

## SEXUALITY OF PHYTOPHTHORA PALMIVORA ON PIPER NIGRUM IN MALAYSIA

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Accepted for publication: 18 Dec. 1972.

### Ringkasan

Di dalam beberapa penelitian mengawan dua "isolate" *Phytophthora palmivora* (Butl) Butl atas *Piper nigrum* L. telah dipasangkan di antara satu dengan lain dan juga 7 *P. palmivora* "isolate" yang lain di atas pokok mangsaan yang lain. Hasil penyelidikan telah menunjukkan bahawa 2 *p. palmivora* atas *Piper nigrum* adalah sesuai dari segi jantina. Sekarang bukti-bukti menunjukkan bahawa ada sekurang-kurangnya 3 baka unggul *P. palmivora* atas *Piper nigrum* di Malaysia; 2 baka sesuai dari segi jantina dan satu lagi baka "atypical" seperti yang telah dilaporkan dahulu. Pentingnya penyelidikan ini kepada pembiakan *Piper nigrum* bagi menentang penyakit reput akar dibincangkan.

### Introduction

*Phytophthora palmivora* (Butl.), is an omnivorous tropical species capable to inciting diseases on at least 51 genera belonging to 29 families of flowering plants (Hickman, 1958). Reports on the variability of members within this species and the occurrence of distinct biological strains have been numerous (Ashbp, 1929; Chee, 1969, Orellana, 1959; Satchuthanathavale, 1963; Turner, 1960; 1961). More recently, Savage *et al* (1968) revealed the presence of A<sub>1</sub> and A<sub>2</sub> compatibility types in *P. palmivora*.

Sexuality of *P. palmivora* on black-pepper (*Piper nigrum* L.) on the other hand, is still little known. Turner (1962) reported the presence of oospores in 2 to 4 month-old pure cultures of *P. palmivora*. However, Holliday and Mowat (1963) were not able to find oospores in the same fungus. The present studies were therefore initiated to elucidate further the sexuality of *P. palmivora* on black-pepper in view of the important role the oospores play in the genetic variation of the fungus.

### Materials and Methods

Two *P. palmivora* isolates on black-pepper from Sarawak and Johore were tested for their ability to produce oospores in paired cultures. The 2 isolates were also tested for their ability to produce oospores with 7 other *P. palmivora* isolates of known compatibility types; 3 of which are from citrus soil, and 1 each from cocoa, durian, papaya and rubber. Cleared lima-bean agar which was used in these studies was prepared by blending 200 gms. of fresh lima-bean in distilled water. The suspension was later filtered through 3 layers of muslin cloth and the final volume made up to 1 litre with further addition of distilled water. The medium was solidified by the addition of 15 gms. of agar per litre.

Pairing was achieved by placing 4 mm. culture discs of 2 isolates 5 cm. apart in Petri-dishes, each containing 15 ml. of the medium. Inoculated dishes were incubated at 25°C under 12 hours alternate light and darkness. Degree of oospores production after 2 weeks were graded according to the following scale:

-	=	nil
+	=	few
++	=	moderate
+++	=	abundant

## Results

The degree of oospore production in the various paired cultures is given in Table 1.

Table 1. Degree of oospore production in 14-day-old paired cultures of *Phytophthora palmivora* from various sources.

Black-pepper isolate	Source of <i>P. palmivora</i> isolates							
	Johore	Citrus soil I	Citrus soil II	Citrus soil III	Cocoa	Durian	Papaya	Rubber
Sarawak	+++	-	+	-	-	+	-	-
Johore	-	+++	-	+++	++	-	-	-

- = nil; + = few; ++ = moderate; +++ = abundant

Oospores with amphigynous antheridia were abundantly produced in paired cultures between the 2 black-pepper isolates (Plate 1). Sarawak black-pepper isolate produced few oospores in paired cultures with durian isolate and 1 of the 3 citrus soil isolates. Moderate to abundant oospores were produced in paired cultures between Johore black-pepper isolates and cocoa isolate and 2 other citrus soil isolates. Both the black-pepper isolates were non-complementary to papaya and rubber isolates. The dimensions of oogonia and oospores produced in the various paired cultures are given in Table 2.

