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Aglaia cucullata: A little-known mangrove with big potential for research

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Introduction

The mangrove *Aglaia cucullata* (previously known as *Amoora cucullata*) is described in the IUCN Red List of Threatened Species as "not well known" and "poorly known", and designated as Data Deficient (IUCN, 2017). In many respects, this assessment may well be justified since *A. cucullata* does not feature strongly in the mangrove literature. This paper seeks to help enhance the current Red List status of *A. cucullata* by reviewing its botany, uses, ecology and physiology. A description of a natural population of *A. cucullata* in the Ranong mangrove forest, which is the first record for Thailand, is provided. Past research studies of the species in Thailand are mentioned and research opportunities are discussed.

Botany and uses

The genus *Aglaia* (previously known as *Amoora*) comprises 25–30 species, many are economically important timber trees (Xu *et al*., 2019). Described in the Mangrove Guidebook for Southeast Asia by Giesen *et al.* (2007), *Aglaia cucullata* (Roxb.) Pellegr. (Figure 1) belongs to the family Meliaceae. The species occurs in lowland forest and along tidal riverbanks. A mangrove associate, *A. cucullata* is a small to medium-sized tree with plank buttresses and pneumatophores. The bark is smooth, brown or pale orange, and somewhat scaly. The wood is pale yellowish to orange-brown, with white latex. Leaves are compound bearing 5–9 asymmetrical leaflets. Inflorescences are in clusters, each bearing numerous small, yellowish flowers, with three petals and six slightly protruding anthers. Fruits are round with leathery skin and they split into three locules each containing one seed wrapped by a shiny red aril.

Figure 1 Line drawing of a twig of bearing leaves, flowers and fruits of *Aglaia cucullata* (From Giesen *et al*., 2007).

The wood of *A. cucullata* is used as fuel wood, posts of houses and wood for boat-building (Giesen *et al*., 2007). Medicinal uses of leaves and fruits of *A. cucullata* in Thailand include treatment of diarrhoea, dysentery, inflammations, skin infections and cardiac diseases (Chumkaew *et al*., 2006). In Myanmar, the species is a medicinal plant where the leaves and seeds are used to treat inflammation and rheumatism, respectively (DeFilipps and Krupnick, 2018).

Tree population at Ranong, Thailand

In July 2020, we encountered a natural population of *A. cucullata* in a remote and undisturbed habitat located some 2 km landward from the banks of the Kraburi River, Ranong Province, Thailand. The 48,000-ha site is within the proposed World Heritage mangrove forest. It was designated a UNESCO Biosphere Reserve earlier in 1997. At the site, a group of five mature trees, all above 30 cm in dbh and 15–20 m in height (Figure 2). The trees have a clear bole with bark that is greyish-brown in colour and faintly fissured. Buttresses are up to a metre tall. The mangrove palm *Nypa fruticans* and fern *Acrostichum aureum* are common in the area.

Figure 2 A cluster of mature *Aglaia cucullata* trees (top), and the bole and buttresses of one individual (bottom) in the Ranong mangrove forest.

On the forest floor, pneumatophores or aerial roots are densely developed (Figure 3). The soft and muddy substrate with silty clay is conducive to the production of many pneumatophores which are spongy, greyish-brown in colour and 5–70 cm in height. The leaves are compound bearing 6–8 leaflets (Figure 3). Lamina of leaflets are slightly asymmetrical and elliptic with a rounded apex. Overall, the leaves do not have obvious signs of halophytic tendencies such as shiny cuticle or succulence.

Figure 3 Pneumatophores (top) and leaves (bottom) of *Aglaia cucullata*.

Our extensive field experience in the context of mud lobster and mangrove succession (Havanond, 2000) shows that *A. cucullata* is a back-mangrove species in the Ranong mangrove forest, a 48,000-hectare proposed World Heritage mangrove forest. Field reconnaissance by the first author conducted as part of the work reported in this paper gave further support to our assessment. Water salinities at this inner forest site are normally low, being in the range of 5–10 ppt, with a mean close to 5 ppt. The low salinity is maintained by two core factors: distance from the open sea and proximity to fresh water from the Kraburi River. Nutrients from soils within the hilly catchment of the Kraburi River are delivered to this inner, ecotone habitat where *A. cucullata* is able to display growth that mirrors its biological potential. At the site, the sea water tidal inundation takes time to reach the habitat and inundation does not stay long before the tide retreats allowing river water to flush out. Thus, a combination of low salinity, good supply of fresh water and nutrient-rich run-off from the hilly terrain of the Kraburi River hinterland has created an ecological regime which helps the grove of *A. cucullata* to grow well under almost pristine conditions.

