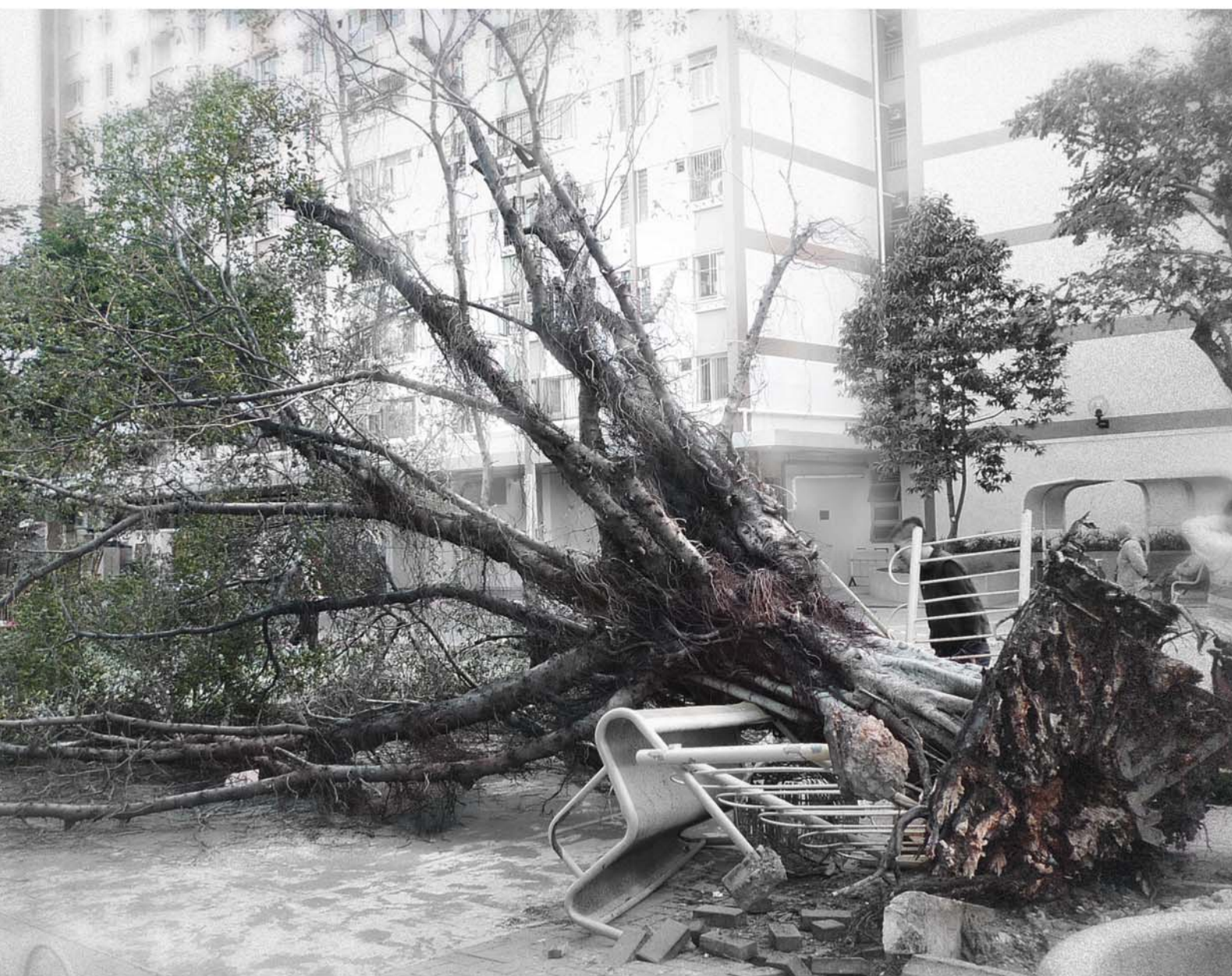


What is Brown Root Rot Disease?



What is Brown Root Rot Disease?

Brown root rot disease, caused by fungus *Phellinus noxius*, is an aggressive and destructive pathogen that thrives in soils and attacks the roots of susceptible plants. It mainly infects the roots and the lower trunk of a tree which causes the roots to rot, making them unable to absorb water and nutrients. This may lead to rapid crown dieback and plant death.

What are the potential hosts?

