

# IN VITRO SENSITIVITY OF MYCELIAL GROWTH OF FUNGI ISOLATED FROM PEPPER (*PIPER NIGRUM* L) TO RECENTLY DEVELOPED FUNGICIDES <sup>1)</sup>

*Kepekaan in vitro pertumbuhan mycelia cendawan yang di-isolir dari tanaman lada terhadap fungisida baru*

by

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## ABSTRACT

Footrot disease has been known since long time as a very harmful and destructive to pepper crop in Indonesia. The results of the isolation revealed that there were 5 genera of fungi associated with this disease, viz. *Phytophthora*, *Pythium*, *Mortierella*, *Rhizoctonia* and *Fusarium*. Dra. A.J. Van der Plaats (CBS, Baarn) had identified some isolates and discovered *Phytophthora capsici* Leonian, *Pythium vexans* de Bary and *Mortierella beljakovae* Milko. For controlling this disease research is still being conducted. The purpose of the research is to test the effectivity in vitro of some fungicides to the sensitivity of these pathogens. The experiment has been done at the Laboratorium voor Fitopathologie, Landbouwhogeschool, Wageningen, The Netherlands. The fungicides used are Rovral 50% WP, Vinclozolin 50 % WP, Fongarid 50% WP and L S 74-783 80% WP. The result of this experiment showed that *Phytophthora* spp. (*P. capsici*, *P. cryptogea*, and *P. nicotianae*) were sensitive to Fongarid, but resistant to Rovral, Vinclozolin, and L S 74-783. On the contrary *Rhizoctonia solani* was very sensitive to Rovral and Vinclozolin, but resistant to Fongarid, and L S 74-783. *Pythium vexans* appeared to be sensitive to Fongarid, but tolerant to Rovral and resistant to Vinclozolin and L S 74-783. *Mortierella beljakovae* was tolerant to Rovral and Vinclozolin but resistant to Fongarid and L S 74-783, while *Fusarium* sp. was sensitive to Rovral, Vinclozolin and Fongarid but tolerant to L S 74-783.

## RINGKASAN

Penyakit "busuk pangkal batang" merupakan penyakit yang sudah lama dikenal dan paling merusak pada tanaman lada di Indonesia. Dari hasil-hasil isolasi sering didapatkan 5 macam genus cendawan yang berhubungan dengan penyakit ini yaitu: *Phytophthora*, *Pythium*, *Mortierella*, *Rhizoctonia* dan *Fusarium*. Beberapa isolat telah diidentifikasi oleh Dra. A.J. van der Plaats (CBS., Baarn) dan didapatkan: *Phytophthora capsici* Leonian, *Pythium vexans* de Bary dan *Mortierella beljakovae* Milko. Pada waktu ini penelitian-penelitian kearah pemberantasan penyakit ini sedang dilakukan. Penelitian ini dimaksudkan untuk menguji efektif-

1. Report on research carried out at the Laboratorium voor Fitopathologie, Landbouwhogeschool, Wageningen, The Nederland.
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fitas dari beberapa macam fungisida secara *in vitro* terhadap patogen-patogen tersebut. Penelitian dilakukan di laboratorium fitopatologi, Landbouwhogeschool, Wageningen, Negeri Belanda. Fungisida yang digunakan adalah Rovral 50% WP, Vinclozolin 50% WP, Fongarid 50% WP dan LS 74-783 80% WP. Dari hasil penelitian ini ternyata *Phytophthora* spp. (*P. capsici*, *P. cryptogae*, *P. nicotianae*) sangat peka terhadap Fongarid tapi resisten terhadap Rovral, Vinclozolin dan LS 74-783. Sebaliknya *Rhizoctonia solani* sangat peka terhadap Rovral dan Vinclozolin, tapi resisten terhadap Fongarid dan LS 74-783. *Pythium vexans* menunjukkan kepekaannya terhadap Fongarid, toleran terhadap Rovral dan resisten terhadap Vinclozolin dan LS 74-783. Toleran terhadap penggunaan Rovral dan Vinclozolin tapi resisten terhadap Fongarid dan LS 74-783 ditunjukan oleh *Mortierella beljakovae*, sedang *Fusarium* sp. peka terhadap Rovral, Vinclozolin dan Fongarid tapi toleran terhadap penggunaan LS 74-783.

