

Phytophthora mekongensis

(Cacciola & Hoa, 2018)

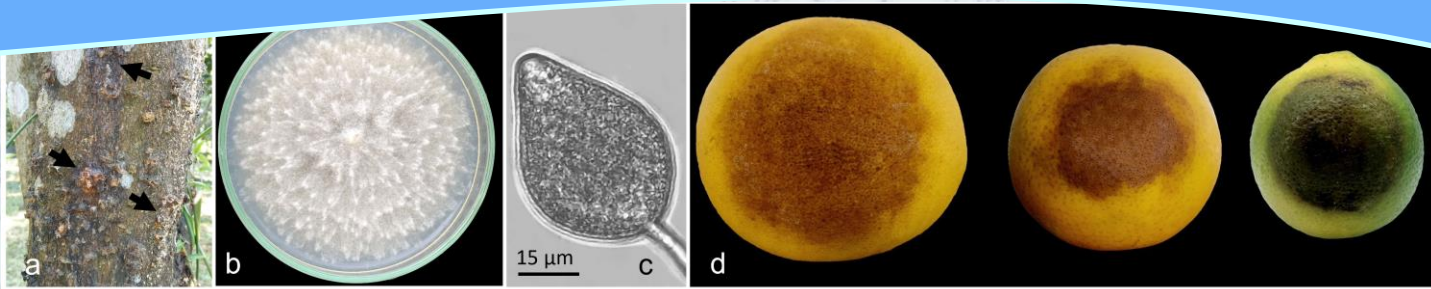


Fig. 1. (a) Symptoms of pomelo stem gummosis in the garden, (b) 5-d-old culture of *Phytophthora mekongensis* on PDA medium; (c) a sporangium; (d) brown rot on pomelo, orange, and lime, respectively.

Disease: Brown fruit rot; Gummosis and root rot; Phytophthora disease of citrus

Pathogen: *Phytophthora mekongensis*

Classification: **K:** Chromista; **P:** Oomycota; **C:** Oomycetes; **O:** Peronosporales; **F:** Peronosporaceae

Phytophthora species are notorious for causing root rot, stem gummosis, and brown fruit rot, also known as Phytophthora disease, in citrus (*Citrus* spp.), especially orange (*C. sinensis*) and pomelo (*C. grandis*). In addition to well-known associated *Phytophthora* species, a novel species of *Phytophthora* Clade 2a – *P. mekongensis* was first reported in 2017 and identified as a pathogen causing brown rot of pomelo and root rot of Volkamer lemon (*C. volkameriana*) in Southern Provinces (Mekong Delta region) in Vietnam. Recently, *P. mekongensis* was isolated and confirmed to cause disease not only in pomelo but also in orange and lime (*C. aurantiifolia*) trees in Northern Vietnam. To date, this pathogen has not been recorded in other countries and regions, particularly Australia, as a citrus pathogen.

Biology and Ecology:

Phytophthora mekongensis is closely related but distinct from *P. meadii*, a pathogen of rubber tree (*Hevea brasiliensis*). Molecular identification by sequencing of the ITS and *cox1* gene regions helps to accurately identify *P. mekongensis*.

Phytophthora mekongensis is a soil and water inhabitant. Zoospores, chlamydospores, and oospores can be spread by rain splash, wind-blown rain, soil, and soil water.

Natural infection by *P. mekongensis* in the roots and stems of oranges, lemons, and limes, in addition to pomelos, in orchards, has been documented. Specifically, in artificial inoculation experiments under controlled conditions, *P. mekongensis* induced root rot, fruit brown rot, and stem gummosis in pomelo, orange, and lime. Pomelo is the most susceptible to this pathogen, followed by orange and lime. Among *Phytophthora* species causing diseases in citrus, *P. mekongensis* is generally more aggressive than *P. nicotianae*, *P. palmivora*, and *P. parvispora*.

Distribution:

Vietnam. This species has not been reported in other countries.

Host Range:

Since *P. mekongensis* is a recently reported species that causes disease in various *Citrus* species, the exact host range and whether this pathogen can cause diseases in non-citrus hosts remains unknown.

Impact:

Phytophthora disease can cause losses of 10–30% of fruit production. Fruits in the lower part are more susceptible to disease, leading to the rot and falling to the ground.

Management options:

Provide adequate soil drainage, avoid over irrigation, select resistant rootstocks or *Phytophthora*-free planting material where possible, remove infected plant debris and fruit on the ground and disinfect the surrounding area. Consider using fungicides and fumigation. Several agro-chemical compounds (a.i. metalaxyl, dimethomorph, chlorothalonil, and potassium phosphonate) still suppress the growth of *P. mekongensis* *in vitro*. Potassium phosphonate suppresses gummosis symptoms in Vietnam and should be an important component of integrated Phytophthora disease management on citrus.

Further Reading:

Abad, Z.G., Burgess, T.I., Redford, A.J., Bienapfl, J.C., Srivastava, S., Mathew, R., & Jennings, K. (2023). IDphy: An international online resource for molecular and morphological identification of *Phytophthora*. *Plant Disease*, 107:987–998. (Website: <https://idtools.org/tools/1056/index.cfm>)
 Puglisi, I., et al., & Cacciola, S. O. (2017). Two previously unknown *Phytophthora* species associated with brown rot of pomelo (*Citrus grandis*) fruits in Vietnam. *PLoS One*, 12:e0172085. <https://doi.org/10.1371/journal.pone.0172085>
 Tran, Q.V., Ha, C.V., Vvedensky, V.V., & Han, V.C. (2023). Current status and characterization of *Phytophthora* species associated with gummosis of citrus in Northern Vietnam. *Journal of Phytopathology*, 171: 478–488. <https://doi.org/10.1111/jph.13204>

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