Brown Root Rot Disease has a wide host range and has been reported on more than 200 plant species in subtropical and tropical regions. Although it is mostly found in *Ficus microcarpa* in Hong Kong, many plant species are also susceptible and sparsely reported. This includes *Acacia confusa*, *Aleurites moluccana*, *Bombax ceiba*, *Celtis sinensis*, *Delonix regia*, *Eucalyptus* spp. *Ficus benjamina* and *Ficus elastica*.

How does it spread?

Spread of disease is mainly via root contact with infested debris or tree to tree transmission via root. It has been suggested that wind-borne basidiospores may have only minor significance in the initiation of new root rot.

How to diagnose the associated symptoms?

It is necessary to thoroughly examine above- and below-ground parts of the plant. Above-ground symptoms are useful but not completely diagnostic. Many different problems can result in the same aboveground symptoms as Brown Root Rot.

Aboveground symptoms:

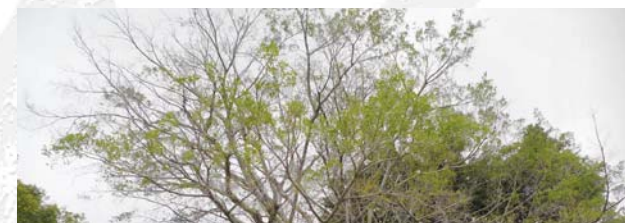
- **Leaf:** wilting, yellowing and reduced leaves, premature leaf fall
- **Bark:** bark shrinkage, crack, sapflow
- **Other parts:** crown dieback, rapid overall declining

Aboveground signs:

- Presence of intense fungal mycelium under the peeling bark of lower trunk or roots
- Fruiting bodies are dark brown and broadly attached to the lower trunk with hard and finely velvety texture.

Belowground signs and symptoms:

- Symptoms are usually more severe at the root tips and least severe near the root crown
- Infected roots appear dark brown, highly discolored with patches of white mycelium
- Yellow-brown mycelial netting may be found on the internal side of roots



Premature leaf fall and crown dieback

What is a DNA-based quick screening test?

A DNA-based quick screening test adopts molecular method for early detection and identification of decay fungi in plant tissues or soil. To conduct the quick screening test, plant tissues or soil will be sampled from the suspected tree and brought back to the laboratory. The samples will then be ground in liquid nitrogen and fungal DNA will be extracted. Specific DNA fragments will be amplified by Polymerase Chain Reaction (PCR) using fungal primers and analysed through sequencing. The whole process will take about two to three days. The amount of Brown Root Rot can also be quantified using Real-time PCR protocols in situations where severity of fungal infection in different root parts will need to be compared.

Why do you need a DNA-based quick screening test?

Symptoms will only be visible at later stages of infection. At the time you notice the crown dieback, the tree is already in critically hazardous stage which may result in windthrow or uprooting. If the visual appearance of the suspected plant is not clear enough to allow for an exact diagnosis of the Brown Root Rot, it is more desirable to conduct molecular diagnosis to confirm if the plant tissues have been infected by a fungus.



PCR Thermocycler



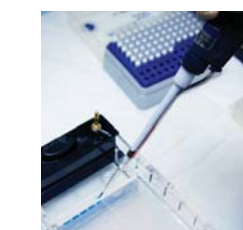
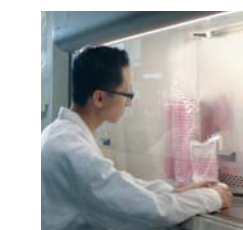
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►►How can we prevent and manage Brown Root Rot Disease?

- ✓ Avoid planting small flowers or plants beneath a mature tree because this may cause damage to existing tree roots, introduce pathogens to the planting area and increase disease susceptibility of the tree
- ✓ Avoid using lawn mower or weed trimmer near a mature tree to prevent mechanical injury and subsequent infection
- ✓ Tree pits or planters should be as large as possible to allow for ample growing space for tree roots
- ✓ Suspected trees that show aboveground symptoms should be diagnosed by a mycologist to confirm the presence of fungal infection
- ✓ Infected trees should be regularly monitored during summer months to identify if any deterioration is occurring which requires immediate mitigation measures
- ✓ Tree removal at the advanced stage of infection may also be desirable
- ✓ Presence of rapid declining symptoms indicates that the trees are beyond the point of recovery. In this case, tree risk assessment by a mycologist should be conducted and mitigations to be taken to reduce the potential hazards to the targets under the trees
- ✓ After tree felling, all root and residuals should be removed from the area
- ✓ Infected root debris that remains in soil should be eliminated by flooding with water for a month or fumigation by urea or Dazomet. Cover the area with thick plastic cloth to prevent fumigant gas from escaping into the air
- ✓ Trench Inserts may be necessary to separate the healthy trees from infected individual
- ✓ All tools must be sterilized with 70% ethanol or 1:49 Chlorox bleach after operation

Who we are? What we do?