## INTRODUCTION

"Footrot" has been for many years the most destructive pepper disease in Indonesia. Five genera of fungi, viz. *Phytophthora*, *Pythium*, *Fusarium*, *Mortierella* and *Rhizoctonia* have been associated with this disease. The problems of controlling these pathogens still have not been overcome, because of the facts that infection of subterranean parts of the crop occurred long before the symptoms become visible.

Recently new fungicides from the chemical group "hydantoin" and "phosphites" were discovered by Rhône-Paulene Phytosanitaire (Paris-France). Moreover, a fungitoxic compound of the chemical group known as "acylalanine" was discovered by Ciba-Geigy Ltd. Basel, Switzerland.

Rovral is a fungicide from the chemical group "hydantoin" and has been tested in the field on a wide range of horticultural and agricultural crops from 1972-75. It showed an excellent activity against grey mould, *Botrytis cinerea*., *Monilia* spp., *Sclerotinia* spp., white mold *Sclerotium cepivorum*, *Pyrenophora* spp., *Alternaria* spp., *Phoma solanicola*, *Tilletia caries*, stem canker, *Rhizoctonia solani*, sheath blight, *Pellicularia sasakii* and other plant pathogens (Burgaund *et al.*, 1975).

Among the other fungicides from the group "hydantoin" Vinclozolin recently got registration as a fungicide. It is effective particularly against *Botrytis cinerea* (Anon., 1974).



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A representative of the "phosphites" group, LS 74-783 (Aluminium ethyl phosphite), is an experimental fungicide effective against several Phycomycetes and other pathogens. This compound is characterised by its powerful systemic activity, being able to move upwards as well as downwards in the plant (Anon., 1977).

A new fungicide from the chemical group "acylalanines" is CGA 38140 as a trade name called Fongarid. It showed excellent activity against Oomycetes. In the Netherlands Fongarid has been tested for the control of diseases caused by *Pythium* spp. and *Phytophthora* spp. (Wiertsema and Wissink, 1977). The aim of the present study is to test *in vitro* antifungal activity of fungicides to some pathogens of pepper and other ones.

### MATERIAL AND METHOD

#### *The isolates.*

The fungi were obtained from roots and the subterranean stem of pepper (*Piper nigrum* L.) in Lampung and Bangka (Sumatra) and from laboratory stock (Table 1.).

#### *The fungicide.*

For *in vitro* tests the following fungicides were used. Rovral 50% W.P. (1 - isopropylcarbamoyl - 3 - (3,5 - dichlorophenyl) hydantoin), Vinclozolin 50% W.P. (3 - (3,5 - dichlorophenyl) - 5 - methyl - 5 - vinyl - 1, 3 - oxazolidin - 2,4 - dion), LS 74-783 80%W.P. (Aluminium ethyl phosphite) and Fongarid 50% W.P. (methyl N - (2,6 - dimethyl - phenyl) - N - furoyl - (2) - alaninate. The *in vitro* activity against the isolates was tested on potato - dextrose agar (PDA, Merck Art. 10130, pH 5.6) to which aqueous suspensions of the fungicides were added to give a serie of the concentrations required. The fungicides were added to the molten agar after cooling from 45°C PDA without fungicides served as control. The PDA-plates were inoculated by placing 5 mm discs of agar with young mycelium upside down in the centre. The diameter of the mycelium was measured in each of four replicates after 4 and 6 days incubation at 23°C. Inhibitory concentration are expressed as ED<sub>50</sub>, that is the concentration causing 50% reduction in radial



growth. To distinguish the sensitivity of various isolates to the fungicides were used four categories (Bollen and Fuchs, 1970):

- a. resistant (ED<sub>50</sub> > 100 ppm)
- b. tolerant (ED<sub>50</sub> 10 — 100 ppm)
- c. sensitive (ED<sub>50</sub> 1 — 10 ppm)
- d. very sensitive (ED<sub>50</sub> 0,1 — 1 ppm)

Table 1. Isolates of the pathogens used in this experiment.

