

THE STATUS AND DISTRIBUTION OF THE NIPAH PALM, *NYPA FRUTICANS* WURMB (ARECACEAE), IN SINGAPORE

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INTRODUCTION

The family Arecaceae (Palmae) is one of the largest monocotyledonous families, comprising over 200 genera and totalling about 2,600 species (Dransfield et al., 2008). Among them, only several species of palms are associated with the mangrove—*Calamus erinaceus*, *Oncosperma tigillarum* and *Phoenix paludosa*—or found as outliers of swamp communities such as *Phoenix reclinata* and species of *Euterpe*, *Manicaria*, *Mauritia* and *Raphia* (see Tomlinson, 1986). However, *Nypa fruticans* is considered the sole member within the family which constitutes as a major element in the mangrove flora (Tomlinson, 1986; Duke, 2006; Dransfield et al., 2008).

The genus *Nypa* is monotypic, with *Nypa fruticans* being its only species, and is placed in its own subfamily, the Nypoideae (see Dransfield et al., 2008). It is one of the most ancient angiosperms and probably the oldest species of palms (Päiväke, 1996). Fossil records of its pollen, fruit, leaf, flowering parts, leaf epidermis and root have been found (Dransfield et al., 2008), the oldest dating back to the Upper Cretaceous period, 65–70 million years ago (Gee, 2001).



Fig. 1. The nipah palm, *Nypa fruticans*, in Sungei Buloh Wetland Reserve. (Photograph by: Teo Siyang).

From this evidence, it was postulated that this species had an original distribution from Asia extending to Europe, Africa, and America (Duke, 2006; Dransfield et al., 2008). Its current range is now confined within the tropical Indo-West Pacific region, from Sri Lanka through Asia to Northern Australia and the Western Pacific islands, suggesting changing climatic conditions and/or the loss of versatile genotypes that can tolerate wider environmental conditions (Duke, 2006). The palm was introduced to West Africa from the Singapore Botanic Gardens in 1906 (Tuley, 1995) and from there, reported to be naturalised recently in Panama and Trinidad (Dransfield et al., 2008).

The generic name *Nypa* is the latinised derivative of “nipah”, which is the native name used in the Moluccas and the Philippines while the specific epithet *fruticans*, is Latin for shrubby, referring to its stemless appearance (Duke, 2006). Probably because of its domestic importance, *Nypa fruticans* is well known by a wide variety of vernacular names [see Giesen et al. (2006) for the list applicable to various countries]. It is one of the most widely utilised mangrove species, with products obtained from the leaves, inflorescences, and fruits (see Jara, 1987; Hamilton & Murphy, 1988). The leaves have traditionally been used for roof thatching, and parts thereof are used for making umbrellas, raincoats, hats, mats, brooms, baskets, cigarette wrappers, ropes, and as a source of fuelwood. The sugary sap from the inflorescence stalk is used to make vinegar, and like those of other palms such as the coconut, its sap is also used to make a popular alcoholic beverage better known as “toddy” in Malaysia, India, and Bangladesh. The gelatinous endosperm (Fig. 2) from the young seeds is edible and can be eaten raw or preserved in heavy syrup (“attap chee”) while the hardened ones from the ripened fruits are used as vegetable ivory, and buttons. Parts of the palm are also used as traditional medicinal remedies (young shoots, decayed wood, and the burned roots and leaves) for the treatment of headaches, toothaches, and herpes (Burkill, 1966).

The nipah palm can grow up to 10 m tall (Tomlinson, 1986; Keng, 1998; Dransfield et al., 2008). It differs from most palms in the lack of an upright stem, but instead, has thick, prostrate, rhizomatous stems that branch dichotomously underground (Fig. 3). A new plant grows out vegetatively from each branch, often creating extensive pure stands that are closely packed. The terminal shoot supports a cluster of erect, pinnate leaves, of which the alternating leaflets are lanceolate and numerous (30–40 per leaf). It is monoecious and the flowers are dimorphic. The female inflorescence is globular while the male inflorescence is catkin-like (Fig. 4b). Pollination appears to be by a variety of insects and wind (Hoppe, 2005; Fig. 5), with drosophilid flies probably playing a more dominant role (Uhl & Moore, 1997; Tomlinson, 1986). Each fertilized flower develops into a fibrous, chestnut-brown fruit and forms a large spherical infructescence upon maturation. The heavy weight of the infructescence causes the inflorescence stalk to droop, but it is supported by seawater during tidal inundation (Fig. 6). Growth of the plumule while on the parent plant pushes the fruit away from the infructescence to cause abscission and these buoyant fruits are subsequently water dispersed.



Fig. 2. Cross section of a fruit, showing the edible, soft endosperm. (Photograph by: Ria Tan).



Fig. 3. Forked, branching rhizomes exposed after erosion at Chek Jawa, Pulau Ubin. (Photograph by: Teo Siyang).



Fig. 4. Reproductive parts of *Nypa fruticans* at Woodlands Town Garden: a, the flowering stalk; b, close-ups of the club-like male inflorescences and the globular female inflorescence. (Photographs by: Ria Tan).

