

EFFECTS OF WATER PROPERTIES AND SOIL TEXTURE ON THE GROWTH OF A MANGROVE PALM; *NYPA FRUTICANS* ON CAREY ISLAND, MALAYSIA

ROZAINAH MOHAMAD ZAKARIA^{1,2*}, NASRIN ASLEZAEIM¹ AND AHMAD BAKRIN SOFAWI¹

¹Institute of Biological Sciences, University of Malaya, 50603, Kuala Lumpur, Malaysia.

²Institute of Ocean and Earth Sciences, University of Malaya, 50603, Kuala Lumpur, Malaysia.

*Corresponding author's email: rozainah@um.edu.my, Tel: ++0060379676794, Fax: ++0060379674178

Abstract

Nypa fruticans is a major species of mangrove palm on Carey Island, Malaysia. The main objective of this study is to determine the effects of water properties on the growth of *Nypa fruticans*. Plant growth measurements and water analyses were carried out in six plots for 16 months. The life stages of *Nypa fruticans* were divided into seedlings, juveniles, adults and matures, based on the number of leaves. Leaf production of juvenile and mature trees showed negative correlation with salinity. Leaf production of seedlings was affected negatively only by heavy metal of Arsenic (As). Calcium (Ca) in the water had a strong positive effect on the new leaf production of juveniles and on the spear elongation of matures, and Iron (Fe) had a negative effect on the leaf elongation of adults. Similarly, spear elongation of juvenile trees was positively correlated to nitrate (NO₃⁻). Silty clay texture provides the best condition for the growth of *Nypa fruticans*. The growth of *Nypa fruticans* was most significantly affected by water parameters in the early life stages.

Key words: Heavy metals, Anions, Macronutrients, Mangrove, Nipah.

Introduction

Nipah or *Nypa fruticans* Wurmb is a mangrove palm that grows well in calm estuaries and coastal regions. It is commonly found on the landward side of a mangrove forest subjected to low water salinity. The species can exist in a simple channel or complex tributaries, bays, tidal flat surfaces and creeks, as long as there is a tide and a freshwater input (Chau Sum *et al.*, 2013). This tree species lacks an upright stem, and the leaves appear at the apex of a horizontal stem. Like many palms, *N. fruticans* exhibits a uniform growth pattern with constantly successive leaf production and height increments throughout the year.

N. fruticans is one of the most common palms in the mangrove forests of Malaysia, and is considered to be one of the most useful. Many products obtained from the leaves, inflorescences and fruits of *N. fruticans* are economically valuable, especially for the local communities. Several studies have focused on the ecology, distribution, and growth of *N. fruticans* (Teo *et al.*, 2010; Rozainah & Aslezaeim, 2010), but there is limited knowledge on the growth response of the species to environmental parameters. Although the effects of light, soil, salinity and disturbances on the growth of many palms have been studied (Tripler *et al.*, 2007), no such study is available for *N. fruticans* specifically. Such a study is highly important in light of the discovery by Irawan *et al.* (2011) that the seedling growth of the sago palm (*Metroxylon sagu*) is a significantly sensitive to N and P deficiency.

The location of the mangroves, between fresh water and the ocean, is a key site for the deposit of nutrients and other materials. Several published works deal with growth responses of mangroves to salinity and nutrients (Alongi, 2010 & 2011; Biber, 2006; Lovelock *et al.*, 2007; Naidoo, 2009 & Yates *et al.*, 2002), in addition to a study on the influence of nutrients in sediment with the composition of the mangrove flora (Clarke & Kerrigan, 2000). The current study focuses on the effects of environmental parameters on the growth of a mangrove palm, *N. fruticans*: mainly water qualities, and also soil texture.

This investigation improves our understanding about the effective stimulus for the growth and regeneration of *N. fruticans*. A high water quality with sufficient nutrient availability and salinity enables the species to maintain continuous growth and a healthy population. However, there has been a significant increase in the natural levels of heavy metals in the aquatic ecosystems because of industrial activities and urban development (Marcovecchio *et al.*, 2007). At certain levels, any chemical elements in water can be dangerous to hydrophytes plants like *N. fruticans*. Therefore, a study on water properties is needed to detect the levels of heavy metals, major metals, trace elements and nutrients in water, and determine their effects, since this species is constantly inundated. In addition, soil texture is also expected to influence the growth rates of this species.

The main objectives of the research are; 1) to find the correlation of water properties and soil texture with the growth of *N. fruticans* and 2) to determine the main parameters noticeably affecting *N. fruticans* during different life stages.

Materials and Methods

This study was carried out on Carey Island, located about 70 km to the south west of Kuala Lumpur, the Malaysian capital. Carey Island is the biggest island of the Klang Isles Mangrove Forest, in the west coast of the Peninsular Malaysia. Oil palm plantation has taken up most of the island for the past 100 years, and currently only the edge of the island is covered with mangrove forest. The study area has a humid tropical climate with high temperature from 23 to 33°C, humidity as high as 80 to 90% and a total annual precipitation of 2000-2500 mm. The study site has coordinates N 02°53'26.1" and E 101° 20'48.4" (Fig. 1). In this study, three 400 m² plots and three 100 m² plots were established where *N. fruticans* was mono-dominant and was not mixed with other mangrove tree species.