Tabel 1. Isolat-isolat patogen yang digunakan dalam percobaan.

| No. | Code            | Species                                                                  | Race origin<br>Asal ras |
|-----|-----------------|--------------------------------------------------------------------------|-------------------------|
| 1.  | Ph <sub>4</sub> | <i>Phytophthora capsici</i> Leonian comp. type A <sup>2</sup> +          | LPTI (Lampung)          |
| 2.  | Ph <sub>7</sub> | " " " " " A <sup>2</sup> +                                               | LPTI (Lampung)          |
| 3.  | Ph <sub>8</sub> | " " " " " A <sup>2</sup> +                                               | LPTI (Bangka island)    |
| 4.  | Ph <sub>c</sub> | <i>Phytophthora cryptogea</i> Pethybridge & Lafferty Lab. Stock no. 111) |                         |
| 5.  | Ph <sub>n</sub> | <i>Phytophthora nicotianae</i> van Breda de Haan Lab. Stock no. 510      |                         |
| 6.  | P <sub>3</sub>  | <i>Pythium vexans</i> de Bary) <sup>+</sup>                              | LPTI (Lampung)          |
| 7.  | P <sub>4</sub>  | <i>Mortierella beljakovae</i> Milko ) <sup>+</sup>                       | LPTI (Lampung)          |
| 8.  | R <sub>s</sub>  | <i>Rhizoctonia solani</i> Kuhn                                           | Lab. Stock no. 172      |
| 9.  | F               | <i>Fusarium</i> sp.                                                      | LPTI (Lampung)          |

+) Identified by Drs. A.J. van der Plaats-Niterink (CBS, Baarn 1977).

## RESULTS AND DISCUSSION

The results presented in Table 2, 3, 4, 5 and Fig. 1, 2, 3, 4, 5 and 6 indicated that the isolates differed considerably in their sensitivity to the four fungicides. Lilly and Barnett (1951) reported that fungi exhibit great variation in ability to grow in the presence of certain fungicides. According to Cochran (1958) the response of fungi to toxic agents relates to the inhibition of mycelial growth or of spore germination. This may be due to the ability of the fungicide in the inhibition of energy production, interference with biosynthesis or disruption of cell structure (Sijpesteijn in Marsh, 1972). Horsfall (1956)



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emphasized the two requirements of a toxicant, which is able in some way to react with essential cell constituents and to reach the site of this reaction.

Dekker (*in* Marsh, 1972) stated that the resistance of a fungus to a fungicide may be brought about in various ways, the fungal cell may be changed in such a way that the fungicide does not reach the site of action. The results of this experiment (Table 2, 3, 4 and 5) showed that the isolates of *Phytophthora* species ( $Ph_4$ ,  $Ph_7$ ,  $Ph_C$ ,  $Ph_n$ ) were resistant to the chemicals of the hydantoin group (Rovral and Vinclozolin) and Phosphites (LS 74-783). However, they were very sensitive to Fongarid. On the other hand *Rhizoctonia solani* ( $R_s$ ) was resistant to Fongarid and LS 74-783, but very sensitive to the hydantoin fungicides. Furthermore-resistant to the Fongarid and LS 74-783 was found for the isolate of *Mortierella* ( $P_4$ ), which was tolerant to the hydantoin. *Pythium* was found to be resistant to Vinclozolin and LS 74-783, tolerant to Rovral and sensitive to Fongarid.

Among the isolates, *Fusarium*, was found to be sensitive to hydantoin fungicides and Fongarid but tolerant to the Phosphites. Working under laboratory and field condition, Burgaud *et. al* (1975) and Jones (1975) showed that Rovral was active to *Botrytis* spp., *Monilia* spp., *Sclerotinia* spp., *Sclerotium* spp., *Helminthosporium* spp., *Alternaria* spp., *Fusarium* spp., *Rhizoctonia* and *Phoma*.

Wiertsema and Wissink (1977) found that Fongarid successfully control diseases caused by *Pythium* spp., and *Phytophthora* spp., Baillot (1977) reported that LS 74-783 was effective to some Phycomycetes (*Phytophthora parasitica*; *P. cinnamomi*, *P. capsici*, *P. fragariae*).

The results indicated that *Phytophthora* and *Pythium* were resistant to LS 74-783. It is important to note that the test carried out *in vitro* may not give an accurate indication than that *in vitro* activity. LS 74-783 possesses a good systemic action moving upwards as well as downwards in the plant (Anon., 1977).

The order of effectiveness of the fungicides used, starting with the most effective one, was as follows:

*Phytophthora* species (*P. capsici*, *P. cryptogea*, *P. nicotianae*): Fongarid, LS 74-783, Rovral, Vinclozolin.