Table 2. Dimension of oogonia and oospores produced in paired cultures of *Phytophthora palmivora* from various sources.

Paired cultures of <i>P. palmivora</i> from various sources	*Dimension In Micron			
	Oogonium		Oospora	
	Range	Mean	Range	Mean
S x J	26.3 — 35.0	31.0	21.3 — 28.8	26.0
S x Citrus soil II	23.8 — 27.5	26.8	20.5 — 25.0	23.8
S x Durian	25.0 — 30.0	27.8	20.0 — 27.5	24.5
J x Citrus soil I	25.0 — 30.0	28.8	21.3 — 27.5	24.5
J x Citrus soil III	22.5 — 27.5	25.5	20.5 — 25.0	23.0
J x Cocoa	27.5 — 36.3	31.9	22.5 — 32.5	28.4

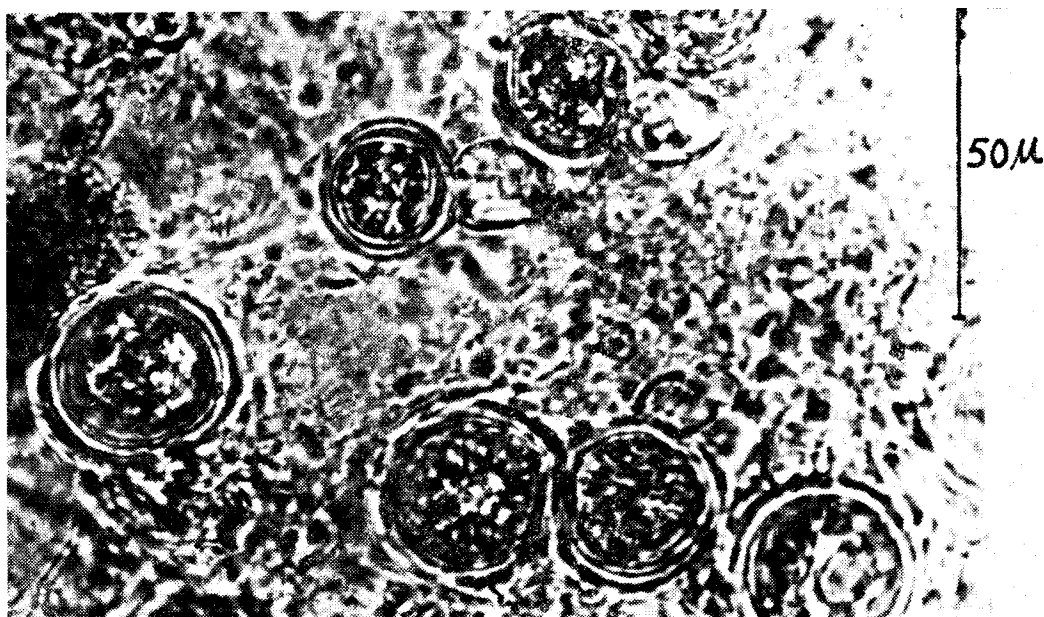
S and J = Black-pepper isolates from Sarawak and Johore respectively.

\*Average of 100 measurements

## Discussion

The 2 *P. palmivora* isolates on black-pepper did not produce oospores in pure cultures even after 6 months of incubation. This was in contradiction to findings made by Turner (1962) in his study of the fungus in pure cultures. However, oospores were abundantly produced when the 2 isolates were paired. Mean dimension of oospores thus produced were similar to those as recorded by Turner (*loc. cit.*). Two distinct sexually compatible strains of *P. palmivora* on black pepper are therefore present in Malaysia. The isolate studied by Turner (1962) could be an atypical strain capable of producing oospores in pure cultures. Ability of *P. palmivora* on black-pepper from Sarawak to produce oospores in paired cultures with durian isolate of  $A_1$  compatibility type indicates the presence of  $A_2$  compatibility type in the Sarawak isolate. Similarly ability of *P. palmivora* from Johore to form oospores in paired cultures with cocoa isolate of  $A_2$  compatibility type indicates the presence of  $A_1$  compatibility type in the Johore isolate.

