

臺北動物園筆筒樹葉動態及其物候調查

陳益明* 張昕禮*

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摘要: 筆筒樹為分布於亞熱帶及熱帶地區的速生樹蕨種類，本研究探討其葉片動態及物候現象。調查自 2005 年 1 月至 2006 年 6 月為止，每月追蹤台北動物園固定樣區內 48 株筆筒樹樣木葉子不同生長型態數量及存活變化。根據葉片數分析結果，2005 年間所有存活的筆筒樹其葉年轉換率介於 1.0-1.5 之間，平均為 1.16，顯示大多數樣木新葉片持續生產速度快於脫落葉現象。樹高和樹幹上葉平均數之間，亦有顯著相關性。18 個月調查期間共發現 9 株筆筒樹死亡，其中有 8 株停止產生新葉至成熟葉全部脫落死亡時間僅有 2-3 個月。不同微棲地葉片生產和脫落所呈現的時間型態，具有顯著的季節性相對應趨勢，可能反應氣候因子如夏、秋季高溫及颱風壓力直接的影響，葉片數恢復至受颱風干擾前數量所需時間平均約為 6.1 個月。筆筒樹於夏季脫落較多帶有成熟孢子的舊葉及秋季萌發較多新葉，快速的反應變化，可以視為一種對物候的適應策略。

關鍵字: 葉動態、轉換率、物候策略、筆筒樹

前言

植物個體葉子因風害、蟲害、低溫、乾燥及老化因子影響，葉子會產生變色、乾枯及脫落現象，由新生葉更替，一方面維持現有光合成產物量，一方面可以再利用脫落葉的養分，固定體內碳氮比率，進而影響生態系統物質碳收支循環及能量流動（彥坂，1998；菊澤，2005；Chabot and Hicks, 1982；Kikuzawa and Ackerly, 1999；Ito *et al.*, 2006）。物候學是研究植物、動物和環境因子的周期變化之間相互關係的科學（竺與宛，1999），植物葉物候學研究則包括葉壽命、葉習性（常綠或落葉）及葉片出現的時間，溫帶落葉樹種具有二種葉出現順序型態，熱帶樹種也有類似情形（Kikuzawa, 1995），植物物候的長期變化可以直接反映某些氣候變化，尤其是氣候變暖現象（陸等，2006）。植物本身為維持長期演化所具有的特性及短期對生態上的適應，營養

器官及繁殖器官二者會有所權衡（Trade off），葉壽命亦有所差異，發展出維持生命及種族繁衍的物候多樣化策略（菊澤，2005；藤田與菊澤，2006）。

Mehltreter and Palacios-Rios（2003）指出熱帶地區以蕨類植物作為物候學研究對象仍不多，Mehltreter（2006）對墨西哥灣攀爬蕨類植物（*Lygodium venustum*）研究顯示，雨季時，葉片枯死率增加近 3 倍及其生產量上昇 2 倍。一些亞熱帶地區研究認為樹蕨類植物其生長型態（Growth patterns）、族群葉片計量（Leaf demography）及轉換速率（Turnover rate）動態觀察，和氣候轉變（季節性雨量或溫度）、干擾現象（動物或颱風）及棲地（原生或次生林環境）等因子有關（Seiler, 1981；Tanner, 1983；Bittner and Breckle, 1995）。

* 臺北市立動物園

Leaf dynamics and phenology on *Cyathea lepifera* at Taipei Zoo

Yi-Ming Chen* and Sing-Li Chang*

Abstract: The species, *Cyathea lepifera*, is a fast-growing tree fern distributed from subtropical and tropical regions. The purpose of this study was to examine several fundamental questions about the demography and phenology of this species. The display of leaf growth patterns and living conditions were tracked over time at repeated month census intervals for 48 marked tree fern from January 2005 to June 2006. In this study, turnover rates of live individuals ranged between 1.0 and 1.5 in 2005, with an average of 1.16, which revealed that the speed of production of new leaves were greater than the losses in most living individuals. There was a detectable relationship between tree height and mean number of leaves of each selected tree fern. Nine observed individuals ceased to live over the past a year and half. Among them, eight individuals stopped growing new leaves and unloaded all leaves, and lost their life within a short time period for two to three months. We inferred that a apparent corresponding seasonal pattern of leaves development across microsites which may be due to direct influence of climatic factors, such as high temperature and the wind stresses of typhoon in summer and autumn. After the first typhoon slashing *Cyathea lepifera* at Taipei Zoo on July 2005, it is estimated that 6.1 months were the average time required for the number of leaves recovering to the preceding month's levels. The quick responses of shedding more old leaves with mature spores in summer and emerging of more new leaves in autumn could be seen as one phenological adaptive strategy.

Key words: leaf dynamics, turnover rate, phenological strategy, *Cyathea lepifera*.

* Taipei Zoo