Table 2. The effect of Rovral 50% WP on mycelial growth of nine fungal isolates on PDA.

Tabel 2. Pengaruh Rovral 50% WP pada pertumbuhan mycelia dari sembilan macam isolat cendawan pada PDA.

| Fungal isolates<br>Isolat     | $\phi$ mycelial growth (mm) after<br>$\phi$ pertumbuhan mycelia (mm) setelah<br>4 — 6 days at 23°C.<br>4 — 6 hari pada 23°C. |          |          |           | ED <sub>50</sub><br>(ug/ml) | Category<br>of<br>sensitivity<br>Kategori<br>kepekaan |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------------------------|-------------------------------------------------------|
|                               | 0 ug/ml                                                                                                                      | 1 ug/ml  | 10 ug/ml | 100 ug/ml |                             |                                                       |
| <i>Phytophthora capsici</i> 4 | 71.3±2.4                                                                                                                     | 70.8±1.5 | 54.3±1.0 | 46.7±1.5  | > 100                       | a                                                     |
| <i>P. capsici</i> 7           | 58.0±1.2                                                                                                                     | 53.8±2.3 | 44.4±2.2 | 34.8±1.9  | > 100                       | a                                                     |
| <i>P. capsici</i> 8           | 37.3±2.8                                                                                                                     | 36.2±0.5 | 33.2±1.7 | 20.9±2.9  | > 100                       | a                                                     |
| <i>P. cryptogea</i>           | 74.3±1.2                                                                                                                     | 72.2±0.5 | 71.5±2.1 | 54.7±1.5  | > 100                       | a                                                     |
| <i>P. nicotianae</i>          | 35.9±1.3                                                                                                                     | 33.2±0.8 | 30.3±1.3 | 27.6±1.3  | > 100                       | a                                                     |
| <i>Pythium vexans</i>         | 75.0±0.0                                                                                                                     | 75.0±0.0 | 64.0±0.0 | 24.0±0.0  | 10 — 100                    | b                                                     |
| <i>Mortierella beljakovae</i> | 66.0±0.0                                                                                                                     | 56.4±1.8 | 36.3±2.3 | 29.6±1.5  | 10 — 100                    | b                                                     |
| <i>Rhizoctonia solani</i>     | 75.0±0.0                                                                                                                     | 35.7±1.3 | 7.8±1.4  | 5.6±1.4   | < 1                         | d                                                     |
| <i>Fusarium</i> sp.           | 75.0±0.0                                                                                                                     | 38.5±1.3 | 32.0±0.0 | 30.3±1.5  | 1 — 10                      | c                                                     |



Table 3. The effect of Vinclozolin 50%WP on mycelial growth of nine fungal isolates on PDA.

Tabel 3. Pengaruh Vinclozolin 50% WP pada pertumbuhan mycelia dari sembilan macam isolat cendawan pada PDA.

| Fungal isolates<br>Isolat     | $\phi$ mycelial growth (mm) after<br>$\phi$ pertumbuhan mycelia (mm) setelah<br>4 - 6 days at 23° C.<br>4 - 6 hari pada 23° C. |          |          | ED <sub>50</sub><br>(ug/ml) | Category<br>of<br>sensitivity<br>Kategori<br>kepekaan |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------------------|-------------------------------------------------------|
|                               | 0 ug/ml                                                                                                                        | 1 ug/ml  | 10 ug/ml | 100 ug/ml                   |                                                       |
| <i>Phytophthora capsici</i> 4 | 69.1±0.9                                                                                                                       | 62.5±2.1 | 56.3±1.4 | 49.3±2.0                    | a                                                     |
| <i>P. capsici</i> 7           | 67.5±1.7                                                                                                                       | 52.1±1.3 | 44.3±1.2 | 44.0±0.0                    | a                                                     |
| <i>P. capsici</i> 8           | 36.7±2.2                                                                                                                       | 35.5±1.9 | 33.0±0.0 | 30.5±0.6                    | a                                                     |
| <i>P. cryptogea</i>           | 73.2±2.3                                                                                                                       | 71.5±1.3 | 70.5±2.7 | 65.0±0.0                    | a                                                     |
| <i>P. nicotianae</i>          | 36.3±1.0                                                                                                                       | 35.8±1.9 | 32.5±2.5 | 27.6±1.3                    | a                                                     |
| <i>Pythium vexans</i>         | 64.7±1.8                                                                                                                       | 75.0±0.0 | 74.3±1.4 | 71.0±0.0                    | a                                                     |
| <i>Mortierella beljakovae</i> | 74.5±0.7                                                                                                                       | 60.0±0.0 | 37.8±2.3 | 31.7±1.0                    | b                                                     |
| <i>Rhizoctonia solani</i>     | 74.5±0.7                                                                                                                       | 36.0±0.0 | 31.3±2.6 | 26.3±1.0                    | d                                                     |
| <i>Fusarium sp.</i>           | 71.9±1.7                                                                                                                       | 38.6±2.5 | 31.8±2.5 | 30.3±1.2                    | c                                                     |