The occurrence of 2 distinct sexually compatible strains of *P. palmivora* on black-pepper is likely to increase the chances of qualitative and quantitative changes in the pathogenicity of the pathogen through sexual recombination. Recent inoculation studies also indicated that these sexually distinguishable strains differed significantly in their degree of pathogenicity on black-pepper cuttings. These factors must be considered when programmes are undertaken to breed black-pepper for foot-rot resistance.



Oospores with amphigynous antheridia from paired culture of Sarawak black-pepper isolate X Johore black-pepper isolate.

## Acknowledgements

The writer gratefully acknowledges the advice given by Dr. W.P. Ting in this work. Thanks are also due to Dr. K.H. Chee, Rubber Research Institute, Kuala Lumpur; Miss L.H. Tai and Mr. C.F. Loh, both from the Crop Protection Research Division, MARDI, for supplying the *Phytophthora palmivora* isolates used in this study.

## Summary

In a series of mating studies, 2 isolates of *Phytophthora palmivora* (Butl.) Butl. on *Piper nigrum* L. were paired with each other as well with 7 other *P. palmivora* isolates on other host plants. Results indicate the 2 *P. palmivora* on *Piper nigrum* are sexually compatible. There is now evidence to show that at least 3 distinct strains of *P. palmivora* on *Piper nigrum* are present in Malaysia; 2 sexually compatible strains and an atypical strain reported earlier. The importance of this finding in relation to breeding of *Piper nigrum* for foot-rot resistance is discussed.

## References

- Ashby, S.F. (1929). Strains and taxonomy of *Phytophthora palmivora* Butler (*P. faberi* Maubl.). Trans. Br. Mycol. Soc. 14, 18 — 38.
- Chee, K.H. (1969). Variability of *Phytophthora* species from *Hevea brasiliensis*. Trans. Br. Mycol. Soc. 52, 425 — 436.
- Hickman, C.J. (1958). *Phytophthora* — plant destroyer. Trans. Br. Mycol. Soc. 41, 1 — 13.
- Holliday, P. & Mowat, W.P. (1963). Foot-rot of *Piper nigrum* L. (*Phytophthora palmivora*). Phytopath. Paper No. 5.
- Orellana, R.G. (1959). Variation in *Phytophthora palmivora* isolated from cocoa and rubber. Phytopathology 49, 210 — 213.
- Savage, E.J., Clayton, C.W., Hunter, J.H., Brenneman, J.A., Laviola, C., and Gallegly, M.E. (1968). Homothallism, heterothallism and interspecific hybridization in the genus *Phytophthora*. Phytopathology 58, 1004 — 1021.
- Satchuthananthavale, V. (1963). Complementary strains of *Phytophthora palmivora* from Ceylon rubber. Phytopathology 53, 729.
- Turner, G.J. (1962). Production of fusion organs by the species of *Phytophthora* which causes foot-rot of *Piper nigrum* L. in Sarawak; Nature, Lond. 195 — 201.
- Turner, P.D. (1960). Strains of *Phytophthora palmivora* (Butl.) Butl. from *Theobroma cacao* L. I. Isolates from West Africa. Trans. Br. mycol. Soc. 43; 665 — 672. (1961). Strains of *Phytophthora palmivora* (Butl.) Butl. from *Theobroma cacao* L. II. Isolates from non-African-countries. Trans. Br. Mycol. Soc. 44, 409 — 416.