



GUIDELINES ON BROWN ROOT ROT DISEASE

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Annexes

- I. Pictorial Guide of Brown Root Rot (BRR) Disease**
- II. Frequently asked questions on BRR Disease**

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Guidelines on Brown Root Rot Disease

1. Purpose

1.1. This guideline on Brown Root Rot (BRR) Disease focuses on disease management strategy, identification of suspected cases and removal procedures of infected trees.

2. What is Brown Root Rot Disease?

2.1. *Phellinus noxius* is an aggressive fungal pathogen that causes BRR disease. The disease mainly spreads through root-to-root contact or through infested wood debris in soil. There may also be a possibility of spreading the disease through the dissemination of basidiospores from fruiting bodies. It is prevalent in tropical and subtropical regions and has a wide host range covering over 200 plant species in 59 families. In Hong Kong, a number of trees species such as *Aleurities moluccana*, *Bombax ceiba*, *Celtis sinensis*, *Delonix regia*, *Ficus microcarpa*, *Ficus benjamina*, *Gleditsia fera*, *Lophostemon confertus*, and *Mangifera indica* have recently been confirmed to have contracted the disease. There is currently no effective cure to the disease.

2.2. Due to the highly pathogenic and infectious nature of *Phellinus noxius*, it is essential to step up measures to avoid the local establishment of BRR disease. Present literature and overseas experience indicate that the most effective way of prevention is through the promotion of tree health and the reduction of the inoculum of *Phellinus noxius*. These are achievable by the implementation of a vigilant surveillance programme. This programme should consist of three components, namely, a management strategy to prevent local spread, a referral mechanism for reporting of suspected cases and a removal procedure of infected trees.

3. Identification of Suspected BRR Cases

3.1. The following steps should be followed in identifying BRR disease.

- Step 1. Look for trees with the following abnormality at the crown:
 - sparse foliage density;
 - abnormal foliage colour;

- abnormal leaf size; and
- dieback twigs.

Section A of Annex I contains a pictorial guide on crown abnormality.

- Step 2. Then, further examination of the entire lower trunk, root collar and individual roots of the trees is required to ascertain whether the trees initially identified have one or more of the typical BRR signs, i.e. fruiting bodies of *Phellinus noxius*, mycelial encrustation, soil aggregates, mycelial nets. **Section B to E of Annex I contains photographic records of fruiting bodies of *Phellinus noxius*, mycelial encrustation, soil aggregates and mycelial nets.** Root excavation with appropriate tools (e.g. handheld adze, digger, air spade, etc.) may be required to expose the root collar and roots for further examination of typical signs of BRR disease. Soil aggregate and mycelial nets, observable after scraping off bark tissue using appropriate tools (e.g. knife) are indicative of BRR. Please note that bark tissue should only be scrapped off from decayed, damaged or dead wood/roots. The use of mallets may assist to differentiate healthy wood/roots from decayed, damaged or dead wood/roots. Damage to healthy wood/roots should be avoided as this may cause unnecessary damage to the tree, which may also create open wounds for fungal invasion.
- Step 3. If a tree with crown abnormality identified in step 1 contains one or more of the typical signs of BRR disease in step 2 examination, the tree is considered a suspected BRR infection case.

3.2. The confirmation of BRR disease can be made through further field diagnosis based on observable signs, or field diagnosis followed by laboratory diagnosis based on culture and/or molecular techniques. Upon confirmation, recommendations should be made based on the information provided in para. 4.1.2 on handling the confirmed case.

4. Management Strategy

4.1. We adopt a dual-pronged management strategy comprising of precautionary and preventive measures. The objectives of this approach

are to keep our trees healthy, and at the same time to minimize the source of BRR inoculum as far as possible.

4.1.1 Precautionary Measures

- Proper tree planting and maintenance practices are the best precaution one can take against BRR disease. These practices include planting the right tree at the right place, providing sufficient growing space, planting at the right depth, proper irrigation and fertilization regimes, and mulching of root zone, not to mention regular and proper pruning. In particular, number and size of pruning wounds as well as damage to the roots should be kept to a minimum. This reduces the surface area where infection may start off. For details on tree maintenance, please refer to the relevant guidelines issued by the Tree Management Office.