Muni Arborist Limited specializes in providing advice and management for trees in urban landscape. Our services covers all your requirements every step of the way, including: disease assessment and diagnosis, on-site hazard tree mitigation work, tree and soil removal, chemical treatment of disease, site supervision, report preparation, monitoring plans.



Assessment and diagnosis of plant health problems	• Fungal disease assessment form and report • Isolation and identification of fungal pathogen • Molecular identification of fungal pathogen, including <i>Phellinus noxius</i>, <i>Armillaria</i> spp. and <i>Phytophthora</i> spp.
Arboricultural consultancy reports	• Tree Risk Assessment Report • Tree Removal Application • Independent Arborist Report
On-site hazard tree mitigation work	• Pruning, cabling, tree removal and soil removal
Chemical treatment of disease	• fungicide application on trees, soil fumigation
Site supervision	• Supervision of landscape works, including transplanting, pruning, chemical application
Landscape and planting design	• Planting Design • Compensatory tree planting proposal
Arboricultural training	• Provision of training in arboriculture, including integrated landscape management, pest control, fungal identification and treatment

Muni Arborist Limited

Telephone: 3583 3111 Fax: 3583 1411 E-mail: info@muniarborist.com Website: www.muniarborist.com
Room 607, 6/F, Sun Cheong Industrial Building, 1 Cheung Shun Street, Lai Chi Kok, Kowloon

褐根病



甚麼是褐根病？

褐根病是由真菌 *Phellinus noxius* 所造成，是一種具侵略及破壞性的病原體。它生長於土壤中，並攻擊敏感植物的根部。它主要感染根部和樹幹基部，導致根部腐爛，使它們無法吸收水分和養分。這可能會導致樹冠於短時間內出現枯萎及令染病植物迅速死亡。

哪些是潛在寄主？

褐根病的寄主範圍甚廣，到目前為止，已發現超過200種亞熱帶和熱帶植物品種為此病的寄主植物。在香港，儘管它主要是在榕樹上發現，但不少植物品種也曾受感染，只是報告較少，包括台灣相思、石栗、木棉、朴樹、鳳凰木、桉屬、垂葉榕及印度榕。

褐根病是怎樣傳播的？

該病主要是通過根部接觸受感染的碎屑，或透過樹與樹之間的根部接觸感染。有研究指出風媒孢子在引起新的根腐病個案中只擔當小角色，並不是引起新症的主要原因。

如何診斷褐根病的病徵及跡象？

這需要深入檢查植物的地面以上和地下部分。地上的症狀是有用的，但不足以作完整診斷。有許多不同的問題均可能導致與褐根病相同的徵狀。

地上病徵：

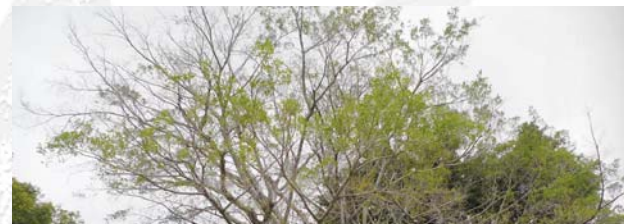
- **葉：**枯萎、黃化和細小，過早的落葉
- **樹皮：**樹皮收縮、樹幹出現裂縫及滲液
- **其它部分：**冠頂出現枯枝，迅速出現全株性衰弱