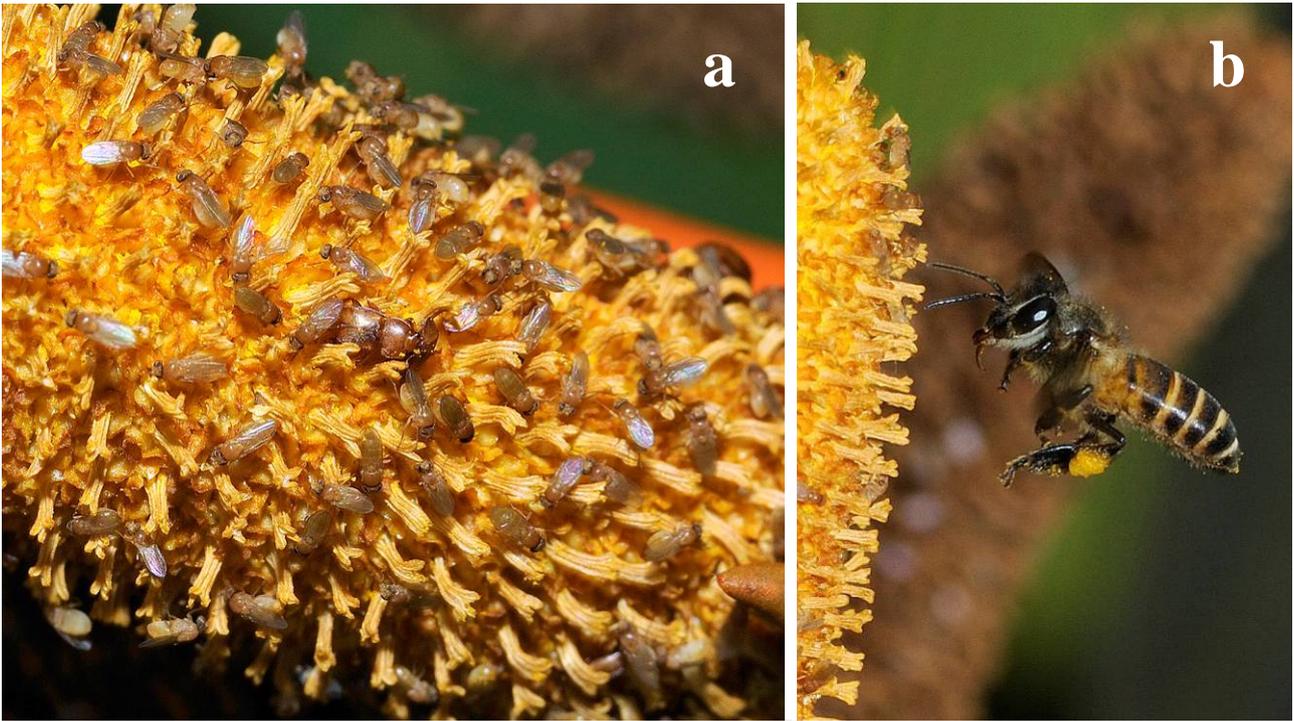


Fig. 5. Possible pollinators of *Nypa fruticans* on a male inflorescence at Woodlands Town Garden: a, beetles; a, and the Asian common honey bee (*Apis cerana*). (Photographs by: Ria Tan).



Fig. 6. Drooping inflorescence stalk bearing the fruits at Berlayar Creek. Note the high tide level marked by the mud at the lower portions of the infructescences. (Photograph by: Teo Siyang).

PAST AND PRESENT RECORDS

There has not been a comprehensive record of the distribution of *Nypa fruticans* in Singapore thus far besides the few short notes by some authors. Ridley (1900) stated that it is common in tidal mud all around Singapore, and speculated that it also formerly grew as far inland as a site near Cluny Road from the fruits discovered there. Tan et al. (2008) provided a more elaborate list, citing its distribution in local mangrove forests at “the end of Lim Chu Kang Road, St. John’s Island, Pulau Tekong Pulau Ubin, Sungei Buloh Wetland Reserve, Sungei Changi and others”. Table 1 is a list of Singapore herbarium specimens and their collection localities. Note that the population in Kallang has been extirpated owing to urban development. The present status of populations in Pulau Tekong Kechil could not be ascertained because of the recent large scale reclamation works around it. To the best of our knowledge and help from various individuals (R. Tan; Morgany d/o Thangavelu; P. X. Ng; R. K. H. Yeo, pers. comm.), we have drawn a map of the current distribution (Fig. 7).

Table 1. Singapore collections of *Nypa fruticans* Wurm deposited in the Herbarium, Singapore Botanic Gardens (SING; with bar code no.) and the Herbarium, Raffles Museum of Biodiversity Research, National University of Singapore (SINU; with accession no.).