4.1.2. Preventive Measures

- Preventive measures are necessary to minimize the source of BRR inoculum and control the spread of the BRR through removal of diseased parts. Trees in the Category I of Tree Risk Management Zone (i.e. areas of high traffic flow and high pedestrian flow such as public parks, playgrounds, roadside etc) infected with BRR disease should be removed entirely, including fruiting bodies, stumps, wood debris and associated fine roots in soil medium. For details on the Tree Risk Management Zones, please refer to the Guidelines for Tree Risk Assessment and Management Arrangement on an “Area Basis” and a “Tree Basis” which may be downloaded at <http://www.trees.gov.hk>.
- There are however occasions where preservation of a tree is warranted e.g. Old and Valuable Trees or trees that draw strong public sentiment for preservation. The tree concerned should be quarantined to avoid local spreading. The structural stability of the retained infected tree should first be ascertained by conducting a thorough tree risk assessment. This should include, among other normal produces, soil excavation with proper tools (e.g. adze, digger or air spade, if applicable) and advanced examination techniques including tomography and resistography, to examine the extent of the infection and decay at critical locations, such the root collar and

subsoil surface levels.

- For structurally stable trees at the early stage of BRR infection (i.e. trees confirmed with laboratory diagnosis based on culture and/or molecular techniques showing no foliage abnormality and typical signs/symptoms of BRR), treatment efforts can still be made through the creation of physical barrier by digging a trench and the use of chemicals as a means to retard the spread of BRR. It must be borne in mind that treatment through chemical means is only an interim measure for suppressing early stage of BRR infection, and will not revitalize the long term health and structural stability of the trees. Regular monitoring and assessment are still necessary. Trees that are structurally safe should be closely monitored on at least a quarterly basis. The tree should also be lodged under the Tree Register.

5. Removal Procedures for BRR Disease Infected Trees

5.1. For confirmed cases that require removal, the proper disposal of diseased parts (i.e. woody stumps, roots systems, fruiting bodies, fine roots in soils, debris) and subsequent removal or sanitation of the soil medium is very important. **The removal procedures of trees infected with BRR disease are summarised below:**

- Step 1. The above ground parts of BRR infected trees could be removed initially before proceeding to the removal of the tree stump and roots. The entire tree stump, infected roots in the soil, and the fruiting bodies should be incinerated or properly disposed of. Measures needed to be taken to prevent accidental dissemination of contaminated soil/ infected tissues to the surrounding environment during transportation to landfill area. Removal of tree stump and large root pieces may require machines, while fine root or root pieces larger than 1cm in diameter in soil need to be manually removed and packed in strong plastic bags before disposal to landfill area. To ensure complete removal of the source of inoculum, other vegetation (i.e. shrubs, perennials, herbaceous) within the dripline area and/or growing in the root zone area of the infected tree should also be removed. Trees in the vicinity should be checked for BRR infection as well.

- Step 2. According to the literature, mycelia of *Phellinus noxius* could survive in decayed root tissues in the soil for 10 years or more. As there may be infected roots in the soil, treatment should cover also the soil. Depending on site conditions, the soil medium containing the infected debris could either be disposed of or disinfected with a soil fumigant. Application dosage and safety measures from the manufacturers should be carefully read and followed before using a specific soil fumigant. If disinfection or replacement of soil could not be done due to site constraint (i.e. on slope or inaccessible area), tree replanting should be avoided.
- Step 3. Tools like adze, knives, scissors, shovels etc. and transportation equipment (such as car hopper etc.) used in the infested area should be thoroughly disinfected (e.g. with 70% ethanol or 1:49 bleach) after operation.

6. Frequently asked questions on BRR Disease

6.1. A list of frequently asked questions at **Annex II** is provided to facilitate the understanding of BRR's biology background, diagnostic methods, identification of suspected cases, management strategy, and removal procedures of trees infected with BRR disease.

7. List of Reference Documents

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- (o) *Phellinus noxius*. Distribution map of plant diseases. 1980. CAB International. April (edition 4). Map 104.
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