

Needle morphological variation within and among population of *Pinus merkusii* Jungh & De Vries in Central Aceh, Indonesia

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Introduction

- Pinus merkusii*, one of the truly tropical pines in the world, is native to South East Asia which is extensively distributed in the regions. It has large altitudinal range from a few meters above sea level to nearly 2000 m. It grows well on diversity of soils over many parent materials and climatic variation.
- P. merkusii* is the medium to large size tree reaching 25 to 45 meter tall, with a trunk diameter up to 1 m., and very promising tree in the context of global climatic change. This is one of the major plantation species in South East Asian countries, and it is favoured for both timber and pulpwood production.
- The needles are very slender, rigid, straight 15-25 cm long and less than 1 mm thick, green to yellowish in colour and found in a pair of two. Two needles in a fascicle are almost same in size.
- The productivity and adaptability of the tree largely depends on the characteristics of leaves / needles. The morphological characteristics of an organism used to be determined by environmental and genetic factors.



Fig. 1. Geographical distribution of *P. merkusii*

Objectives

- To assess the variability in the length and shapes of needles in *P. merkusii*,
- To assess the relationship of needle length and weight in *P. merkusii*
- To assess the stomatal density variability in *P. merkusii*

Methodology

- 6 population = 90 trees, 4 twigs per tree (N, S, E, W aspects)=360 twigs.

Measurements of

- Twig length
- Length and shape of 5 needles per twig =1800 Needles
- Length of Fascicle sheaths

Lab works

- Weighing up 10 needles per population: air dry needles
- Stomatal analysis (10 slides per population)
- Statistical analysis: Stastica 6.0 software

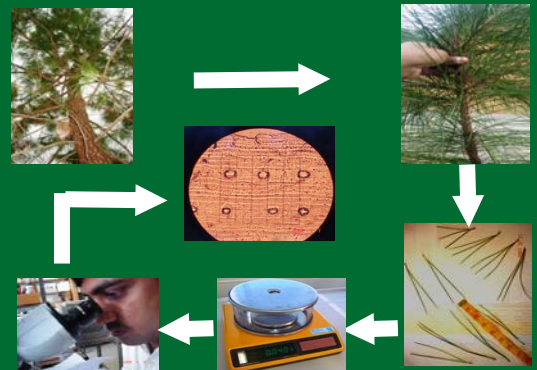


Fig. 2. The methodological sequence

Findings and Discussion

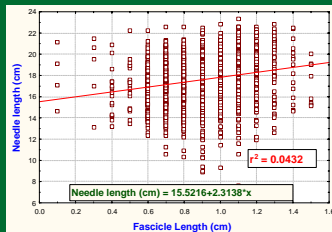


Fig. 3 Needle & Sheath length relationship

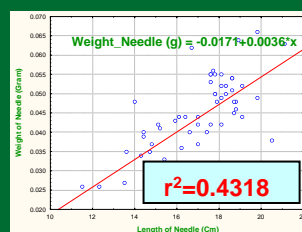


Fig. 4 Relationship between needle weight & needle

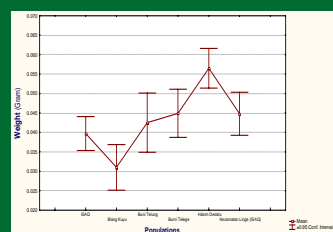


Fig. 5 Weight of needle as per population

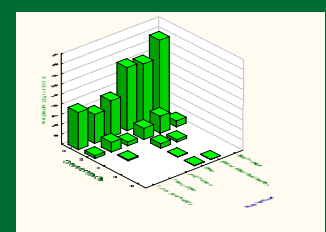


Fig. 6 Frequency of shape of needles

- The lengths of needles vary from 7.6 to 23.3 cm. The average length of needles as per population ranges from 16.71 cm to 18.53 cm, with mere 1.82 cm differences in comparison to marked ecological and environmental changes.
- Within and among population variation of needle and its fascicle sheath are significant at $p=0.05$. The aspect has no significant effect on the needle lengths, yet it has significant effect in the size of fascicle.
- The average needle weight in Central Aceh is calculated as 0.0432 grams, ranging from 0.0310 grams (Blang Kuyu) to 0.0565 grams (Hakim Bale Dedalu). The needle weight significantly differs as per population (at $p=0.05$). The weight of needles depends on its length and thickness.
- The shape of *P. merkusii* needles are predominantly strout and straight. The shapes are significantly different with each other (at $p=0.05$) according to its population.
- The estimated mean stomata density per square mm of needle is 93.41 ranging from 52 to 142. There is not significant difference in the stomata density among the populations. Highest variability of stomata density has been found inside Burni Telege ($CV=0.23$) and the least within variability has been found inside Kecamatan Linge ($CV=0.11$).
- Exceptionally 3 needles Fascicle:** Some trees of *P. merkusii* had few fascicles with exceptional three needles despite it is two needle Pine. This might be due to mutation or some other reason.

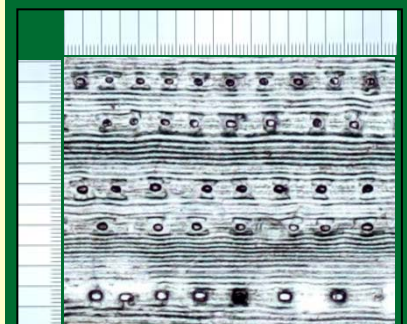


Fig. 7. Stomata in regular row in *P. merkusii* needle under 200X magnification and the scale (in μm)

Conclusion

Many morphological traits examined in *P. merkusii* needles at Central Aceh, Indonesia are found significantly different whereas the absolute differences measured is relatively low against large differences in locality factors, indicating that the low influence from genetic factors.