Molecular Phylogeny of Moluccan Shorea Species Inferred from Chloroplast DNA Sequences and *PgiC* Nuclear Region

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**Dipterocarpaceae**

*Three subfamilies*, including
- Pakaraimoideae in South America
- Monotoideae in Africa
- **Dipterocarpoideae** in SE Asia

*Asian tropical subfamily Dipterocarpoideae*
- 13 genera and 470 species ([Ashton, 1982](#))
- Many are important for commercial timber
- The most abundant group in SE Asian lowland tropical forests
Identification of dipterocarps

Not an easy task

→ vary with age and habitats (Symington, 1974)

General identification

→ morphology, wood anatomy, palynology, and fossil record (Ashton, 1980)

More recent years

→ DNA molecular marker

→ Suitable for discriminating closely related species, not influenced by the environment or by the developmental stage of the plant.

Distribution of *S. selanica* and *S. assamica* ssp. koordersii

→ Both are very limited number of species in the genus *Shorea* whose distribution extends through to east of the Wallace Line

→ Section *Anthoshorea*, known as *Shorea* White Meranti in timber trade
1. Phylogeny of Sub-family Dipterocarpoideae

(Modified from Dayananda et al, 2006; trnL-trnF spacer, trnl intron and matK cpDNA)

2. Classifying Shorea species based on cpDNA sequences

(Tsumura et al, 2011; trnL-trnF spacer, trnl intron, psbC-trnS, and trnH-psbA-trnK ~ 4.2 kbp

Only include *Shorea assamica* (with no sub species noted) and none are include *Shorea selanica*
Plant materials

*S.selanica* $\rightarrow$ four individuals from CRFRDC arboretum

*S.assamica ssp. koordersii* $\rightarrow$ one each from Mangole, Sanana, Obi Island

**Loci used**

*cpDNA* based on Tsumura *et al* (2011)

$\rightarrow$ *trnL-trnF* spacer, *trnL* intron, *trnH-psbA-trnK*, psbC-*trnS*

Nuclear gene based on Kamiya *et al* (2005)

$\rightarrow$ *PgiC*

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**Result & Discussion**

1. Phylogenetic position of *S.selanica* and *S. assamica ssp. koordersii* as inferred by *cpDNA* sequence

Alignment of the matrix contained 4363 bp

All four *Shorea* clades are supported by $> 90\%$ of bootstrap values

*S. selanica* nested within the clade of *Shorea Red Meranti*

> *S. assamica ssp koordersii* nested within the clade of *Shorea White Meranti*
2. Phylogenetic position of *S. selanica* and *S. assamica ssp. koordersii* as inferred by *PgiC* nuclear sequences

Alignment of the matrix contained 1638 bp

Grouping of four group of Shorea based on PgiC nuclear gene were also supported

*S. selanica* nested within the clade of Shorea Red Meranti

*S. assamica ssp koordersii* nested within the clade of Shorea White Meranti

Yulita et al. (2005)

trnL-trnF intron, trnL-trnF spacers

*S. selanica* was the only *Shorea* species that grouped into Hopea clade
Modified from Yulita et al. (2005); ITS region

*S. selanica* was grouped together with section *Richetioides* (*Shorea* Yellow Meranti) and *Hopea*

Intraspecific hybridization is not uncommon among dipterocarps

Molecular identification for hybridization and introgression
- Kamiya et al. (2005)
- Ishiyama et al. (2003, 2005)
- Cao et al. (2006)
- Kamiya et al. (2011)

Our present study **apparently confirmed** *S. selanica* as the member of *Shorea* Red Meranti which is fully support its present taxonomical and morphological classification
Conclusion

- Based on both cpDNA nucleotide sequences and PgiC nuclear gene, *Shorea selanica* was confirmed to be in the clade of Shorea red meranti while *Shorea assamica ssp. koordersii* was confirmed to be in the clade of Shorea white meranti

- Both species are congruent with their current botanical section