S/No.	Accession/Bar Code No.	Herbarium	Collector(s)	Collector’s No.	Date	Locality
1.	14892	SING	H. J. Murton	1540	12 Dec.1877	–
2.	14891	SING	H. N. Ridley	s.n.	1892	Kallang
3.	2007015182	SINU	D. Pillot	s.n.	2 Dec.1963	–
4.	2007015181	SINU	H. Keng	s.n.	20 Jul.1969	Pulau Tekong Besar
5.	58280	SING	E. Tang	844	10 Oct.1995	St. John’s Island
6.	2007015180	SINU	H. T. W. Tan & K. S. Chua	s.n.	26 Mar.1996	Pulau Tekong
7.	2007015178	SINU	Ali Bin Ibrahim, A. H. B. Loo & E. E. L. Seah	s.n.	22 Aug.1996	Pulau Tekong Kechil
8.	2007015177	SINU	H. B. Loo, H. T. W. Tan, J. C. B. Teo, M. W. K. Goh & P. W. L. Tan	s.n.	12 Sep.1998	Pulau Seletar
9.	2007015179	SINU	D. H. L. Teo	s.n.	2000	Pulau Ubin
10.	45120	SING	A. T. Gwee & S. Lee	317	27 May 2003	Pulau Ubin, Chek Jawa
11.	2007015176	SINU	K. Y. Ang & K.-x. Tan	50	24 Mar.2003	Mandai
12.	2007015175	SINU	K. Y. Ang & K.-x. Tan	199	22 Apr.2003	Simpang North
13.	2007015174	SINU	K.-x. Tan & C. K. Yeo	662	6 May 2003	Pulau Seletar

The nipah palm is currently found mainly in the northern region of Singapore Island, specifically at Lim Chu Kang, Sungei Buloh Wetland Reserve, Kranji Reservoir, Sungei Mandai, Woodlands Town Garden, Admiralty Park, Sungei Simpang, Khatib Bongsu, near Seletar Camp Wet-Gap, and Punggol Reservoir. They are also found at the eastern (Pasir Ris Park and Sungei Changi), western (near Pasir Laba Camp, Poyan Reservoir, and Pergam Channel, which links Poyan and Murai Reservoirs), and southern parts (Sungei Pandan, and Berlayar Creek) of Singapore Island. In the offshore islands, they occur in parts of Pulau Seletar, Pulau Tekong, and Pulau Ubin at the north as well as Pulau Buaya, Pulau Sakijang Bendera (St. John’s Island), and Pulau Semakau in the south.

Most of the nipah palm populations in Singapore are found in the more brackish mangrove forest strips, situated further inland and away from the direct exposure to pure seawater. Tomlinson (1986), and Giesen et al. (2006) noted that the palm is found in mangrove areas with calm conditions and a high freshwater input. The current populations at Kranji Reservoir (Fig. 8), and the Western Catchment Area (Poyan Reservoir, and Pergam Channel), originated from similar brackish environments but are now in an enclosed freshwater body after the rivers were dammed in 1976 and 1981, respectively (Lee, 2005). The population in Punggol Reservoir is still growing in brackish conditions as the river had only been dammed in 8 Dec.2009. This demonstrates the wide ecological amplitude of the nipah palm—being able



Fig. 7. Distribution of *Nypa fruticans* in Singapore. (Adapted from Tan et al., 2010; map by: Alex Yee Thiam Koon).



Fig. 8. *Nypa fruticans* stands along the Kranji Reservoir. (Photographs by: Alvin Francis Lok Siew Loon).

to thrive in an exclusively freshwater environment as well. It grows easily in freshwater conditions in the tropics (Riffle & Craft, 2003), and a cultivated colony has been established in Bogor Botanic Garden, Indonesia for at least a century, while more recent cultivation of this palm has also taken place in the Palmetum in Townsville, Australia, the water lily pond in a tropical glasshouse in the Royal Botanic Gardens, Kew, UK (Jones, 1995) and in Singapore, this species been successfully established at the Eco-Lake in the Singapore Botanic Gardens (Fig. 9) and at Kent Ridge Park.

CONCLUSIONS

Nypa fruticans is classified as nationally vulnerable in Singapore (Chong et al., 2009). Tan et al. (2008) noted that the main threat it faces is habitat destruction, but “the populations in Sungei Buloh Wetland Reserve, Pulau Ubin and Pulau Tekong are protected”. Adding to this, the wild populations in parks (Admiralty Park and Pasir Ris Park),



Fig. 9. Cultivated plants in Eco-Lake, Singapore Botanic Gardens. (Photograph by: Ang Wee Foong).

Pulau Ubin (Chek Jawa), restricted military training areas (Pulau Tekong, and the Western Catchment Area) and a nature reserve (Sungei Buloh Wetland Reserve), are generally safe from development. However, it must be noted that ongoing reclamation work in Pulau Tekong may affect several known nipah palm populations along the northern coastline, according to future development plans drawn up (URA, 2008). On a positive note, those at Lim Chu Kang, and Berlayar Creek will be protected in the near future after announcements of an expansion of Sungei Buloh Wetland Reserve that will encompass the Lim Chu Kang mangroves (Tan, 2008), and the construction of a mangrove boardwalk through Berlayar Creek as part of the Singapore Park Connector Network programme (Liaw, 2008). The widespread local distribution and broad ecological amplitude of this nationally vulnerable plant, including occurrences within the parks and legally protected nature reserves, should ensure the nipah palm's continued survival in Singapore.

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