



# Survey of wood decay fungi of *Casuarina equisetifolia* on the islands of Guam and Saipan

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**Plate 1.** Trees in severe decline on University of Guam campus at survey site 2.



**Plate 2.** Cross-section of rotted ironwood tree butt infected with *Ganoderma australe* species complex.



**Plate 3.** Sporocarp (conk) of *Ganoderma australe* species complex on lower left side of an ironwood tree at University of Guam site 1.



**Plate 4.** Sporocarp (conk) of *Ganoderma australe* species complex on butt of ironwood tree in woodlot at George Washington high school.



**Plate 5.** Sporocarp (conk) of *Phellinus* sp. on roots of ironwood tree at University of Guam site 1.



**Plate 6.** *Phellinus* sp. sporocarps are occasionally found on large, healthy appearing ironwood trees

## Abstract

As a result of statistical modeling of data from individual trees and tree sites, the occurrence of basidiocarps consistently emerged as the dominant explanatory variable for Guam's declining ironwood trees (*Casuarina equisetifolia*) (Schlub, 2010).

A survey was conducted in February 2012 in the Mariana Islands to elucidate which of the known basidiocarp genera are most likely responsible for the decline. Species from five basidiomycete genera of the class Agaricomycetes, belonging to the orders Polyporales (*Ganoderma*, *Favolus*, *Pycnoporus*), Hymenochaetales (*Phellinus*) and Thelephorales (*Sarcodon*) were previously identified from Guam based on macro- and micromorphology and DNA sequencing (Mersha *et al.*)

As a result of the February survey, *Ganoderma australe* species complex was the basidiocarp most frequently associated with ironwood tree decline (Plate 1) and its subsequent wood rot (Plate 2). Conks of the fungus were commonly found on Guam where they appeared on roots and butts of declining trees. On Saipan, where decline does not exist and the trees are healthier, this same *Ganoderma* was rare; however, its actual existence will need to be verified by DNA sequencing.

*Phellinus* sp. was the most commonly found basidiocarp on Guam and Saipan. The *Phellinus* sp. as well as two other rarely found *Ganoderma* spp. on Guam and Saipan are less likely the cause of ironwood decline and more likely a part of the normal decay process of the ironwood trees in the Mariana Islands. Though the actual species of *Phellinus* remains to be determined, it can be said with certainty that it is not *Phellinus noxious*. *P. noxious* is commonly on the islands' flame tree (*Delonix regia*).

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## Methods

The tree survey was conducted to quantitatively and qualitatively document existing basidiocarps of wood decay fungi on ironwood trees in Guam and Saipan. The methodology used to document existing basidiocarps was developed, in part, to be consistent with previous surveys of ironwood on Guam (Schlub *et al.*, 2010.)

The survey conducted on Guam consisted of 2 stages. The first stage was conducted by Dr. Schlub and Agriculture students Charles Aiseam, Rowena Mendi, Robert Mendi and Jonathan Davis on 1/24/2012 and the class's survey of 2/7/2012. The survey was conducted to quantify basidiocarps on ironwood trees in various ironwood decline sites. The second part of the survey consisted of a subsequent visit to these sites a few days later with Dr. Cathie Aime, during which time she qualified the basidiocarps on the surveyed trees. Type samples were collected for later laboratory analysis.

The surveys conducted by Drs. Schlub and Aime on Saipan February 6 and 7 consisted of one-time site visits, where both quantitative and qualitative basidiocarp information was recorded.

**Survey area:** Tree surveys were conducted in areas where trees were moderate to large in size, easily accessible and where their health was in question. Three areas on Guam were surveyed and six on Saipan.

**Survey sites:** Survey sites consisted of an entire survey area or a portion. The survey area and sites on Guam included trees flanking sidewalks on University of Guam campus (UOG 1 & 2), a woodlot at George Washington High School (GW), and windbreaks at Onward Mangilao Golf Course (OM 1, 2, & 3). The survey area and sites on Saipan included trees in landscaped area at American Memorial Park (AMP 1, 2, & 3), Fisherman Memorial (FM), Tennis courts (TC), Banzai Cliff (BC), Lau Lau Bay (LLB), and Public Works Beach (PWB).

