

CHARACTERIZING BUTT-ROT FUNGI ON USA-AFFILIATED ISLANDS IN THE WESTERN PACIFIC

Phil Cannon¹, Ned B. Klopfenstein², Robert L. Schlub³, Mee-Sook Kim⁴, Yuko Ota⁵, Norio Sahashi⁵, Roland J. Quitugua³, John W. Hanna², Amy L. Ross-Davis², and Sara M. Ashiglar²

INTRODUCTION

Ganoderma and *Phellinus* are genera that commonly cause tree butt-rot on USA-affiliated islands of the western Pacific. These fungal genera can be quite prevalent, especially in older mangrove stands. Although the majority of infections caused by these fungi lead to severe rotting of the heartwood, they typically do not directly kill the living tissues of the sapwood, cambium, or phloem. In this region, infection by butt-rotting fungi usually causes a loss of structural strength in the bole, but not direct mortality. However, three notable exceptions were found during a recent forest health survey of western Pacific islands. The first includes typhoon damage within a forest, where butt-rot-afflicted trees were exceptionally prone to wind breakage and wind-throw. A second includes the after effects of typhoon-strength winds that cause wounds and breakage in previously healthy trees, consequently allowing ingress of butt-rot fungi that can then subsequently spread

via root contact to neighboring trees. A most-notable third exception is when *Phellinus noxius*, the cause of brown root rot, is the primary pathogen.

The purpose of this project is to collect root-/butt-rot fungi from diverse tropical forest, agricultural and urban trees in the western Pacific islands, conduct local workshops with natural resource professionals, and establish collaborative efforts to survey root-/butt-rot diseases in USA-affiliated islands of the western Pacific (Palau, Yap, Guam, Saipan, Pohnpei and Kosrae).

SURVEY METHODS

Samples of root-, butt-, and wood-rot fungi were collected in September 2013 within natural forests, agroforestry settings, and urban forests in the western Pacific islands of Palau, Yap, Guam, Saipan, Pohnpei and Kosrae (Figure 1). On these islands, local forestry staff noted locations of root- and butt-rot disease problems in their forests and obtained permission to survey and sample these areas. Local staff also assisted with the logistics of these surveys and participated actively in the collection of the samples, the identification of host species, and the characterization of the infection foci. Location data (latitude, longitude, elevation), host species, and other pertinent information were collected at each sampling site. Representative samples (fungal fruiting bodies and infected wood) were collected at each survey area. Fungi were isolated from

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fruiting bodies and/or infected wood using Potato Dextrose Agar (PDA), PDA with benomyl, or Benomyl-Dichloran-Streptomycin (BDS) media. Samples were then sent in accordance with APHIS permits to the Forest Pathology Laboratory of the Rocky Mountain Forest Research Station in Moscow, Idaho where DNA-based techniques will be used to verify identifications. *Phellinus noxius* samples will be further examined to evaluate genetic diversity across the western Pacific islands, Japan, Taiwan, and other locations.

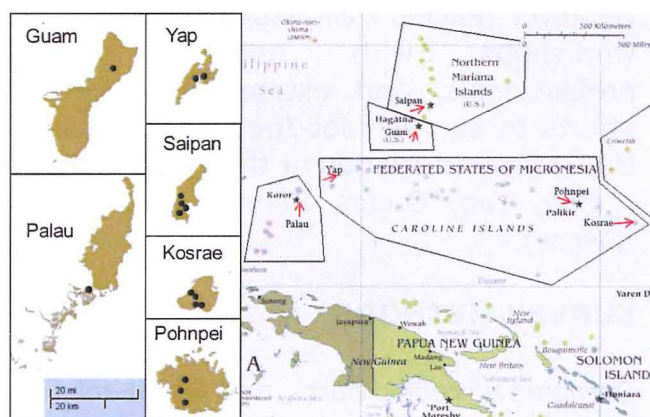


Figure 1. Locations of *Phellinus noxius* collected in 2013 shown by black circles on individual island maps.

PRELIMINARY OBSERVATIONS AND DISCUSSION

From the preliminary surveys conducted on Palau, Yap, Guam, Saipan, Pohnpei and Kosrae, it appears that most butt-rot infections are being caused by either *Phellinus* or *Ganoderma* species. Precise taxonomic identification of the fungi surveyed will be provided by DNA-based techniques during 2014. Initial findings using morphological characteristics suggest that *P. noxius* is uncommon in Guam, Palau and Yap; and fairly prevalent in Pohnpei, Kosrae and Saipan (Figure 1).

As this preliminary survey progressed, it became quite apparent that *P. noxius* was the deadliest of the butt-rotting pathogens encountered; this fungus could easily spread from tree to tree via root systems and subsequently engulf and kill the cambial tissue of its widely ranging host trees (Figure 2). Fruiting bodies of *P. noxius* were also found in some locations, and could contribute to pathogen spread via basidiospores. Because the impact of this fungus is quite dramatic and raises considerable concern, significant discussion ensued about potential management of this pathogen through workshops and on-site discussions with local stakeholders (Figures 3 and 4). Several very novel remedies were conveyed by local natives and tentative plans were made for testing their effectiveness.

PLANNED FUTURE ACTIVITIES

The first planned activity from these surveys includes the identification of the fungi collected from western Pacific islands using DNA-based techniques. Species identifications and determination of the history will provide a basis for future genetic studies to examine spread pathways of *P. noxius* on the islands. This potential project could be conducted through microsatellite and/or restriction site-associated DNA sequencing analyses in conjunction with local accounts. In collaboration with local forestry staffs on each island, potential follow-up studies are also planned to further investigate brown root rot, conduct pathogenicity tests of *P. noxius* isolates, and/or evaluate local remedies. Pending study results, one-page bulletins showing symptoms and signs of this fungal pathogen as well as effective management measures for minimizing the disease caused by *P. noxius* are an

example of technology transfer needs. Additional needs include campaigns designed to reduce human-caused fire damage to tree boles, reduce unauthorized tree harvesting, and increase awareness of proper tree care to minimize damage caused by *P. noxius* and other root-, butt-, and wood-rot fungal pathogens.

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Figure 2. Right: *Phellinus noxius* attacking African flame tree (*Delonix regia*) in Saipan. Left: *P. noxius* attacking breadfruit tree (*Artocarpus altilis*) in Pohnpei.



Figure 3. Workshops and meetings in Pohnpei. Left: The "root- and butt-rot team" meets with Ambassador to the Federated States of Micronesia (Dorothea-Maria "Doria" Rosen); Middle: Field collections and interaction with native Pohnpeians; Right: "townhall" meeting with local stakeholders.



Figure 4. Left: Native student of Northern Mariana College (Saipan) assisting with *Phellinus noxius* collection. Right: Phil Cannon consults with local grower about *P. noxius*-infested mango farm.

