submitted manuscript entitled " The Effect of Tobacco Extract Dosage on the Development of Virus Disease in Curly Chili" has been published. Please kindly find your publication by following this link :

<https://jhpttropika.fp.unila.ac.id/index.php/jhpttropika/article/view/794>

or

<https://doi.org/10.23960/jhptt.124120-127>

Please share the link to your colleagues as a notification of your published manuscript in hope that they will cite your manuscript on their publication.

Thank you very much

Sincerely yours  
Prof. Rosma Hasibuan  
Editor in chief