Table 4. The effect of Fongarid 50% WP on mycelial growth of nine fungal isolates on PDA.  
 Tabel 4. Pengaruh Fongarid 50% WP pada pertumbuhan mycelia dari sembilan macam isolat cendawan pada PDA.

| Fungal isolates<br>Isolat     | $\phi$ mycelial growth (mm) after<br>$\phi$ pertumbuhan mycelia (mm) setelah<br>4 — 6 days at 23°C.<br>4 — 6 hari pada 23°C. |          |          |           | ED <sub>50</sub><br>(ug/ml) | Category<br>of<br>sensitivity<br>Katagori<br>kepekaan |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------------------------|-------------------------------------------------------|
|                               | 0 ug/ml                                                                                                                      | 1 ug/ml  | 10 ug/ml | 100 ug/ml |                             |                                                       |
| <i>Phytophthora capsici</i> 4 | 69.6±1.5                                                                                                                     | 28.3±2.5 | 17.2±2.2 | 14.7±2.1  | > 1                         | d                                                     |
| <i>P. capsici</i> 7           | 66.7±1.1                                                                                                                     | 10.6±1.8 | 5.8±1.3  | 3.4±2.8   | > 1                         | d                                                     |
| <i>P. capsici</i> 8           | 37.5±2.1                                                                                                                     | 14.7±1.1 | 6.4±1.4  | 3.8±1.7   | > 1                         | d                                                     |
| <i>P. cryptogea</i>           | 74.0±0.0                                                                                                                     | 38.0±0.0 | 15.2±1.3 | 1.0±0.0   | > 1                         | d                                                     |
| <i>P. nicotianae</i>          | 36.7±1.5                                                                                                                     | 27.3±2.2 | 7.5±2.8  | 0.0±0.0   | > 1                         | d                                                     |
| <i>Pythium vexans</i>         | 75.0±0.0                                                                                                                     | 55.5±1.3 | 26.3±1.2 | 9.5±0.7   | 1 — 10                      | c                                                     |
| <i>Mortierella beljakovae</i> | 65.8±2.0                                                                                                                     | 67.7±2.0 | 67.0±0.0 | 50.2±2.0  | < 100                       | a                                                     |
| <i>Rhizoctonia solani</i>     | 75.0±0.0                                                                                                                     | 75.0±0.0 | 75.0±0.0 | 72.5±1.3  | < 100                       | a                                                     |
| <i>Fusarium sp.</i>           | 75.0±0.0                                                                                                                     | 58.5±1.3 | 37.3±2.0 | 36.7±2.0  | c, 100                      | c                                                     |



Table 5. The effect of LS 74—783 80% WP on mycelial growth of nine fungal isolates on PDA.

Tabel 5. Pengaruh LS 74-783 80% WP. pada pertumbuhan mycelia dari sembilan macam isolat cendawan pada PDA.