地上的跡象：

- 於剝落樹皮的下部或根部出現大量真菌菌絲
- 子實體為黑褐色，堅硬和天鵝絨質，平伏地緊貼在樹幹基部

地下部分的病徵和跡象：

- 病徵通常於根尖較為嚴重，根頸附近則較不嚴重
- 受感染的根部通常呈深褐色、褪色、或出現白色的菌絲所造成的斑點
- 在根內側出現黃褐色網紋



過早的落葉及冠頂出現枯枝

甚麼是快速測試？

這是以脫氧核糖核酸（DNA）為基礎，採用分子生物學的方法的快速測試，以便及早發現和鑑定在植物組織或土壤中的腐菌。要進行快速測試，首先從懷疑受感染的樹木身上或附近的土壤中採集樣本，並帶回實驗室。樣本會在液態氮中被磨碎，再從中抽取真菌的脫氧核糖核酸。之後，使用聚合酶鏈鎖反應（PCR）及真菌的引子（primer）複製特定的脫氧核糖核酸碎片部分。最後，通過測序法作分析。整個過程大約需要兩至三天。當須要比較在不同的根部部分受感染的嚴重程度時，也可以使用即時聚合酶鏈鎖反應（Real-time PCR）量化褐根病菌量，再加以比較。

為甚麼需要快速測試？

感染症狀在感染後期才可以看到。可是，當你發現樹冠出現枯枝時，該樹已經到達極度危險的階段，該樹便會容易被風吹倒或倒塌。如果你正懷疑你管理的樹木已受褐根病感染但表面沒有明確的病徵，分子生物學診斷將是較為可取的方法，以確認植物組織是否受真菌感染。



聚合酶鏈鎖反應器



即時聚合酶鏈鎖反應器

►► 怎樣處理褐根病？

- ✓ 避免在成熟的樹下種植小型花卉或植物，因為這可能會損壞現有的樹根、為原來的栽種範圍帶來病原體及減低樹木的抗病能力
- ✓ 避免在成熟的樹木附近使用剪草機打草機，以防止造成機械性損傷及隨後的感染
- ✓ 應盡可能使用大型的樹槽或花盆，以提供充足的根部成長空間
- ✓ 如發現該樹地上部分出現病徵，或懷疑受真菌感染，應由真菌學家診斷，以確認是否出現真菌感染
- ✓ 夏季期間，應定期監測懷疑受感染樹木，以確定病情有否惡化，及是否需要立即採取任何緩減措施
- ✓ 可能需要移走嚴重感染的樹木
- ✓ 如迅速出現全株性衰弱，表示該樹已難以恢復健康。在這種情況下，應由真菌學家進行樹木風險評估及採取相應的緩減措施，以減少對目標的潛在危險
- ✓ 砍伐樹木後，所有的根和殘枝應從該地區撤走
- ✓ 殘餘在泥土內的根部碎屑應迅速移除，方法包括淹水一個月或利用尿素或邁隆 (Dazomet) 作薰蒸。用厚膠布覆蓋所需要的範圍，以防止薰蒸氣體洩漏
- ✓ 如需要可挖掘溝道，把受感染的樹木從健康的樹木中隔離
- ✓ 所有工具使用後，必須使用70%乙醇或1:49的含氯漂白劑殺菌消毒

我們是誰？可提供甚麼服務？

我們是都市樹藝有限公司，主要為市區樹木提供顧問及管理服務。我們涵蓋的服務範圍廣泛，包括樹木疾病評估和診斷、現場危險樹木緩減工作、樹和土壤移除、化學治療、現場監督、報告編制及項目監測。



植物健康問題的評估和診斷	▪ 真菌病評估表和報告 ▪ 病原真菌的分離與鑑定 ▪ 真菌分子檢測，包括褐根病 (<i>Phellinus noxius</i>)、蜜環菌 (<i>Armillaria</i> spp.) 及疫病菌 (<i>Phytophthora</i> spp.)
樹藝顧問報告	▪ 樹木風險評估報告 ▪ 樹木移除申請 ▪ 獨立的樹藝師報告
現場危險樹木緩減工作	▪ 修剪、纜索安裝、樹木移除及泥土移除
化學治療	▪ 樹木殺真菌劑應用，薰蒸土壤消毒
現場監督	▪ 景觀工程，包括移植，修剪和化學應用的監督
景觀與綠化設計	▪ 綠化設計 ▪ 補償植樹建議
樹藝培訓	▪ 提供樹藝方面的培訓，包括綜合景觀管理，病蟲害防治，真菌鑑定及治療

都市樹藝有限公司

電話：3583 3111

傳真：3583 1411

電郵：info@muniarborist.com

網址：www.muniarborist.com

九龍荔枝角長順街一號新昌工業大廈6樓607室