Brown Root Rot Disease

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Brown root rot is a disease of woody plants that causes decline and death of trees throughout the tropics. The name brown root rot refers to a dark brown crust formed by the fungus, *Phellinus noxius* (Corner) Cunningham, on exposed roots and lower plant stems. The fungus has devastated plantations of cacao, mahogany, rubber, and hoop pine. Reforestation projects have been seriously affected when exotic trees such as *Cordia alliodora* and *Swietenia macrophylla* were introduced into native stands, became infected and died. Fruit tree orchards and woody landscape plants are also susceptible to *P. noxius*. The disease, called *limu mea* by Samoans, was first reported in American Samoa in 1971 as charcoal crown rot of breadfruit, but later recognized as brown root rot.

Pathogen. *P. noxius* is a fungus that grows on the outer surface of roots and stems as it rots the wood beneath. It spreads when roots of healthy trees contact roots, stems, or stumps of infected trees. The first symptoms of disease are leaf yellowing (chlorosis) followed by wilt and branch dieback as the fungus destroys infected roots and cuts off the plant's supply of water and nutrients (Figure 1). A crust of the fungus is usually detected growing on exposed lateral roots and up the plant stem. Crusts generally measure 1-2 m (3'-6') from the soil line (Figure 2) but crusts 3-5 m high (10'-15') have been recorded (Figure 3). Fine mats of the fungus also grow beneath crusts and destroy the vascular cambium, girdling and killing the tree. Fruiting bodies (sporocarps) form on a small percentage of trees; they are either shelf-like (dimidiate), grow flat along undersides of fallen trees (resupinate), or a combination of both (effused-reflexed). The sterile upper surface of sporocarps is brownish-black, rough, and irregularly zoned; the fertile pore surface is gray-brown.

Figure 1. Symptoms of brown root rot in kapok: tree in foreground is dead, leaves of second tree are yellow and falling, while other trees appear unaffected.

Figure 2. Measuring a crust of *P. noxius* about 1 m in height.

Tropical Forests. A survey conducted in 2001 of relatively undisturbed forests on Tutuila Island, American Samoa, recorded 37 different tree species in 30 genera and 22 families infected by *P. noxius* (Table 1). Of over infected 300 trees, 25 percent were *Myristica fatua*, 16 percent *Dysoxylum samoense*, and 10 percent *Hibiscus tiliaceus*. The number of diseased trees was lowest at montane survey sites (above 350 m) and on ridgetops, increasing in primary valleys, on slopes, along the coast and on the lowland plain, respectively. Secondary forests in three valleys disturbed by man had by far the highest incidence of disease, more than twice the other sites combined. Possible reasons for this include a decline in species richness at disturbed valley sites and a large number of early succession species susceptible to *P. noxius*. The effect of a lack of species richness has been demonstrated in single-crop plantations on cleared forest land: *P. noxius* moved rapidly through plants of the same species, whereas it

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had moved more slowly through a mixture of forest trees. This may be due to different levels of resistance to the fungus among tree species, different microenvironments around their roots, or both.

Management. There is no cure for brown root rot disease. Chemicals will not control its spread and no resistant tree varieties have been identified. In American Samoa it is believed a member of the lily family, *lau talo talo* (*Crinum* sp.), planted next to a tree will protect it from *P. noxius*, but this has not been tested objectively. Current recommendations include removal of infected trees and as much of the root system as possible. Planting herbaceous crops with vigorous roots, such as grasses, will increase the breakdown of woody debris in the soil that may harbor the fungus. Replanting trees, widely spaced, about one year later and quickly removing any infected plants may control spread of the disease.

Table 1. List of forest trees on Tutuila Is., American Samoa, infected by *P. noxius* (from a 2001 survey).

Anacardiaceae
Rhus taitensis Guillemin
Spondias dulcis L.
Annonaceae
Cananga odorata (Lam.) Hook & Thoms.
Apocynaceae
Cerbera manghas L.
Barringtoniaceae
Barringtonia asiatica (L.) Kurz
Barringtonia samoensis A. Gray
Boraginaceae
Cordia aspera Forst. f.
Burseraceae
Canarium harveyi Seem.
Clusiaceae
Calophyllum neo-ebudicum Guillaumin
Combretaceae
Terminalia richii A. Gray
Ebenaceae
Diospyros samoensis A. Gray
Euphorbiaceae
Flueggea flexuosa Marg.
Glochidion ramiflorum Forst.
Macaranga harveyana (Muell. Arg.) Muell. Arg.
Macaranga stipulosa Muell. Arg.
Fabaceae
Adenanthera pavonina L.
Inocarpus fagifer (Parkinson) Fosb.
Intsia bijuga (Colebr.) Kuntze
Samanea saman (Jacq.) Merr.
Hernandiaceae
Hernandia nymphaeifolia (Presl) Kub.
Malvaceae
Hibiscus tiliaceus L.
Meliaceae
Dysoxylum samoense A. Gray

Figure 3. A 3-m-high crust of *P. noxius* on roots and trunk.

Moraceae
Ficus obliqua Forst. f.
Ficus tinctoria Forst. f.
Ficus sp.
Myristicaceae
Myristica fatua Houtt.
Myrtaceae
Syzygium inophylloides (A. Gray) C. Muell.
Syzygium sp.
Rhizophoraceae
Crossostylis biflora Forst.
Rubiaceae
Morinda citrifolia L.
Neonauclea forsteri (Seem. ex Havil.) Merr.
Sapotaceae
Planchonella grayana St. John
Planchonella samoensis H.J. Lam. ex Christoph.
Sapindaceae
Elattostachys falcata (A. Gray) Radlk.
Pometia pinnata Forst.
Urticaceae
Pipturus argenteus (Forst. f.) Wedd.

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