| Fungal isolates<br>Isolat     | Ø mycelial growth (mm) after<br>pertumbuhan mycelia (mm) setelah<br>4 — 6 days at 23 °C.<br>4 — 6 hari pada 23 °C. |          |          |          | ED <sub>50</sub><br>(ug/ml) | Category<br>of<br>sensitivity<br>Katagori<br>kepekaan |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------------------------|-------------------------------------------------------|
|                               | Oug/ml                                                                                                             | 10ug/ml  | 100ug/ml | 500ug/ml |                             |                                                       |
| <i>Phytophthora capsici</i> 4 | 70.5±1.8                                                                                                           | 54.7±1.4 | 42.5±1.5 | 4.3±1.0  | 100—500                     | a                                                     |
| <i>P. capsici</i> 7           | 60.3±1.5                                                                                                           | 45.2±1.1 | 31.1±1.4 | 2.7±2.1  | 100—500                     | a                                                     |
| <i>P. capsici</i> 8           | 37.5±1.8                                                                                                           | 38.5±1.0 | 27.5±0.7 | 1.0±0.0  | 100—500                     | a                                                     |
| <i>P. cryptogea</i>           | 74.0±0.0                                                                                                           | 72.3±2.1 | 54.6±2.3 | 2.5±0.7  | 100—500                     | a                                                     |
| <i>P. nicotianae</i>          | 36.3±1.7                                                                                                           | 27.8±1.0 | 5.5±2.1  | 0.0±0.0  | 10—100                      | b                                                     |
| <i>Pythium vexans</i>         | 75.0±0.0                                                                                                           | 72.5±1.3 | 71.5±1.3 | 2.6±1.7  | 100—500                     | a                                                     |
| <i>Mortierella beljakovae</i> | 65.7±2.4                                                                                                           | 64.3±1.2 | 60.7±1.5 | 14.3±2.1 | 100—500                     | a                                                     |
| <i>Rhizoctonia solani</i>     | 75.0±0.0                                                                                                           | 75.0±0.0 | 75.0±0.0 | 17.0±0.0 | 100—500                     | a                                                     |
| <i>Fusarium sp.</i>           | 75.0±0.0                                                                                                           | 37.8±1.5 | 29.2±1.4 | 0.0±0.0  | 10—100                      | b                                                     |



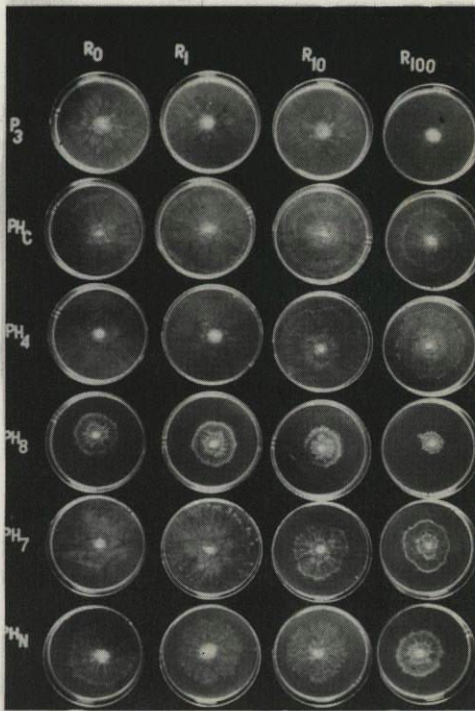


Fig. 1. (Gamb. 1). Mycelial growth of (pertumbuhan mycelia dari) *Pythium vexans* ( $P_3$ ), *Phytophthora cryptogea* ( $PH_c$ ), *Phytophthora capsici* ( $PH_4$ ,  $PH_8$ ), and *Phytophthora nicotianae* ( $PH_n$ ) on (pada) PDA with (dengan) 0, 1, 10 and 100 ug/ml Rovral (R).

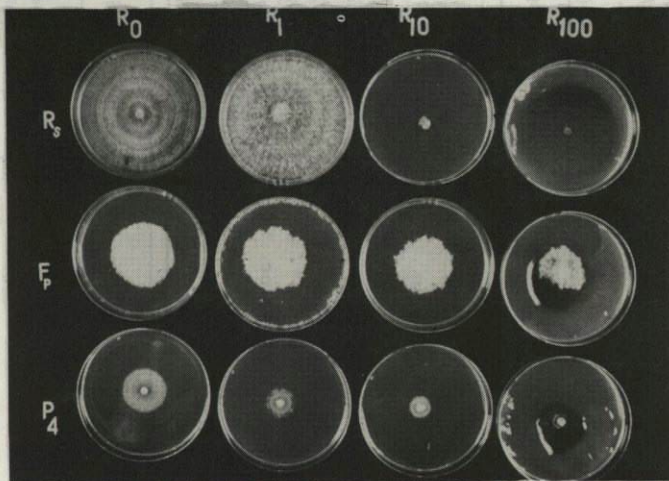


Fig. 2. (Gamb. 2). Mycelial growth of (pertumbuhan mycelia dari) *Rhizoctonia solani* ( $R_s$ ), *Fusarium* sp. ( $F_p$ ) and *Mortierella beljakovae* ( $P_4$ ) on (pada) PDA with (dengan) 0, 1, 10 and 100 ug/ml Rovral (R).