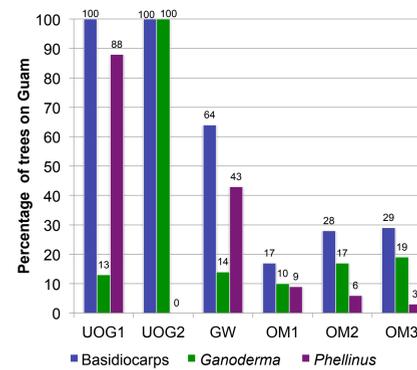
**Identification of basidiocarps:** In the first stage of the Guam survey, which occurred prior to Dr. Aime's arrival, fruiting structures were tentatively identified based on visual comparisons with type samples of *Ganoderma* and *Phellinus* from ironwood trees previously identified by Dr. Aime.

Distinguishing features for Guam's *Ganoderma* sp. sporocarp includes a cap that is unvarnished, gray to brown, and fan shaped (Plate 3), with an white pored undersurface that when young easily bruises brown (Plate 4).

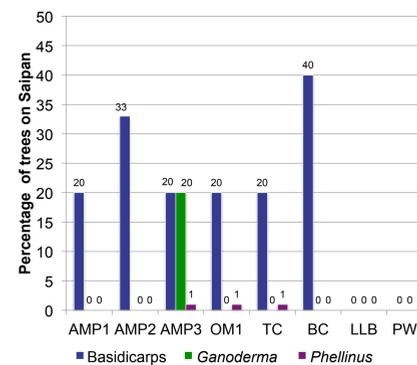
Distinguishing features for Guam's *Phellinus* sp. sporocarp includes a cap that is more or less fan-shaped, often formed in overlapping shelves, rusty-brown to dark-brown, cap margins when young are yellow-brown and pubescent, with a yellow-brown undersurface (Plate 5).

## Results

One-hundred and three ironwood trees were inspected in three different locations in Guam and 44 trees in six locations in Saipan. The two most occurring basidiocarps are *Ganoderma* and *Phellinus*. *Ganoderma* samples were placed into one of three groups *australe*, *lucidum*, and an unnamed group with yellow mycelium, which was only seen on Saipan. *Phellinus* appears to be all the same species. Unidentified resupinate polypores were commonly founds on trunks on Guam but were rare on Saipan. Two surveys of several dozen trees in health tree stands on Guam at Ritidian and Cocos Island resulted in no *Ganoderma* (*australe* complex) and one basidiocarp of *Phellinus* at both locations.



**Figure 1** Percentage of trees on Guam with root, butt, or lower trunk basidiocarps, percentage with identifiable sporocarps of *Ganoderma* (*australe* complex) and or *Phellinus*. The survey area and sites include trees flanking sidewalks on University of Guam campus (UOG 1 & 2) (Plate 1), a woodlot at George Washington High School (GW), and windbreaks at Onward Mangilao Golf Course (OM 1, 2, & 3).



**Figure 2** Percentage of trees on Saipan with root, butt, or lower trunk basidiocarps, percentage with identifiable sporocarps of *Ganoderma* (*australe* complex) and or *Phellinus*. The survey area and sites on Saipan include trees in landscaped areas at American Memorial Park (AMP 1, 2, & 3), Fisherman Memorial (FM), Tennis courts (TC), Banzai Cliff (BC), Lau Lau Bay (LLB), and Public Works Beach (PWB).

## Conclusion

Tree stand density may have a weak but direct relationship to incidence of conks. It appeared to have no effect on incidences of basidiocarps such as at UOG where the majority of the trees have them. However, in a location where the incidence is much lower, such as at the Onward Mangilao Golf course, it may have a deleterious effect. For example, the percent difference between the highest tree density site OM 3 (242 sq. ft / tree) and lowest, OM 1 (185 sq. ft / tree) is 24%, which compares to the percentage difference between their incidence of conks for OM 1 at 17% and OM 3 at 29% which equates to a difference of 41%. Similar trend was seen on Saipan.

There were mainly two species of basidiocarps on most affected trees; *Ganoderma* sp. (*australe* group), which fruits on tree roots, butt and less commonly on trunk, and *Phellinus* sp., which primarily fruited on the butt. Both are common on Guam (Figure 1) and infrequent on Saipan (Figure 2). The presence of *Ganoderma* is a consistent indicator of a tree in decline and its occurrence is irrespective of tree size. *Phellinus* is found in association with *Ganoderma* or by itself on very large mature trees. On its own, *Phellinus* does not appear to be a contributor to ironwood decline (Plate 6).

### References

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