In the World Atlas of Mangroves, the geographical distribution of *A. cucullata* in countries of Asia are India and Malaysia (Spalding *et al*., 2010). A more recent publication on mangrove biogeography of the Indo-Pacific including *A. cucullata* has reported India and Bangladesh in South Asia, and Myanmar, Malaysia and Indonesia in Southeast Asia (Saenger *et al*., 2019). This report on a natural population of *A. cucullata* in the mangroves of Ranong is therefore the first record for Thailand.

Ecology and physiology

A recent study on the adaptation of mangrove trees to different salinity areas in the Ayeyarwaddy Delta Coastal Zone, Myanmar, showed that *A. cucullata* has an eco-physiology that enables it to tolerate salinities from as low as 0.5 ppt to as high as 28.9 ppt (Win *et al*., 2019). Among other possibilities, *A. cucullata* has the potential to enrich mangrove biodiversity by being an alternative candidate species in mangrove eco-restoration schemes (Maxwell, 2016). This new finding enlarges the description by Aksornkoae *et al*. (1992) that *A. cucullata* is a back-mangrove species, growing where the salinity is low.

Research conducted in Thailand

In Thailand, an analysis of the wood anatomical features of 13 *Aglaia* species including *A. cucullata* has been conducted (Khaopakro *et al*., 2015). The wood sample of *A. cucullata* was obtained from the xylarium (wood library) of the Forest Management and Forest Production Research Office in Bangkok. Compared to the other *Aglaia* species, the cross-section of *A. cucullata* wood showed very low vessel density (Figure 4).

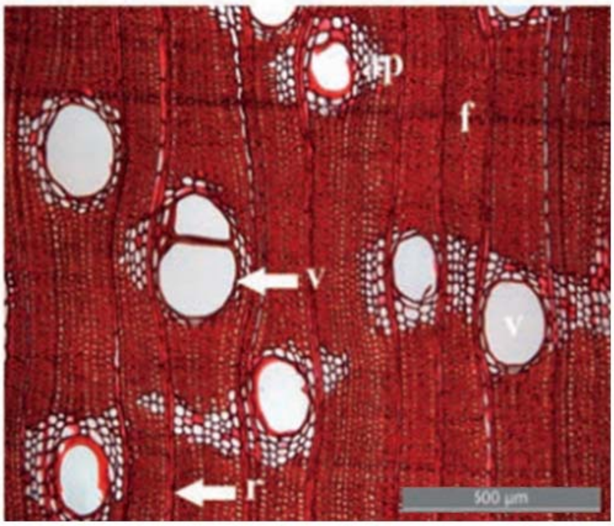

Figure 4 Cross-section of *A. cucullata* wood showing very low vessel density (ap = axial parenchyma, f = fibre, v = vessel and r = ray) (From Khaopakro *et al*., 2015).

Subsequently, the timing of leaf flushing, flowering and fruiting (phenology) of 22 tree species including *A. cucullata* in Bang Kachao Peninsula, a prominent large urban forest along the Chao Phraya River and surrounding Bangkok, was monitored for one year (Pancharoen *et al*., 2020).

Research opportunities

It is hoped that this paper will identify and encourage further research on *A. cucullata* which we believe to be a mangrove tree with much potential. The paper by Win *et al*. (2019) reported that, in the Ayeyarwaddy Delta Coastal zone of Myanmar, *A. cucullata* was one of 15 mangrove species belonging to the 0.5–29 ppt salinity range group. This finding raises questions and invites focused studies of eco-physiology of these species, a point strongly advocated by Maxwell (2015).

With regard to the wide salinity tolerance of *A. cucullata*, some research opportunities include examination of the ecological anatomy of the leaves and pneumatophores. Do the leaves display halophytic adaptations and do the pneumatophores possess aerenchyma cells? What are the salinity and redox conditions of the soil in which the dense pneumatophores grow? Do mud lobsters exist in the inner mangrove zone where *A. cucullata* thrives and do crabs damage or consume *A. cucullata* seeds or fruits? Is *A. cucullata* a candidate species in mangrove restoration schemes where variable salinities are a challenge?

Phenological studies on the natural *A. cucullata* population in Ranong will be useful in determining the season for collecting mature fruits and seeds for raising in the nursery prior to out-planting in the field. Although *A. cucullata* was one of the species chosen for the mangrove rehabilitation project in Sabah (Baba *et al.*, 2019), and planted in clusters along Sungai Garama (Tangah *et al*., 2012), its silviculture needs to be studied including nursery and planting techniques, growth and yield, and pests and diseases.

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