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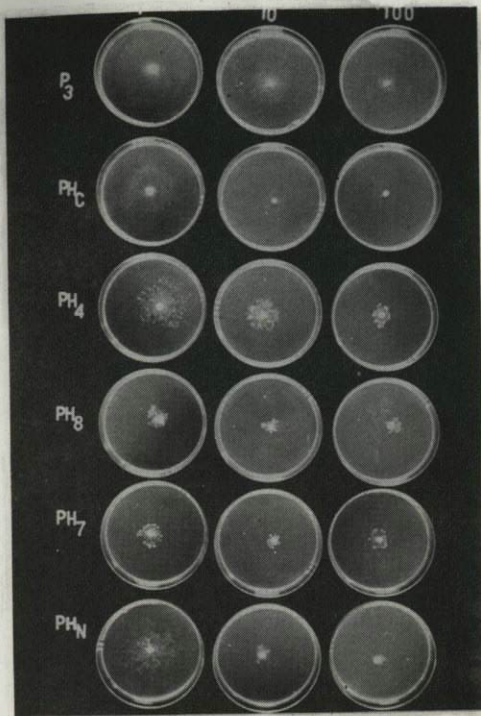


Fig. 3. (Gamb. 3).

Mycelial growth of (pertumbuhan mycelia dari) *Pythium vexans* ( $P_3$ ), *Phytophthora cryptogea* ( $PH_c$ ) *Phytophthora capsici* ( $PH_4$ ,  $PH_8$ ,  $PH_7$ ) and *Phytophthora nicotianae* ( $PH_n$ ) on (pada) PDA with (dengan) 1, 10 and 100 ug/ml Fongarid (F).

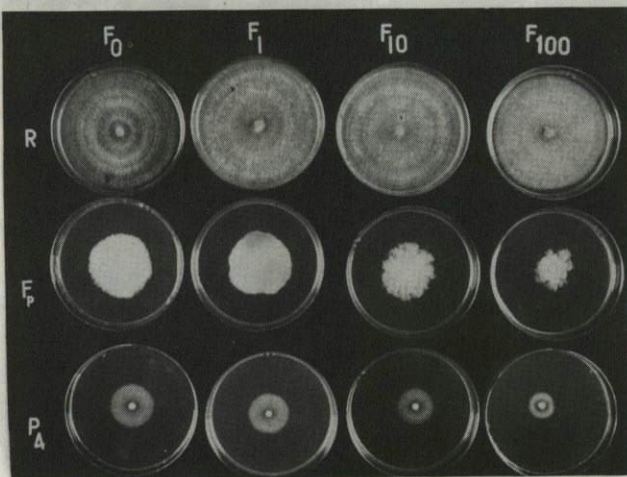


Fig. 4. (Gamb. 4). Mycelial growth of (pertumbuhan mycelia dari) *Rhizoctonia solani* ( $R_s$ ), *Fusarium* sp. ( $F_p$ ) and *Mortierella beljakovae* ( $P_4$ ) on (pada) PDA with (dengan) 0, 1, 10 and 100 ug/ml Fongarid (F).



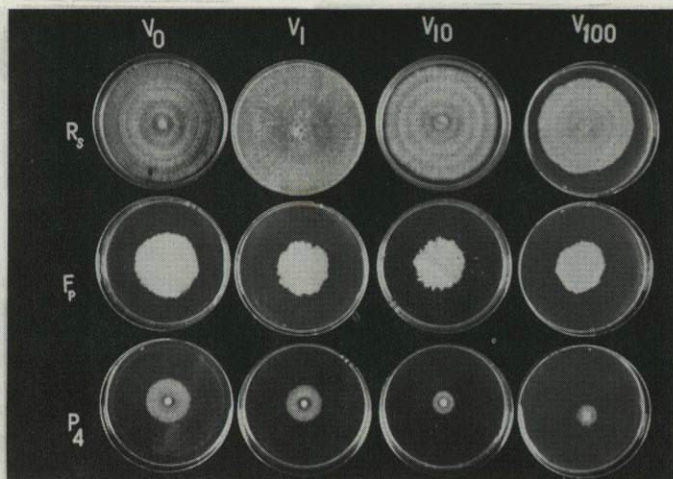


Fig. 5. (Gamb. 5). Mycelial growth of (pertumbuhan mycelia dari) *Rhizoctonia solani* ( $R_s$ ), *Fusarium* sp. ( $F_p$ ) and *Mortierella beljakovae* ( $P_4$ ) on (pada) PDA with (dengan) 0, 1, 10, and 100 ug/ml Vinclozolin (V).

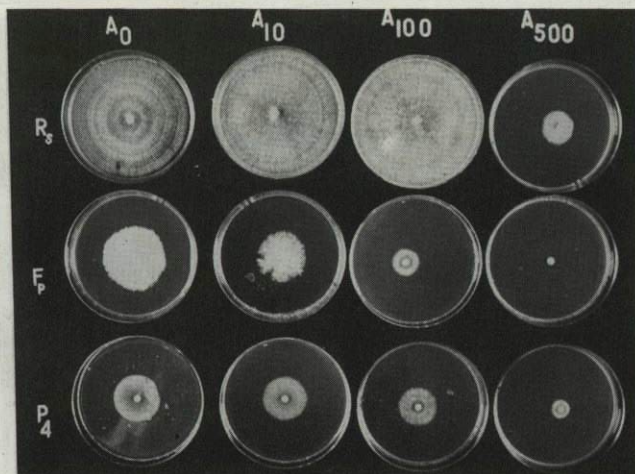


Fig. 6. (Gamb. 6). Mycelial growth of (pertumbuhan mycelia dari) *Rhizoctonia solani* ( $R_s$ ), *Fusarium* sp. ( $F_p$ ) and *Mortierella beljakovae* ( $P_4$ ) on (pada) PDA with (dengan) 0, 10, 100 and 500 ug/ml LS 74-783 (A).



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*Pythium vexans*: Fongarid, Rovral, LS 74-783, Vinclozolin.

*Mortierella beljakovae*: Rovral, Vinclozolin, Fongarid, LS 74-783.

*Rhizoctonia solani* : Rovral, Vinclozolin, Fongarid, LS 74-783.

*Fusarium spp.*: Rovral, Fongarid, Vinclozolin, LS 74-783.

Further research is needed to provide reliable data for the eradication of these pathogens in the greenhouse as well as in the field.

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## Pedoman untuk penulis

1. Judul naskah supaya tepat dan tidak melebihi dari 8 kata. Bila sangat diperlukan sekali dapat dipakai sub-judul.
2. Pada halaman pertama dimintakan suatu ringkasan dari naskah bersangkutan dalam bahasa Indonesia dan bahasa Inggeris (abstract). Kedua ringkasan tersebut sama isinya dan tidak melebihi 250 kata. Kedua ringkasan ini harus memberikan informasi yang lengkap, summary tidak diperlukan.
3. Naskah ditik rapi dengan jarak  $1\frac{1}{2}$  spasi, jangan memakai huruf miring (cursief), dan jangan memakai letter yang ukurannya kecil serta tidak boleh ditempel-tempel.
4. Naskah tersebut dikirimkan ke alamat redaksi rangkap 2.
5. Naskah tidak boleh ditik timbal balik, cukup singkat dan harus merupakan informasi yang padat.
6. Daftar disusun rapi dan bila ada diagram atau kurva jangan berhimpitan. Setiap daftar, diagram dan gambar memakai teks bahasa Indonesia dan Inggeris.
7. Diharapkan agar penulis-penulis naskah menuliskan nama lengkap (tanpa singkatan), jabatan, kantor dan alamat lengkap yang jelas.
8. Redaksi dapat menolak sesuatu naskah dan naskah tersebut dapat dikembalikan kepada penulisnya bila diminta.
9. Redaksi dapat merombak dan merubah naskah sepanjang tidak merubah isi naskah tersebut.
10. Foto yang dapat diterima untuk sementara hitam-putih dan mengkilap dengan ukuran  $9 \times 12$  cm.

Redaksi.